

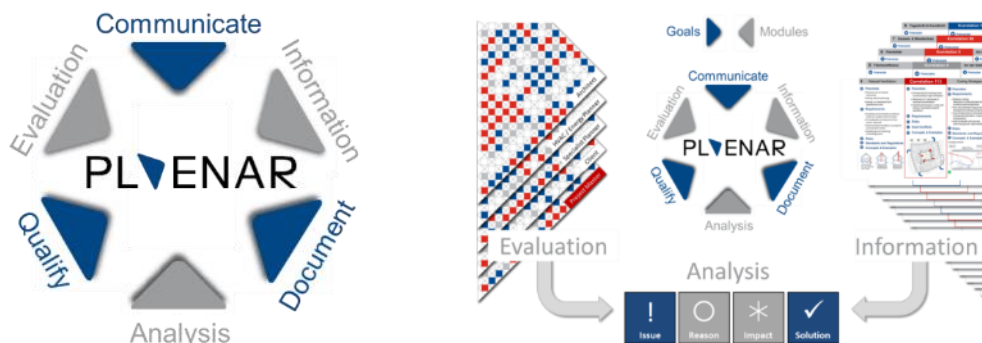
# PL·E·N·AR Planning Aid for Energy Efficient and Sustainable Architecture

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## ABSTRACT

PLENAR is a design guide for structuring of basic principles of building design for the preparation and implementation of an integrated design process. Without this process ambitious projects won't succeed. Main focus is the support of a common, interdisciplinary understanding of planning philosophy regarding energy efficiency and sustainability, among all partners involved in a building project.



PLENAR consists of three main goals which include

1. Communication among actors involved by well-structured discussion formats
2. Qualification of participants and project goals by interdisciplinary approaches
3. Documentation of results in suitable formats for decision making and QA

Facilitating these goals PLENAR provides correlating application modules including

4. Evaluation: Using a given matrix, interrelations of relevant criteria can be evaluated individually by actors, the next step is to compare and assess the results.
5. Information: A database provides generic information on criteria and their correlations with a focus on energy efficiency and sustainability.
6. Analysis: The individual assessments of the relevant correlations made by the participants are discussed to derive the main goals for the individual project.

The presentation will inform planners, interested customers, and companies about the current state of development to promote the progress towards a professional web-based application which would support assessment systems in particular.

**Keywords:** *integrated design process, sustainable building, energy efficiency, design guidance*

## 1. BACKGROUND – OBJECTIVE - POTENTIALS

The complexity of design processes increases continually. The potential of influence on energy performance, comfort and cost efficiency, as the most essential characteristics of sustainable building design, lies in early design stages. Hence, already in state of demand planning certain conditions have to be settled to define a requirement profile with an entire space allocation plan and holistic project goals.

Therefore, it is necessary that a common understanding of planning philosophy regarding energy efficient and sustainable building is set from the very beginning among all project partners. The early and constructive examination of the most important criteria and their correlations as well as their impact on sustainability quickly

leads to this common planning understanding and guarantees a higher quality of the entire planning process. PLENAR can be used and adapted by all design teams for their individual project.

