

Assessment of energy and sustainability aspects in architectural competitions

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Abstract

Architectural competitions are considered to be a driving force for architectural quality, providing benefits in terms of financial aspects, quality, functionality, energy efficiency and sustainability with relevance throughout the life cycle of buildings. Furthermore, up to certain threshold values of services, EU Directives on public tenders oblige public authorities to conduct architectural competitions for their buildings.

The architectural competition and the programming stage are the most important phases for implementing energy and sustainability-relevant aspects in the planning of the building. Many decisions during this phase have a profound and irreversible impact on the sustainability of the building. Aspects like orientation, compactness and openings of windows are decided upon during the preliminary design phase (the scope of most architectural competitions) and determine the future energy performance and the operation costs of the building. However, consideration of energy related issues and LCA (Life Cycle Assessment) aspects is difficult due to the lack of information about the building (materials and components are not determined at that time) and due to the lack of suitable tools, in terms of objectivity, consistency and simplicity.

The aim of this paper is to analyse possibilities and chances and suggest solutions which help to integrate the assessment of energy related issues and LCA aspects into architectural competitions. Based on an analysis of the documents and minutes of over 50 architectural competitions and workshops with an expert team the current practice of assessing project submissions

to architectural competitions is investigated. Although clients often demand an ecologically sustainable building, these criteria are seldom controlled and do not play a significant role in jury decisions. As a possible solution to these shortcomings we will then present strategies which we have developed and tested in architectural competitions in Austria and which enable clients to assess the environmental quality of submitted design proposals.

The presentation is based on our research in two projects: the EU-FP 7 project “LoRe - Low Resource consumption buildings and construction by use of LCA in design and decision making” and the Austrian research project “IEAA - Integration of energy-relevant aspects in architectural competitions”.

Background

Architectural design competitions are considered a favourable instrument to obtain design proposals revealing different architectural approaches towards a construction project and thus leaving a possibility for choice to the client. Architectural competitions offer an excellent way to find the best solutions concerning design, economy, functionality, energy efficiency and sustainability. The European Commission considers architectural competitions to be a driving force for architectural quality, providing benefits in terms of financial aspects, quality, functionality and efficiency with relevance throughout the life cycle of buildings [(COM 2007) 501].

Architectural design competitions are commonly used by public sector clients in European countries. The regulatory basis is the EU procurement directive and its national implementations, e.g. in Austria the “Bundesvergabegesetz”, which however does not deal with architectural competitions in par-

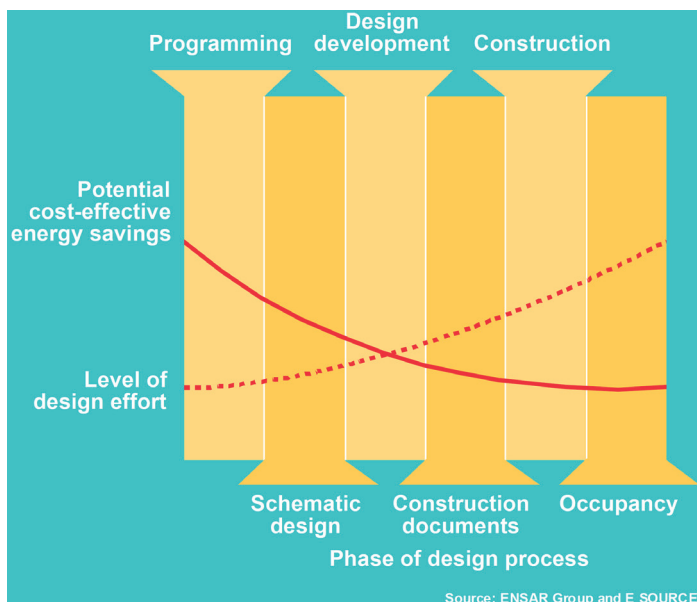


Fig. 1: Potentials of cost-effective energy savings in different project phases (Jacob, Henderson 2002).

ticular. Competition rules are often provided by the national union of architects or similar architects' organisations, like the WSA ("Wettbewerbsstandards für Architektur") of the Austrian chamber of architects.

Among building experts there is wide acclaim that the most important phases for the implementation of sustainability aspects are the programming stage and the preliminary design stage which is exactly what is covered by architectural competitions. Design related aspects like compactness (surface to volume ratio), orientation and size of windows and bioclimatic design strategies (e.g. facility for natural night ventilation) have huge impacts on heating and cooling consumption, energy consumption for lighting and consequently on a buildings CO₂-emissions (Schlueter, Thesseling 2009). Considerations concerning energy and sustainability in programming and early design stages enable broader options for the further planning process, a lacking of integration into these stages leads to extensive modifications or high costs afterwards to meet performance criteria (Schlueter, Thesseling 2009).

As shown in Figure 1 highest potentials for cost-effective energy savings can be found in early design stages, lacking integration minimises opportunities for sustainable measures (Jacob, Henderson 2002). Inefficient "energy design" has to be compensated in later planning stages with cost intensive "end of the pipe" solutions, like expensive, disproportional thermal insulation, costly sunblind measures and cost intensive HVAC systems. To stress the importance of energy efficient building design Cody talks in reference to one of the most prominent principles of functionalist architecture "form follows function" about "form follows energy" (Cody 2011).

The primary purpose of architectural competitions is to generate design ideas. The majority of literature deals either with the procedure at single buildings and case studies or with the discussion of legislative issues and requirements. Scientific literature beyond these subjects and focussing on more general questions is rare and concentrates on management aspects and on the interplay of architects and their clients.

Especially the implementation of sustainability and energy aspects in architectural competitions has not been examined in detail. Experiences with the integration of sustainability aspects in German architectural competitions pointed out that urbanistic and design quality is the most important issues in competitions (Grabke, Wosnik 2010). Thus while the German directive for architectural competitions (Richtlinien für Planungswettbewerbe, RPW 2008) does pay attention to sustainability and energy related aspects, common competition praxis shows that there are insufficient strategies for implementation. Sustainability often is seen as an unimportant add-on to the design concept, to be solved in further project stages (Fuchs, 2010).

For the Austria situation Treberspurg comes to the same conclusion: Although sustainability targets are becoming more and more popular in tendering documents of important clients (public authorities, large housing companies), sustainability plays a minor part besides other aspects. On one hand there is no continuous strategy for implementation of sustainability (setting of targets, assessment, weighting, quality of the jury) and on the other hand it is seen as an add-on with marginal relevance for this planning stage (Treberspurg 2010).

Although there has been an increase of tools for the assessment of sustainability in the building sector (LEED, BREEAM, DGNB, TQ-B) tools adapted to the requirements of architectural competitions hardly can be found. To the authors of this paper only the German ClimateDesignCompetition tool (Hausladen 2009) is known which has been developed simultaneously with Staller (Staller, et al., 2010) and which also deals with energy efficiency and architectural competitions.

The main focus of this paper is on "classical" architectural competitions, as this type is the most common competition type all over Europe. Classical architectural competitions are competitive tendering to select the architect to carry out design work for his or her winning project. It is not tendering for a building itself with detailed information about construction, materials, HVAC systems and guarantees for construction costs. Carefully rendered graphics and drawings that are submitted to competitions mislead to the assumption that buildings are already well described. Quite contrary they are not: Materials and material properties of the building are - to a large extent - not yet specified. More specifically, a static dimensioning has not been performed and thus the masses of steel, concrete, timber, etc. that will be used e.g. for LCA are not provided. Number and size of glazed elements like windows or a glass façade are but roughly defined. At this time not enough detail is given to perform a normal energy performance calculation like e.g. for the energy certificated according to the EPBD (European Directive on energy performance of buildings).

The aim of this paper is to investigate the current practice of how project submissions to architectural competitions are assessed and to suggest solutions which help to integrate the assessment of energy related issues and sustainability aspects into architectural competitions. The analysis is based on an online-questionnaire among architects, on the documents of over 50 architectural competitions and on the results of a series of workshops with representatives of clients.

The paper is structured as follows: The first section (following this background chapter) will present a comprehensive

study of energy and sustainability aspects in Austrian architectural competitions that have been conducted in the Austrian research project "IEAA - Integration of energy-relevant aspects in architectural competitions". Three different methods of data collection have been used (online survey, documents analysis and expert workshops). The findings are described and results are concluded.

We then proceed to outline recommendations that have been acquired within the EU project "LoRe - Low Resource consumption buildings and construction by use of LCA in design and decision making" and the Austrian research project "IEAA - Integration of energy-relevant aspects in architectural competitions". Although somewhat technical this section indicates how to operationalise energy and sustainability issues for architectural competitions.

Even though the paper is based mainly on the Austrian situation, it can be assumed that the main outcomes will also be of relevance to other European countries because structure, content and procedure of these competitions correspond to similar rules. Of course a detailed integration of the outcomes has to be adapted to national characteristics and to the "culture of sustainability" in different countries.

Study of energy and sustainability aspects in Austrian architectural competitions

To arrive at a comprehensive impression of the present situation of the Austrian architectural competition sector concerning energy and sustainability aspects the study was conducted in three parts:

- Online survey among Austrian architects
- Workshops with stakeholders
- Study of 51 architectural competitions

The results from the online survey deliver a quantitative picture of how common energy requirements are and to what extent architects perceive these requirements as problematic.

The stakeholder workshops were designed to collect information on the perceptions of clients and competition promoters. What are their demands and their experiences? What driving forces towards energy/sustainability integration into architectural competitions do they experience? The discussions in the workshops provide qualitative statements and shed light on barriers and synergies.

This quantitative-qualitative picture is fleshed out further by the analysis of competition documents. What are typical paragraphs that contain text and requirements and in what manner do they occur in the competition documents? Are there (big) differences between various competitions? Especially the connection between the jury's statement and the promoter's competition documents was considered interesting: What constellation leads to energy/sustainability acknowledgement in the jury's decision?

ONLINE SURVEY AMONG AUSTRIAN ARCHITECTS

The intention of the online survey was to gain an impression of the relevance of energy aspects in architectural design competitions and on how the present situation is perceived by architects in this respect. Information was derived by an on-

line survey among architects. The request to participate in the survey was sent to the members of the Federal Chamber of Architects and Engineering Consultants of Austria by e-mail in 2009. 1,500 persons received the request, 806 started the online survey and 430 completed the forms representing a return rate of about 30 %.

50.5 % of the survey respondents had participated in more than 6 design competitions in the last 3 years, 49.5 % in less than 6. But only 30 % had acquired more than 25 % of their projects by winning of competitions.

The 6 main questions of the online survey were:

- What is the importance of energy in your work?
- What is the importance of energy in architectural competitions?
- Are tendering documents clear with respect to energy to allow for an objective assessment of the competitors?
- Are jury decisions transparent and comprehensible with respect to energy related criteria and weighting?
- Which problems exist if energy aspects are integrated in architectural competitions?
- What should be changed in today's competition practice with respect to energy aspects?

Figures 2 to 7 show the results of the survey.

Energy is without doubt an important topic in the design process rated as important or very important by 95 % of the respondents. However, concerning the relevance in architectural design competitions the opinions are split: for 47 % it is also important and very important in this early stage, whereas another 47 % say it is less or not important.

For only 2.7 % the wording of energy targets in tender documents is unambiguous and clear, 53 % consider this is partly true and for 33 % this is not the case. Even more evident are the answers concerning the jury decision: for 50 % it fails to be transparent, 35 % assume it is partly transparent, 1 % say it is fully transparent.