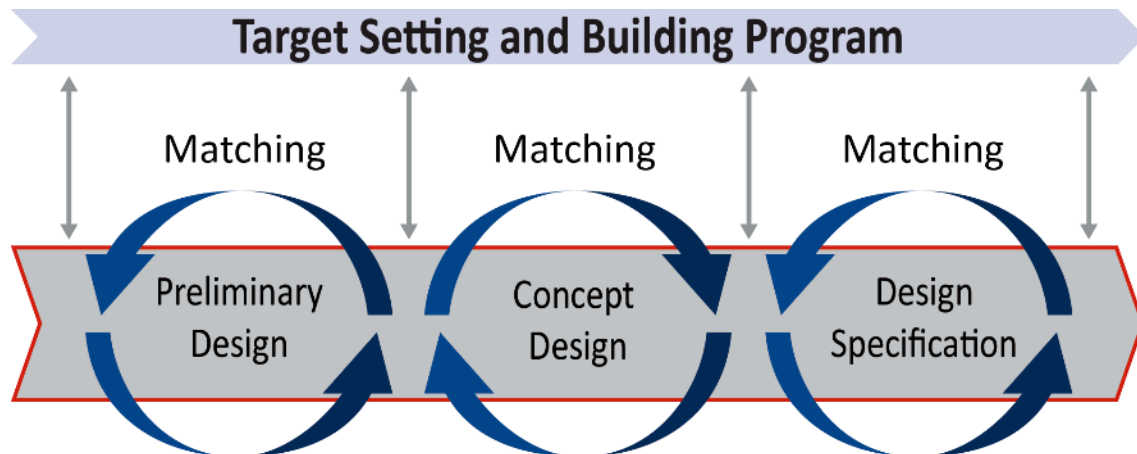


Figure 9: Optimization by iteration loops during an integrated design process

The planning aid PLENAR enables in a short period of time

- An improvement of transdisciplinary understanding on energy and sustainability-oriented relations for all project partners: client, architect, professional planners, user, facility manager and others
- The development of an individual project master as a baseline for the specific project requirement profile and the structuring of the projects integrated design process by selecting and adapting the type and number of relevant criteria
- The development of a project roadmap for the further approaches in the integral design process with concepts to iterations in individual planning stages to optimize the entire planning and implementation process
- The documentation of results as a requirement profile for target agreements and performance specifications as a to-do-list for planners
- The documentation for the building certification as a verification and optimisation for planning objectives when applying assessment systems

## 2. APPROACH

The design guidance is based on extensive experience of comprehensive project support focussing integrated building design, energy efficiency and sustainability. All correlations (Figure 10) are assessed individually concerning their degree of influence on energy efficiency and sustainability by each actor.

Example: Correlation no. 21 represents the relation between building mass distribution (criteria no. 2) und flexibility (criteria no. 6). The assessment of the actors is determined and compared to a reference (master). Significant deviations to this master, but also among actors, allow a structured discussion. By this way misunderstanding among participants and information gaps can thereby be eliminated. Moreover, the actors will get insight to their role during an integrated design process.