The last two questions provided multiple choice listed answers and the possibility of other responses. The main barriers for integration were: Assessment criteria are not detailed enough (27 %), related design effort is too big (25 %), design stage does not support energy calculations (23 %). There is still uneasiness: the whole topic seems to be too complex (18 %); but only 6.6 % state as a problem that energy targets could delimit their design options.

4 items were listed that could improve today's practice. Not amazingly clear assessment criteria ranked highest with 30 %. 27 % voted for (simple) calculation tools. But also additional expertise in the pre-approval stage and in the jury was demanded (by 20 % and 22 %, respectively).

Several free responses dealt with the additional efforts needed to develop the energy aspects. Some respondents demanded that this effort should be rewarded. The online survey showed that architectural competitions have a high relevance for architects although they acquire only a small share of their business volume: 70 % of the respondents acquired less than 25 % of their contracts by competitions.

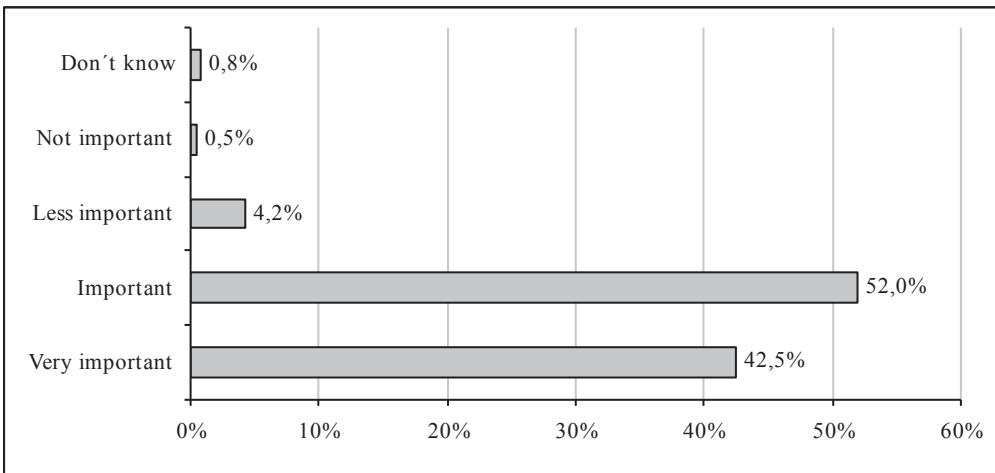


Fig. 2: "What is the importance of energy in your work?"

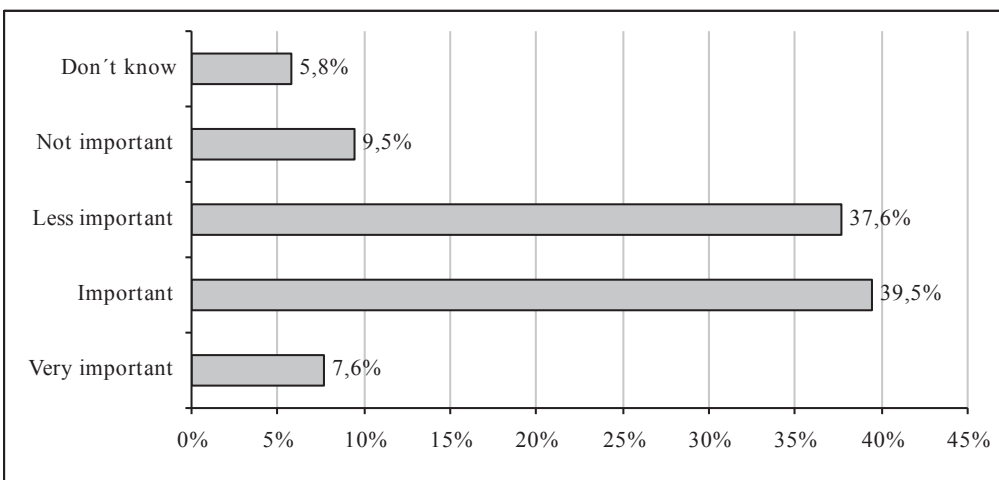


Fig. 3: "What is the importance of energy in architectural competitions?"

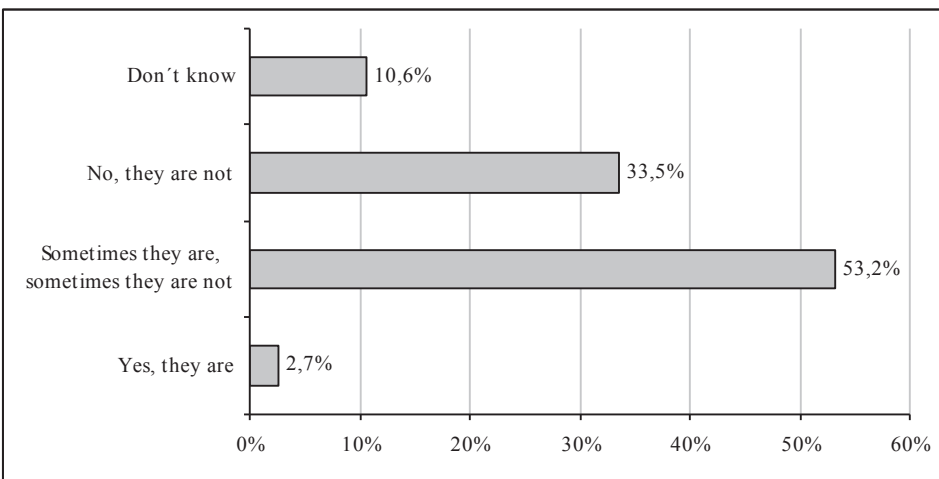


Fig. 4: "Are tendering documents clear with respect to energy to allow for an objective assessment of the competitors?"