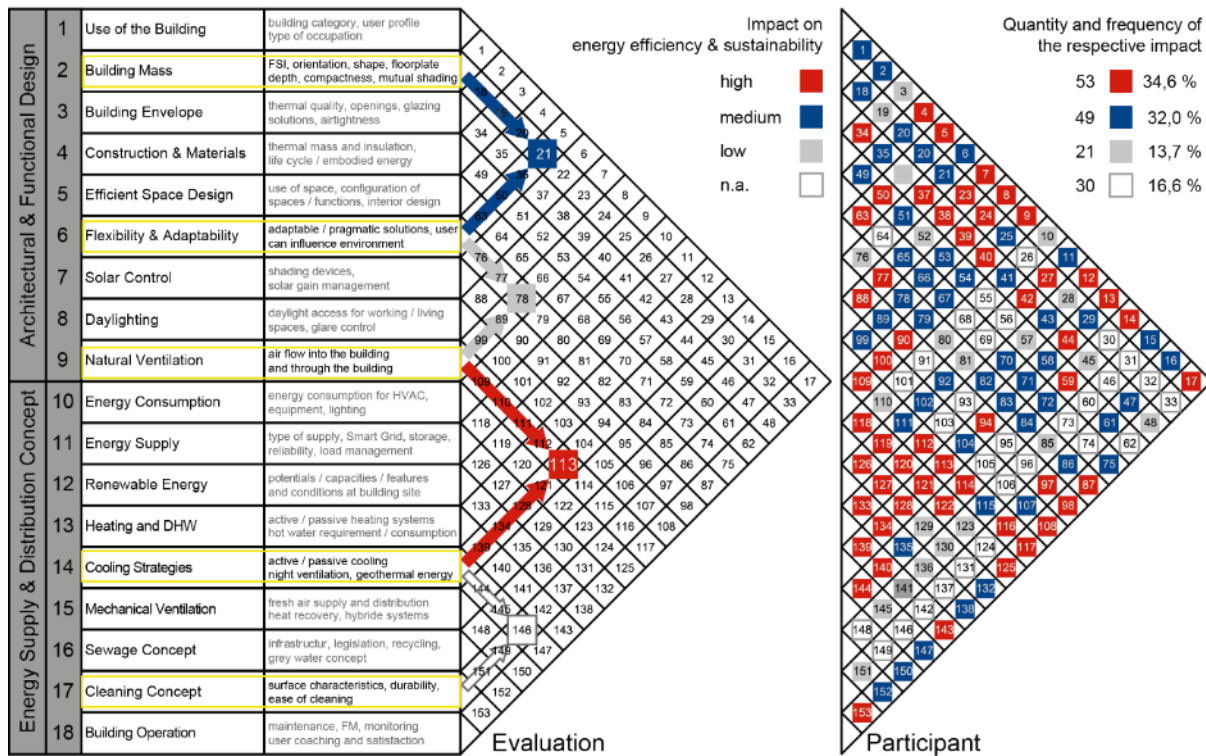


Figure 10: The correlation matrix for an individual application for planning actors

All planning participants, such as architects, energy planners, client and other experts evaluate 153 correlations resulting from 18 criteria, e.g. for office buildings, according to their individual assessment and experience. If possible, all correlations are to be assessed completely with regard to their impact on energy efficiency and sustainability and to be determined in the matrix according to the evaluation level (high, moderate, low or not applicable).

Hence, in the early planning stage each member of the interdisciplinary team has to deal with the same questions. This means, all project participants gain an extensive insight into the planning complexity and, above all, beyond the boundaries of their own planning discipline.

## 2.1 Evaluation of the individual knowledge

The results are analysed on the basis of the assessments made by the actors, i.e. they will be compared among each another and mirrored to a (master-) reference matrix provided by the design guidance PLENAR. This process gives an overview of the individual knowledge of all actors involved (Figure 11).

With a professional supported and moderated discussion, the different perspectives of the actors can be brought to a common level. Thus, individual expertise is exchanged and expanded for each participant. In the first iteration of the discussion process only the assessments with substantial deviations (deviation of 3 levels) are considered. In a second loop the deviations of level 2 can be discussed on demand as well.

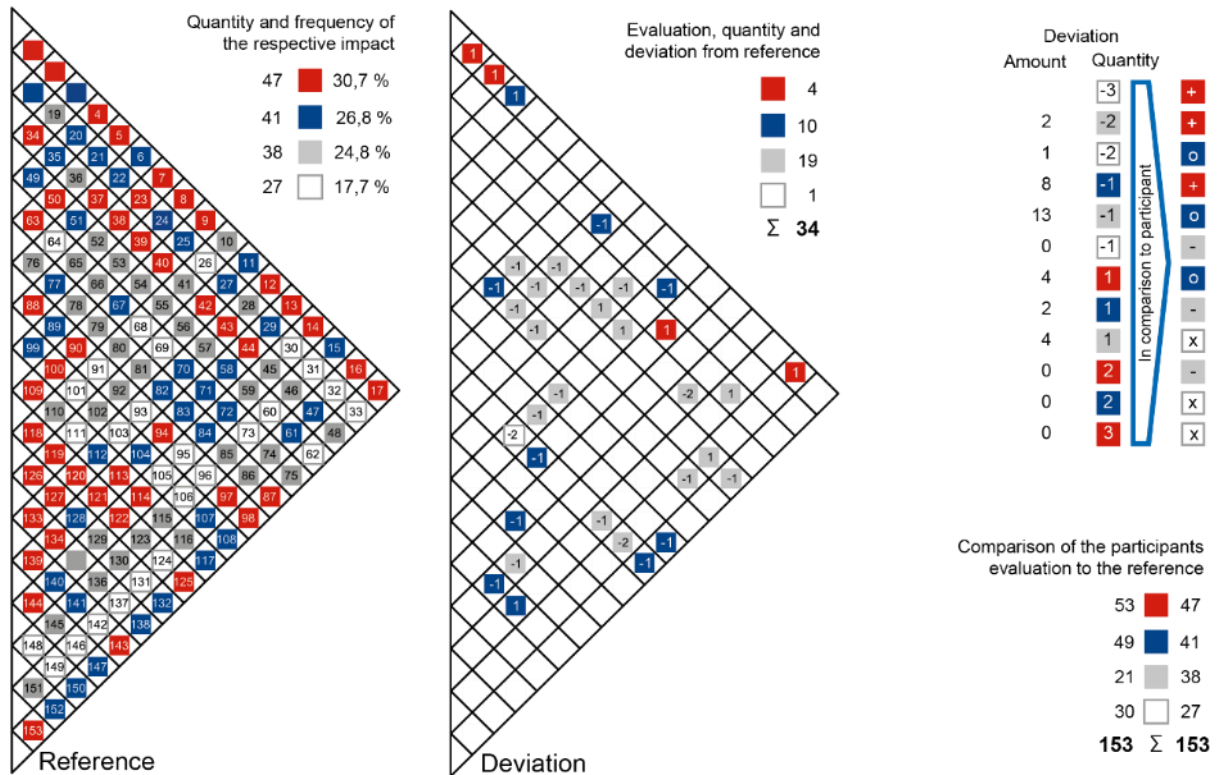


Figure 11: The individual correlation matrix is compared to a reference matrix (master) and evaluated

PLENAR is applicable on different levels. Information level 1 (Figure 12) gives a rough description of the related criterion and its specification and a recommendation for the planning to its user. This level is the basis for evaluating the correlations of individual assessments regarding their respective relevance and the degree of their influence on energy efficiency and sustainability.

Information level 2 describes a variety of information about the potentials of the respective criteria, requirements, risks, standards and guidelines, concepts and examples, such as generally formulated sheets for the requirement and performance specifications (Figure 13). In a discussion, this additional information provides well-founded information to qualify and simplify the planning process.

## 2.2 Information about the correlations (Level 1)

The database provides supportive generic information for the interdisciplinary discussion of the actor's assessments. This is done for all 18 criteria. If the correlation between two criteria has a high impact on energy efficiency and sustainability (e.g. correlation 113 marked in red), corresponding relevant information is provided as well (Figure 12).

This information can also be adapted and documented according to the respective project specific requirements of the construction project. In this way you fulfil the prerequisites for compiling a performance specification sheet for further planning steps.