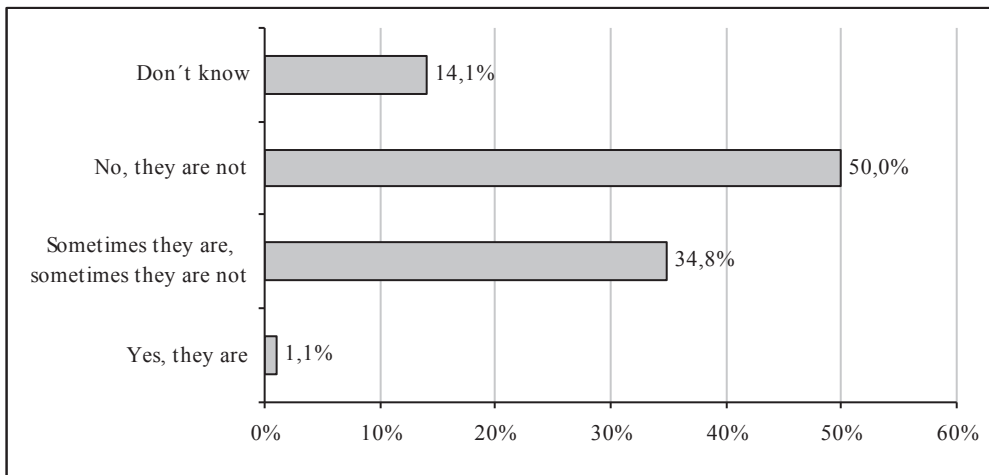


Fig. 5: "Are jury decisions transparent and comprehensible with respect to energy related criteria and weighting?"

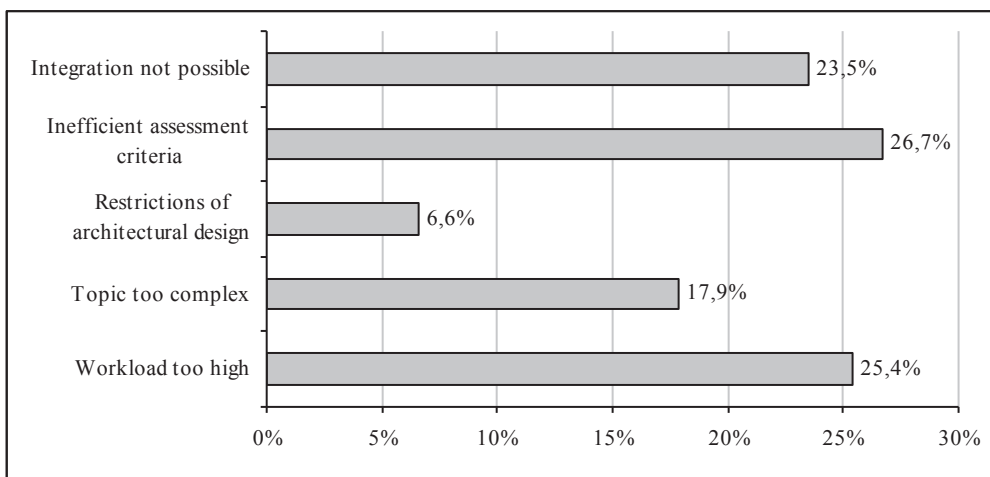


Fig. 6: "Which problems exist if energy aspects are integrated in architectural competitions?"

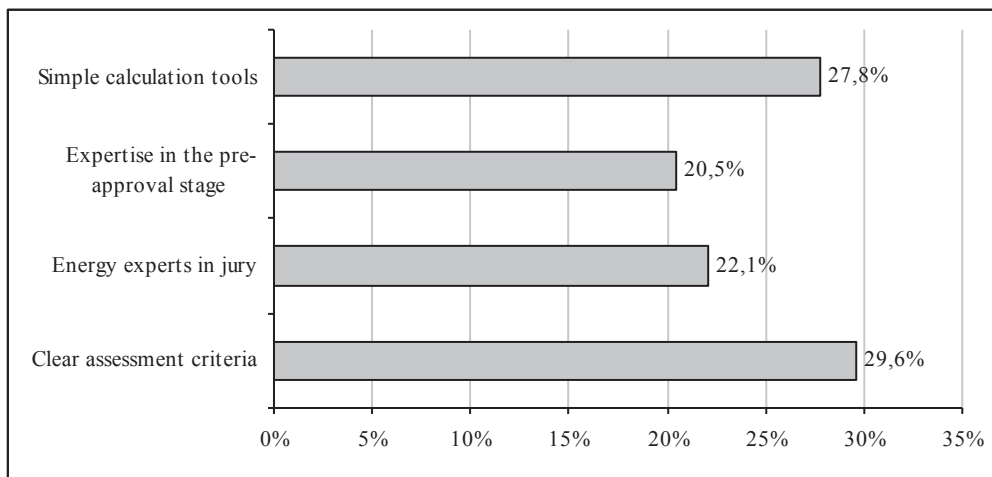


Fig. 7: "What should be changed in today's competition practice with respect to energy aspects."

WORKSHOPS WITH STAKEHOLDERS

Whereas the survey showed the opinion of the architects, professional clients expressed their view on the questions listed above in two workshops. The workshops were conducted with representatives of 5 project partner organisations that are actively issuing architectural design competitions for their building projects (KAGES – Styrian health care company, OEAD – housing office for students, BIG – Federal property owner, the building management of the Styrian administration, the Styrian Chamber of Architects). The aim of the workshops was to get feedback of stakeholders on the same questions as listed in the previous chapter. Moreover all issues of the above mentioned project “IEAA” were addressed, reaching from experiences to conclusions about the current situation and suggestions on tools that might be helpful.