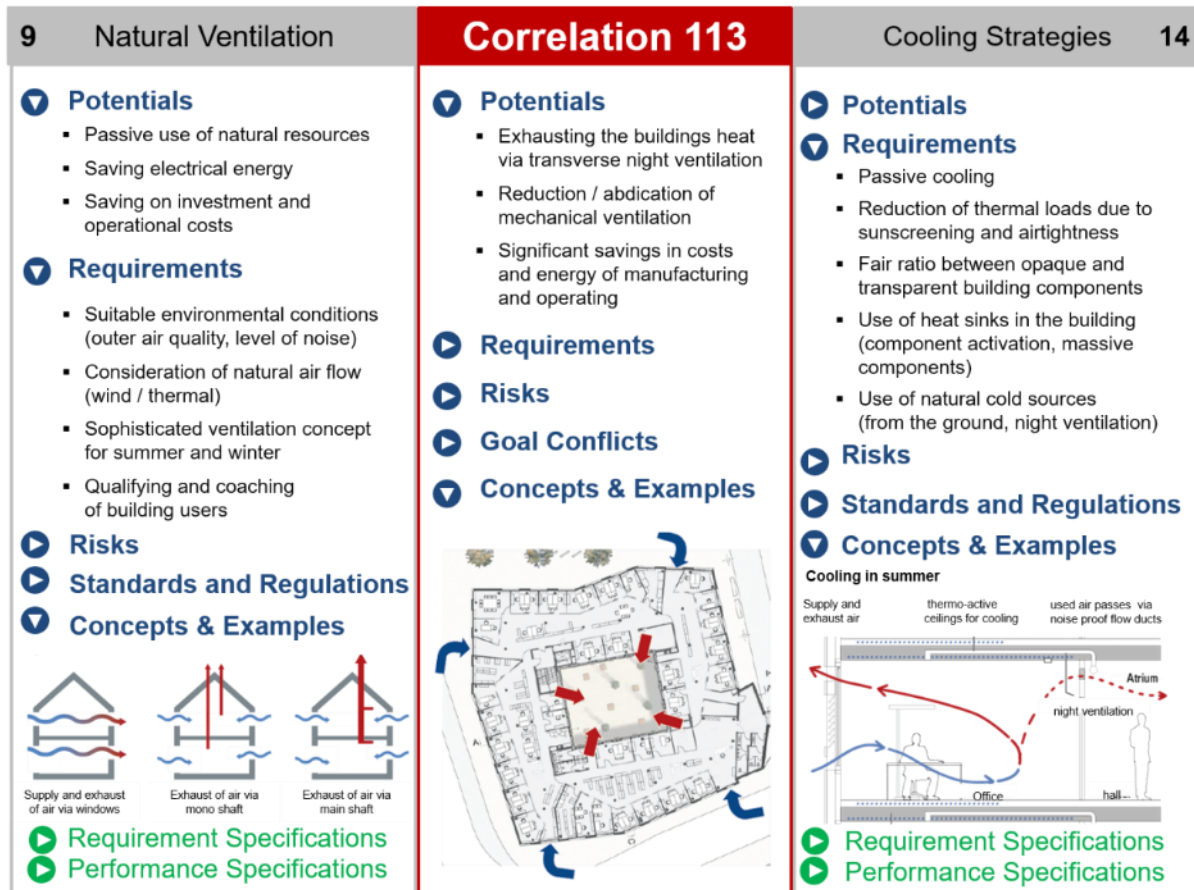


Figure 12: Correlation example 113: Natural ventilation versus cooling strategy

Information: As a communication basis a database provides information on all criteria provided and relevant correlations of high, moderate and low impact. In the discussion different levels of knowledge of the individual actors are balanced and the database is expanded continuously by the feedback of each project implementation. This is true for all building type applications.

Communicate contents and attitudes. Deviations of assessments will be analysed and interpreted in comparison to the chosen reference (generic master, individual project matrix, individual actor's assessment). Important deviations are preferably discussed in a kick-off workshop.

### 2.3 Profile of requirements and implementation concept (Level 2)

For sustainable design, the requirements profile must be defined with clear project targets and subsequently a complete building program, which is then to be transferred into a performance specification sheet and implementation concept. The starting point and guideline are the confirmed project targets resulting from and addressed in the sustainable building certification system.

The example in Figure 13 shows requirements for a qualified ventilation concept: air quality, user acceptance, low energy demand, low operating costs and noise distribution. The performance specification sheet instructs the relevant measures to be implemented.