The integration of energy aspects in architectural competitions was very high on the agenda of all workshop participants. They anticipate strict requirements in the future by public policy and by decision makers of their organisations. In their opinion jury decisions in practice often do not reflect the energy specifications, thus the winning project does not always perform as desired in this respect.

Several clients have already started to develop their own criteria and assessment instruments. However, quantitative criteria promising verifiable evaluations are still missing.

A point of vivid discussion has been to set the pre-conditions appropriately: To reach a jury decision that is transparent and also satisfies the client/meets the client's demands it is prerequisite that tendering, criteria and weighting has to be prepared thoroughly to get design proposals that can be compared soundly. The workshop participants agreed that the assessment should at least cover the demanded quantitative and qualitative characteristics (size, functions, costs) and a discussion of the pros and cons of the design. It was also considered as important to add also energy/sustainability to the list of quantitative characteristics.

More awareness of the energetic quality of the design would greatly be appreciated by all professional clients.

STUDY OF 51 ARCHITECTURAL COMPETITIONS

A study of 51 architectural design competitions for various buildings in Austria was conducted with the objective to analyse the present situation and focus on how environmental aspects are integrated. The competitions were selected from an online platform (www.architekturwettbewerb.at) operated by the Federal Chamber of Architects and Engineering Consultants of Austria that contains documentation of all major Austrian architectural design competitions.

From this platform 51 competitions were taken that showed ambitions concerning sustainability and that offered a range of building types and of representative clients (see below). The majority was issued 2006–2008. The study is based on documents from the online platform www.architekturwettbewerb.at. Documents comprised the tendering documents and jury panel protocols. Sometimes also reports from the design approval stage and additional competition materials (plans, project descriptions, expert reports, etc.) were available.

The promoters of the competitions had been 27 Public authorities and third-party companies of public authorities, 13 housing companies and 11 private companies as clients.

The building type mix was 37 % housing projects (and similar projects), 18 % offices and other conditioned buildings, 35 % schools and university buildings, and 10 % hospitals.

38 % of the competitions dealt with new buildings, 12 % with retrofit and 1 % both with retrofitting plus new building parts. The distribution of competition types was: 4 general contractor competitions, 2 ideas competition, 34 one-stage and 11 two-stage-competitions.

- The analysis of the integration of environmental targets in design competitions followed the most important competition stages, which in general can be divided into: Programming (project development), aims and aspiration of the project, incorporated in the tender documents
- Tendering, in specific definition of assessment criteria and assigning their weights
- Design works of the participants and provision of the required calculations/diagrams (if any) by the participants
- Design approval through an expert (or several experts)
- Jury panel meeting and decision

The main focus of our study was on energy related aspects, e.g. targets for operational energy in the use stage, as in all competitions under study they represent the most important environmental aspect. Other requirements that we examined were primary energy demand, ecological properties of building materials, land use, life cycle costs and social aspects like e.g. indoor environment and health aspects. Overheating in summer was also important issue in many competitions; as a requirement it was linked either to energy demand, to operational costs or to comfort.

In the following sub-section any quantitative objectives like the energy standard (the energy certificate that the finally constructed building should reach) were focussed on. Then the assessment criteria were analysed. The next sub-section deals with requirements concerning the submission of each design proposal. Finally the pre-approval and the jury's work were studied.

Envisaged environmental aims and energy standard

The tender documents of virtually all competitions contained a passage stating that the building is meant to be sustainable (this was also a selection criterion as mentioned before). The text however is not always going into further details.

Fairly often the energy standard that the building should reach is given:

- 29 % (15 building tenders) required “low energy standard”; mostly an energy performance of lower than 30 kWh/m²/year is given as the target.
- 14 % (7 building tenders) required to perform even better: 5 should be a Passive house, 2 should be better than low energy standard. In this category often the calculation method is also specified, e.g. according to PHPP (“Passivhaus Projektierungspaket”).
- For 16 % (8 buildings) it is stated that buildings codes are sufficient.
- For 41 % (21 buildings) there was no instruction on this issue.

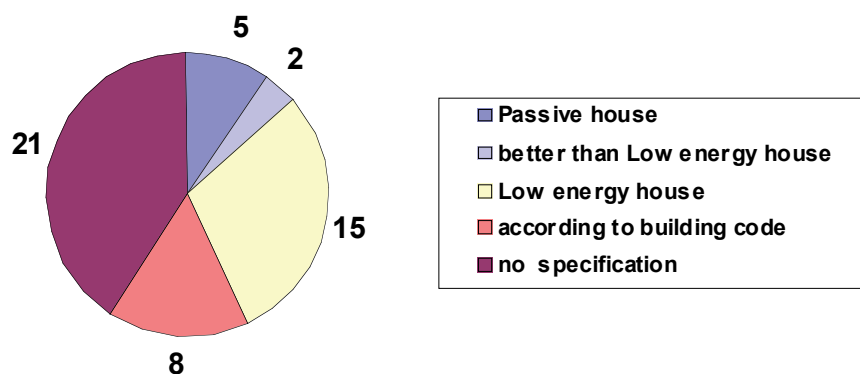


Fig 8: Specification of the energy building standard that should be reached.

The use of renewable energy sources is also desired in several cases:

- 10 times passive solar energy use should be integrated in the design.
- 7 times active solar components should be integrated; 5 times for domestic hot water and 2 times additionally for heating and/or cooling.
- 2 projects should also have photovoltaic.

Solar energy use was expressed as an aim particularly for the low energy standard buildings. But seldom was the fraction that should be covered by solar energy specified.

An elaboration of the HVAC-concept was requested for all 4 general contractor competitions which should by the way all reach Passive house or better than Low energy standard. It was stated what should be the calculation basis (e.g. Passive house standard according to PHPP programme). In 18 tender documents the favourite energy source was named, which was 10 times district heating, 4 times renewable energy (e.g. biomass), 2 times “alternative energy” (e.g. heat pump) and 2 times other energy carriers (natural gas, fuel oil). In few tender invitations it was required to show that no overheating in summer will occur; but not always a method was determined how to fulfil the requirement.

Other environmental targets were not quantified and thus are even less definite than the energy standard.

Some clients attached additional information brochures and studies, e.g. a Greenpeace leaflet on climate-conscious organization of construction processes and choice of materials or gave data hubs and sources. It was left up to the participants to draw conclusions for their design proposal and to elaborate their ideas in the description of their proposal. It was required in 5 of the projects by the client that sustainability aspects (apart from mere energy centred considerations) should be referred to in the description.

When environmental and life cycle statements were part of the tender documents the projects were often also designated as “pilot projects”. The vision that could clearly be recognized was to go beyond usual practice concerning sustainability. Nevertheless only few examples explained visions and objectives in detail or quoted measures how they should be reached (e.g. grey-water tank, etc.).

Assessment criteria and weighting

The criteria that the jury is going to apply to their decisions on all submitted schemes have to be disclosed in the tender documents in Austria. Commonly used criteria are “urban development”, “architecture”, “functionality” and “economical operation”; sometimes a 5th criterion “ecology” or “sustainability” is added, occasionally even more criteria are held. 4 of the 51 competitions did specify only the above stated first four criteria with no further reference to energy or sustainability and with no further explanation of them either. The remaining 47 competitions explicated sub-criteria for each criterion and are evaluated in the following paragraph.

Assessment criteria and weighting for energy

Energy and energy-related aspects are either contained in an own criterion (7 times), or they are part of another criteria category (29 times) or they are not included in a criterion or sub-criterion (11 times) at all. 4 times only headings of criteria categories were given with no reference to energy or sustainability. So it can be presumed that these aspects were not assessed either.

Regarding the 29 competitions with energy supply and energy use requirements being part of another category, these were most often economical criteria (in 15 competitions). The corresponding wordings read e.g. that energy consumption is a factor of “economical operation”, it is determining the “follow-up costs”, it is causing the need for optimized solutions with respect to overheating in summer, etc. In 16 competitions energy aspects are a part of a sustainability or ecology criterion. In 5 competitions energy was also addressed in another criterion, e.g. within functionality.

Some tender documents had a weight (in percent or as a certain number of points) assigned to each criterion that the jury would reflect. Weights were indicated on the level of criteria; sub-criteria were not weighted. 15 competitions specified weights; in 5 of them the energy criterion was given a weight ranging from 33 % (of 100 % total sum) in 3 passive house projects, to an innovative façade renovation (15 %), to a guest house committed to sustainability (4 %).

Assessment criteria and weighting for sustainability

Sustainability was one of the assessment criteria in 21 competitions. Three times the sustainability criterion was extensively detailed and further subdivided. Eight times sustainability was a main criterion (usually one of 4 or 5 main criteria). In all

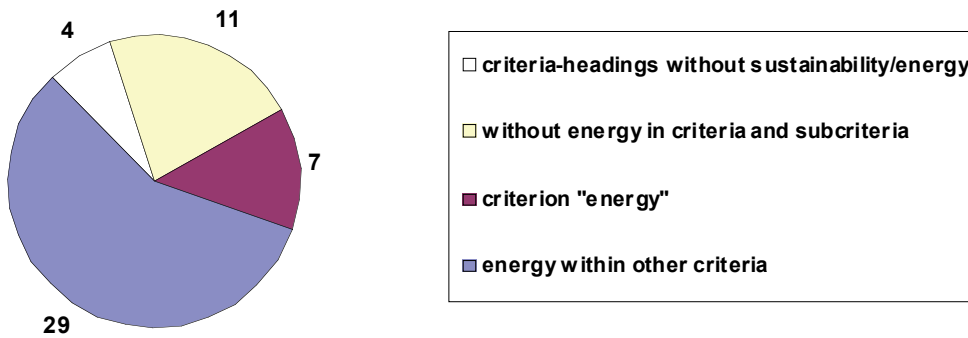


Fig. 9: Role of energy and energy-related aspects in the assessment criteria of the analysed competitions.

other cases ecology or sustainability was either part of the criterion header (very often it was termed "Ecology and economy") or a bullet point. There are some examples of tenders with no sustainability criterion in their list. Nevertheless they claim to be ambitious in terms of creating a sustainable building. In one of the competitions even an expert was hired to analyse all proposals with respect to the primary energy demand of the building materials; however the participating designers were not involved in this expertise.

Scope of submitted work

Defining one or more dedicated assessment criteria is a good possibility to ascertain that the applicants will respond to that issue – this has been analysed in the previous chapter. Another very strong possibility is to require specific documents for submission, e.g. certain drawings, diagrams or calculations. Usually a list of required documents is given in the final chapter of the tender. A submission is considered incomplete without these documents and is not admitted further. In the 51 scanned competitions no such requirements had been posed.

Requirements may also set forth in the course of the text of the tender documents. This was found in some of the analysed competitions. The formulation sounds often: "The scheme should react on...". These references can either be visions explained in detail, or guidelines included or external studies that are attached. They are rather vague hints for the implementation of sustainability goals. A contradictory example – may be an exception proving the rule – was a tender document stating in a sole paragraph that the design has to meet low operation costs and that this will be checked in the design approval.

As a matter of fact, sustainability is often dealt with in written statements of the participants which cannot be verified and which thus cannot seriously be counted on. On the other hand the designers do not know whether it is worth to invest time and effort since it is not evident that the jury will take these sections into consideration.

Design approval and jury

In Austria a pre-check of all submissions is customary to ensure that all designs meet the requirements, e.g. that they are compatible with the local building codes or with housing subsidy requirements. This check is performed by a professional architect, at times assisted by additional experts like energy experts or technical experts of the client. One important task is also to compile key indices to benchmark the submitted projects and to provide the numbers to the jury.