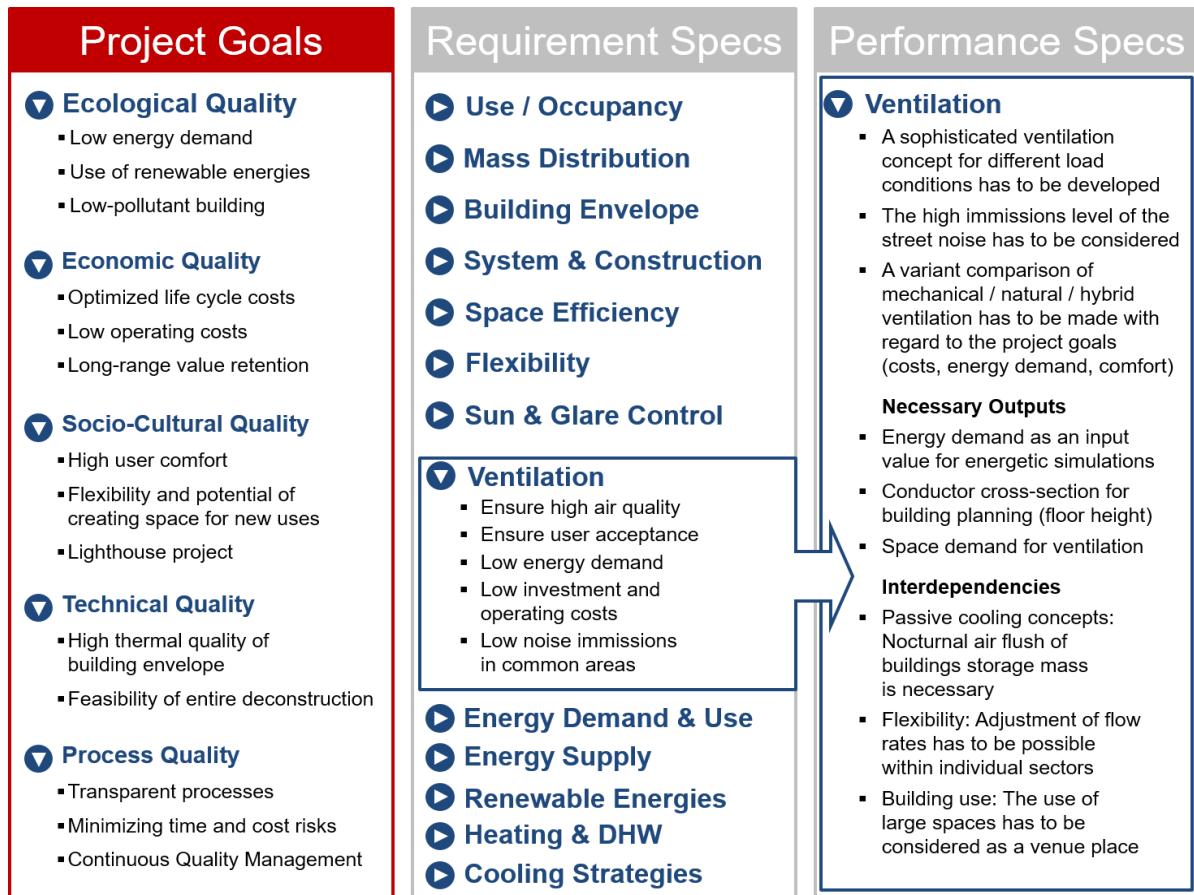


Figure 13: Requirement specs define requests - performance specs determine related steps for a successful realisation

Qualification: The professional exchange for the assessment of correlations and the relevance for the certain project quality both the actors and the entire planning process. As a target agreement, elaborated content and results are documented in a requirement specification and in the performance specification sheet based on it.

Document the integrated design process. With the help of PLENAR, all results of the assessment, the discussion and the specification of the connections for the optimisation of energy efficiency and sustainability can be structured and documented bindingly, for all subsequent planning steps.

## 2.4 Analysis of effective conclusions

The respective interrelation of tasks, targets, issues and target conflicts, requirements and desires as well as their backgrounds and effects can be analyzed in a subsequent context analysis (Figure 14) in order to develop solutions. In further planning progress, design related specifications are defined and updated or re-defined especially for the current project. As a directive for the objective implementation they are then documented in a comprehensive performance specification manual serving as an instruction book as well.

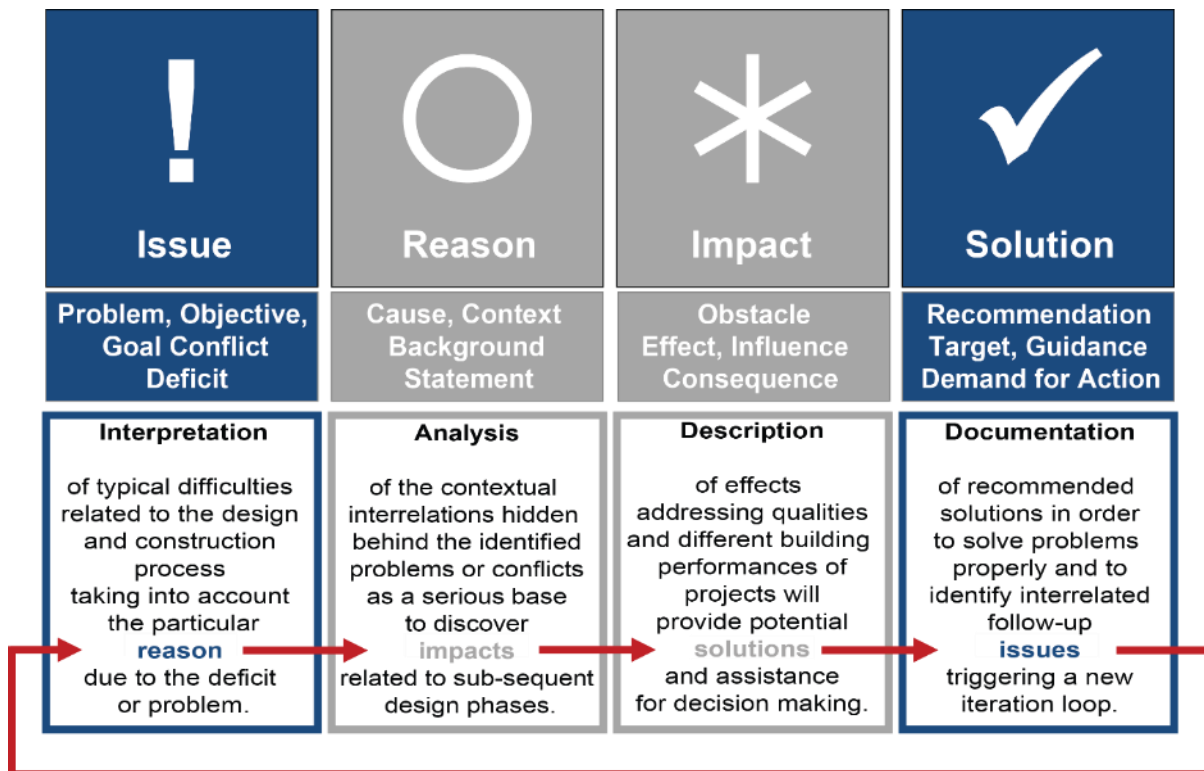


Figure 14: The context analysis is a method for the holistic analysis of correlations in the context of tasks and solutions of all kinds, in order to create a solid basis for the decision-making process.

By using the method of context analysis, tasks, issues, goal conflicts and deficits or problems can be identified in a dialogue with all planning actors. Their backgrounds should be described as well as the respective effects, for example on comfort or operating costs, can be identified systematically. Only this kind of view on the entire context will give the opportunity to deal with questions in a comprehensive way.

For example, solution approaches of the context analysis will also be developed resulting from contradictions and problems with review of the requirement and performance specification sheets or with deviating in goal statements during design progress.

Thereby this method is an important instrument for the elaboration of decision papers and also, based on comprehensive consideration, an element for the integrated planning and implementation process.