Time and effort of design approval will be enormously increased if complex key indicators have to be calculated, e.g. an energy index. In some competitions those key indicators had been quoted as a relevant decision criterion, e.g. the surface/volume ratio albeit this number has not been demanded from the applicants. In practice it can be assumed that this indicator was not available to the jury then and the jury decided "on instinct". Alas, pre-check protocols were not available for all 51 analysed competitions.

Involvement of energy expertise

Energy experts had been involved in the design approval (pre-check) in 14 competitions, whereas in another 14 competitions they had not been. For 23 competitions no further information on this subject could be gathered.

The energy experts had evaluated all schemes, and information was included in the protocol, with the exception of 2 competitions showing no energy-relevant additional information. 12 of the 14 competitions can be termed ambitious with respect to energy and sustainability goals, 6 claimed to be pilot projects in this respect. 5 of the 14 competitions had been a call for passive houses, 7 had been a low energy house call. Strikingly many municipalities involved external (energy) experts.

Energy experts had been participating in 7 jury panels, although 5 of them were already energy-pre-checked. This is a particular firm basis for assessing how appropriate the future building will be in terms of energy performance. In all 7 competitions energy aspects are present in the jury protocol. But in another 12 competitions also energy aspects were apparently discussed and recorded. 7 of the latter had been energy pre-checked.

In Austria the jury examines every admitted scheme and puts down an outline of the decision. Often a detailed reasoning of the decision is recorded, especially for the winning projects. It was analysed whether energy-aspects were raised in the description of the winner project.

An overall picture is given in the diagram below. So, if energy experts participate in the pre-check and/or participate in the jury energy aspects will also be mentioned in the jury's description of the winner. So the winner description gives some indication on the energy assessment.

Sustainability aspects

From the jury protocols it is virtually impossible to recognize what weight sustainability was given in the jury or whether it was considered at all. In the minutes of the discussion the

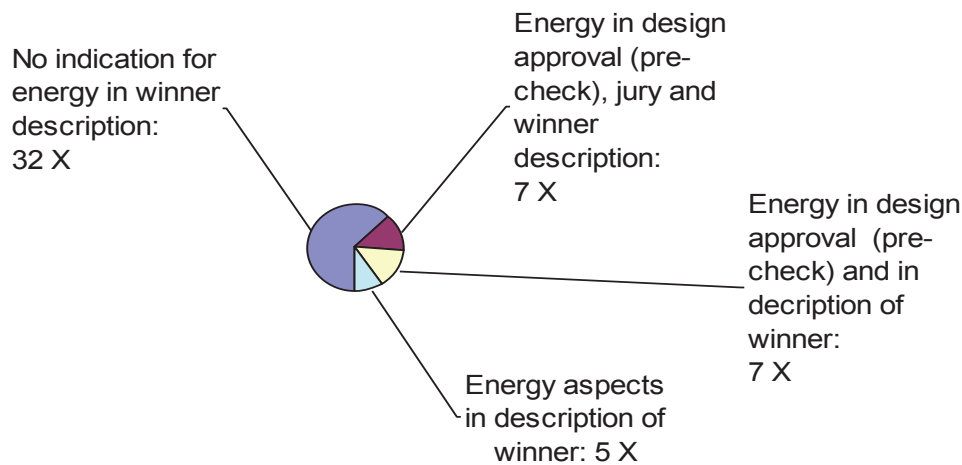


Fig 10: Consideration of energy in the description of winner project with/without energy experts involved in design approval/jury.

submitted design proposals usually are described in terms of the functionality, how they fit into the neighbourhood, the expressed “design statement”, etc. but not the expected contribution to sustainability.

DISCUSSION OF RESULTS FROM THE STUDIES

Sustainability and high energy performance is very often a vision of clients nowadays. The EPBD has raised the need to set the tracks in this direction early. Professional clients and competition promoters perceive this challenge and have already started to develop own tools to evaluate pre-design. This was confirmed in the workshops with representatives of 6 national and regional authorities and institutions that are acting as competition promoters.

In the online survey architects approved the significant status of energy in architectural competitions: After all 47 % rate it as a very important or important issue.

The analysis of the 51 architectural design competitions also reflected sustainability as a client’s value. Tender documents contain sustainability information and requirements at various points of the competition brief, e.g. in the description of the project, in design guidelines and advice, or in the assessment criteria. The expectation was also often expressed that the submitted schemes should be an answer to these client’s ambitions and that the winning project is also an outstanding sustainability solution. But detailed guidance was seldom given in the competition brief on what method to use or what evidences had to be included.

Problems that were mentioned to come along with early assessment of pre-design schemes that are submitted in architectural competitions are: time and effort that might be too high, details might be needed that are not developed yet, and criteria that are not clear and elaborated. These problems ranked equally important in the online survey. It is interesting to note that the concern that design options and variability might be reduced was not voiced.

Clients and competition promoters report the same problems related to assessments. They additionally complain about “empty promises” applicants make concerning the energy performance of their submitted scheme.

The situation was analysed in greater detail in the competition documents: Several competitions contained detailed

energy-related text but no corresponding assessment criteria. The other way round was also found: there were energy-relevant assessment criteria (mostly under economic or ecology headings) but no explaining text and no further information indicating the seriousness and importance within the decision process. It can be stated that rarely any applicant knows how energy and sustainability aspects are rated and how he/she should illustrate how well his/her scheme is prepared to cope with it.

Recommendations for the assessment of energy and sustainability aspects in architectural competitions

Following recommendations for the implementation of energy and sustainability aspects in architectural competitions have been developed in the EU project “LoRe” and the Austrian project “IEEA”, they are based on the study of architectural competitions conducted in these projects. Although somewhat technical this section indicates how to operationalise energy and sustainability issues for architectural competitions.