### 3. FUTURE PROSPECTS

In order to provide the tool for planning teams in all kinds of projects, it is to be developed as a web-based application. For individual adaption. As a result, it gives an important contribution to the improvement of the interdisciplinary planning and building culture towards integrated design, energy efficiency and sustainability. In addition to the use of PLENAR as design guidance in building projects, it is also suitable for (interdisciplinary) teaching at universities as well as for further education and training through the academies of architects and engineers chambers.

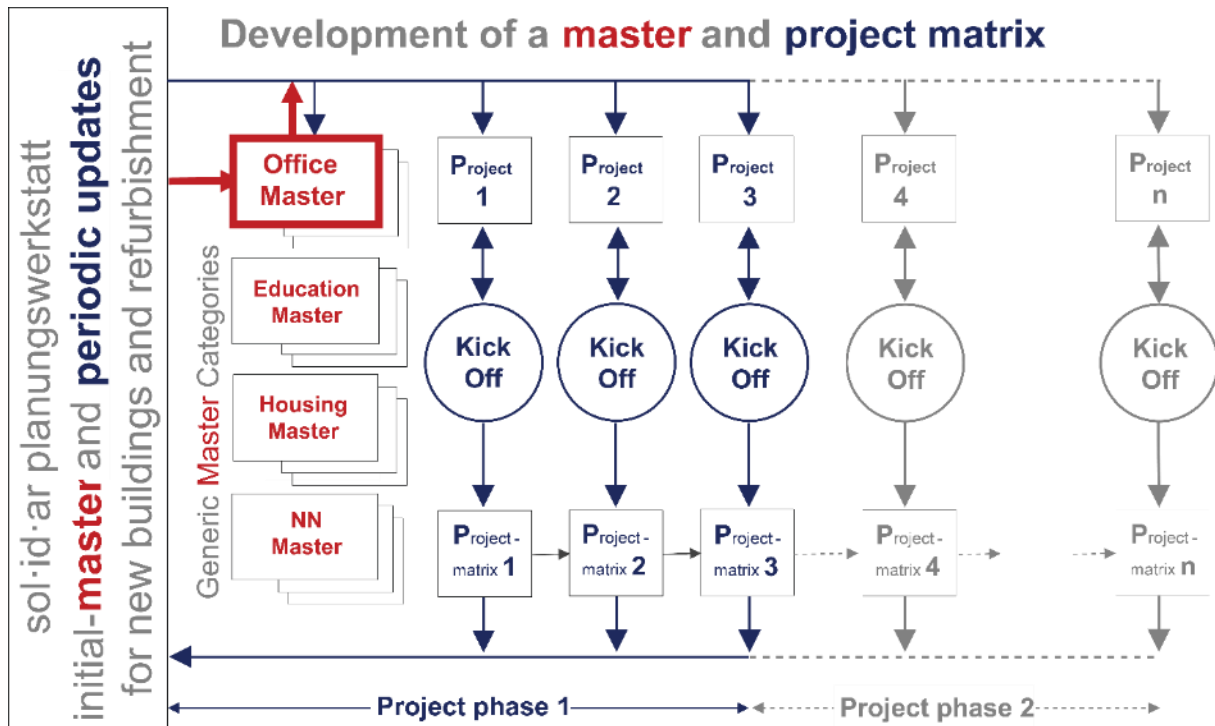


Figure 15: Development of master and project matrix: By applying PLENAR in different projects with different building categories, different masters for different building uses will be created

Moreover, it is also reasonable to use the tool to educate sustainability coordinators and auditors of sustainable building certification systems such as DGNB and BNB in Germany, LEED, BREEAM, etc.

The development for professional applications will provide so-called masters for building categories like office building, housing, education buildings, etc. for both new buildings and refurbishment (Figure 7). Thus, PLENAR qualifies itself frequently by the implementation into design processes and feedback from application practice.

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