Besides these recommendations, which are outlined in the following, a detailed guideline and an energy assessment tool for architectural competitions have been developed in the Austrian research project “IEEA”. Both are already successfully implemented in the daily practice of important Austrian clients. In order not to go beyond the scope of this paper, on the following pages only a summary of the “general” recommendations is given. Detailed information on the IEAA guideline and the IEAA assessment tool can be found in the paper listed in the reference chapter following the link <http://www.ifz.tugraz.at/index.php/ieaa-tool> (German version only).

ORGANISATIONAL PRINCIPLES

To enable a comprehensive integration of energy and LCA aspects (like choice of materials) into architectural competitions all stages of an architectural competition have to be considered. Tailor-made strategies and instruments for these different stages have to be developed. Therefore a practicable implementation of energy and LCA-related aspects has to be done along the typical stages of architectural competitions, considering content and scope of these stages.

- *Programming stage/project development.* A clear definition of energetic and environmental targets by the client should be first step. If possible the client's brief should contain benchmarks with quantitative indicators for energy and environmental aspects. Specification for energy and LCA related aspects and their weighting should be seen in relation to other specifications (architectural quality, function, costs, etc.). Therefore tendering institutions/clients have to provide clear and transparent weighting criteria for the participating architects and the jury. Also a weighting within different environmental specifications (e.g. higher weighting of operational energy use) in most cases makes sense.
- *Tendering stage.* Tendering documents have to be based on the targets and specifications set in the programming stage of project development. A clear communication of these aspects to the participants is very important. Preferably quantitative, rateable criteria should be used. All targets set have to correspond to assessment criteria and assessment tools. Provision of simplified assessment tools for all participants is highly recommended. Participants have to be obliged to provide the tendering authority with all data required for the assessment of their projects (plans, calculations, detailed descriptions). Data required by the participants should follow the level of detail (content and scope) of the competition, which is in classical competitions corresponding to the preliminary design stage.
- *Design approval.* For the proof of data provided by the participants the competition promoters have to create clear rules. Provision of standardised, simplified tools by the tendering authority, which has to be used mandatory by all participants, is the only way to get comparable, verifiable, results. Tools should be such that participants can use them for the optimisation of their projects. Evaluation of results should be done by experts in the design approval stage. Besides other results LCA results should be summed up in a report for the jury, which is the basis for the jury decision.
- *Jury meeting.* Especially for architectural competitions with strong focus on environmental aspects the inclusion of LCA experts with voting right in the jury meeting is essential. To avoid jury decisions by "instinct", decisions of the jury, as far as possible, should be based on quantitative results provided by a report from the design approval stage.

CONTENT AND SCOPE OF ENERGETIC AND ENVIRONMENTAL ASSESSMENTS

Adaption to the level of detail corresponding to the type of competition

Content and scope of energetic and environmental specifications have to correspond to data and information available in each architectural competition. Classical architectural competitions are corresponding to the preliminary design stage, information on the building are limited to design-related aspects like definition of heated and cooled areas, shape to volume ratio, area and disposition of windows, building position and orientation. Detailed information on construction system, building materials and HVAC systems are not available. This circumstance has to be kept in mind when integrating the as-

essment of energy related issues and LCA aspects into architectural competitions. Therefore the focus of the assessment in classical architectural competitions mainly should be on environmental aspects influenced by the design of the building. Therefore in most cases the energy demand for the operation stage (heating, cooling, electric lighting, DHW) will be in the centre of the assessment and other environmental impacts, like impacts of building materials, will be secondary.

System boundaries

As there is only limited information about the building in the competition stage and, additionally, the winner project often takes changes until its realisation, only following LCA aspects are recommended. System boundaries should be restricted to product and use stage, with the product stage limited to the manufacture of building structure and building envelope materials. The assessment of construction and building materials should be limited to the thermal building shell and suspended ceilings. On one hand experiences from different LCA studies show that these building elements have the biggest environmental impacts and on the other hand information on these elements are available in almost all architectural competitions.

Conclusions

The most important phases for implementation of sustainability and energy aspects are programming and preliminary design which is exactly covered by architectural competitions. Energy and sustainability in architectural competitions is seen as important topic by architects and clients, but so far suitable strategies and instruments for successful implementation are missing.

In most architectural competitions energy and sustainability turns out to be a vague vision of the client without measurable targets and clear specifications in the tendering documents. This situation gives broad wiggle room for participants, pre-checkers and the jury. For participants the lack of transparent assessment criteria means ambiguity concerning their performances. Pre-checkers are not able to provide transparent, traceable documents for the jury, so that jury decisions are very much characterized by acquired or claimed experiences or maybe by a sense of relevant characteristics or even by "instinct".

Strategies for the integration of sustainability and energy aspects have to be done along all phases of architectural competitions both on organisational and on technical level. The development of practicable assessment tools turns out to be one of the most important issues. This has been quoted as well in the online survey by architects and in the workshops by clients. Compulsory use of the same assessment tool by all participants is the only way to get reliable and comparable results, the use of alternative tools should be excluded.

As a stating point energy related objectives like heating and cooling energy demand should be integrated in the assessment, as on one hand information for the assessment of these aspects is available in almost all architectural competitions and on the other hand the effort for all actors (architects, pre-checkers, jury) is passable. The assessment of the environmental performance of building materials proves to be more difficult, as

detailed information on building components in architectural competitions are not common. If an environmental assessment of building materials is performed a limitation to the main building components like the thermal building shell and suspended ceilings is recommended.

Last but not least, besides the development of assessment instruments, comprehensive measures (like education, skill enhancement, dissemination activities) to improve the awareness for the importance of sustainability in architectural competitions have to be forced.

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