Integrated (Energy) Design: Tool-kit and lessons learned from practice

The IEE-project MaTrID – market transformation towards nearly zero energy buildings through widespread use of integrated energy design – started in June 2012 and ended in December 2014. The project aimed to support the implementation of the Directive on the Energy Performance of Buildings. Integrated design is a proven method of achieving high-performance buildings that meet the set goals without sacrificing architectural quality or causing excessive costs. Stakeholders start to collaborate within the very early phases of the project. Therefore, an easily applicable IED tool-kit has been developed and pilot projects have been accompanied.

Key words: Integrated Design, Integrated Energy Design, Nearly Zero Energy Buildings, high energy performance buildings, design process, life cycle costs.

Major outputs and results of the MaTrID project:

- Establishing a common understanding among building developers and designers with respect to the advantages and requirements of IED;
- Strengthening the know-how in applying IED by improving availability of IED procedures, guidelines and contractual stipulations;
- Large scale test for integrating IED in design processes in 10 partner countries: Austria, Greece, Italy, Norway, Sweden, Slovenia, Slovakia, Poland, Latvia, UK;
- Broad dissemination and promotion of IED on the national level as well as on the EU level.

STEFAN AMANN
e7 Energie Markt Analyse GmbH
stefan.amann@e-sieben.at

The IED tool-kit:

During the past 2.5 years an easily applicable IED tool-kit has been developed. The tool-kit consists of an ***ID Process Guide***, a ***Tenant Brief***, a ***Client Brief***, a ***Supplement on Remuneration Models*** and a ***Supplement on Case Studies and Lessons learned*** (see **Figure 1**). This tool-kit helps to get all stakeholders started in the very early planning phase. The guidelines and its supplements address clients, contractors, engineers from all disciplines and facilitators to learn about the benefits from application of an Integrated Design approach. Also the ID Tool-kit has been translated and adapted to national regulations and circumstances.

The relevance of the concept is based on the well-proven observation that changes and improvements of the design are relatively easy to make at the beginning of the design process, but become increasingly difficult and disruptive as the process unfolds.

Thus, the performance of buildings should be assessed in a lifecycle perspective, both regarding environmental performance (LCA) and costs (LCC). The ID model of collaborative design emphasizes that the very early

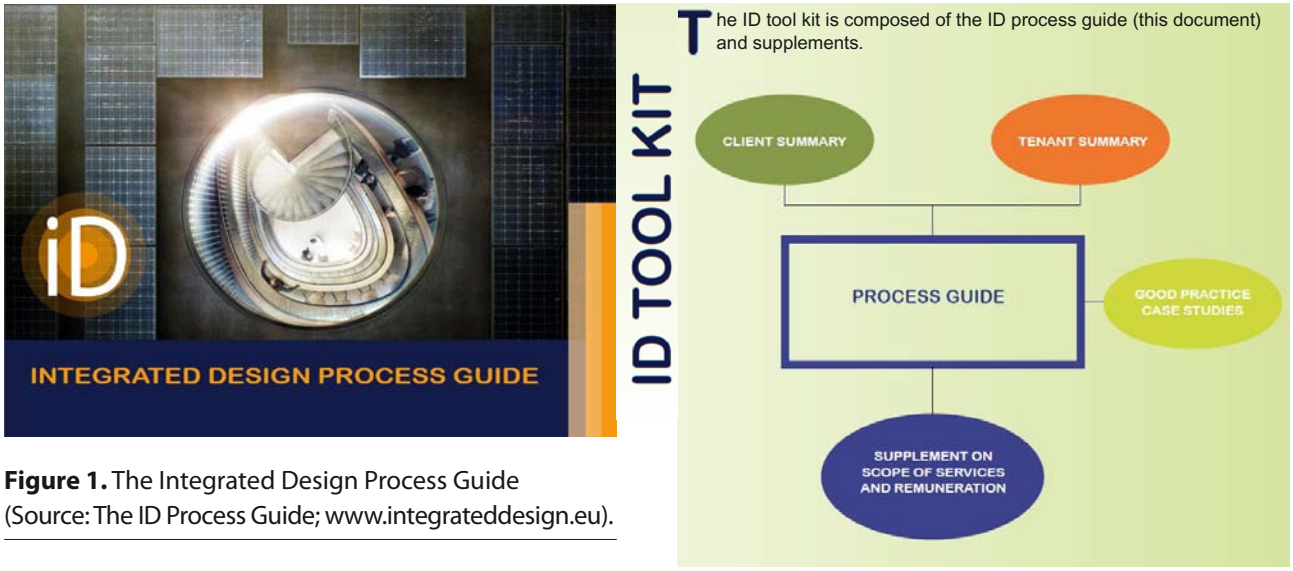

Figure 1. The Integrated Design Process Guide (Source: The ID Process Guide; www.integrateddesign.eu).

phases of design need more attention because well informed decisions here will pay off in the rest of the building process, as well as through into the lifecycle of the completed building. Well informed planning from the start can allow buildings to reach very low energy use and reduced operating costs at very little extra capital cost, if any.

When considered against the whole life cycle of a building, the running costs are significantly higher than construction and refurbishment costs; thus, it becomes obvious that it is a short-sighted approach to squeeze the first design phase regarding resources. Experience from building projects applying ID shows that the investment costs may be about 5% higher, but the annual running costs will be reduced by as much as 40–90% (see **Figure 2**).

The ID process has been prepared in an easily applicable step-by-step manner (**Figure 3**) with comprehensive explanation. All documents can be found at **www.integrateddesing.eu**.

Integrated Design in building projects

The core of the project was the application of the ID process in the building design phase. This was demonstrated in 21 pilot projects among Europe. Demonstration projects have been accompanied from the first idea of the project until the detailed planning phase. The following issues have been taken into account:

- Suitability for ID;
- Aim of the project to achieve an energy performance close to NZEB;
- Possibility to influence the design process from the beginning;
- Replication potential;
- Size: large projects with a complex design process rather than small projects with simple design processes.

Reports from all demonstration projects are available online. These ID projects were carried out in Austria, Greece, Italy, Latvia, Norway, Poland, Slovakia, Slovenia, Sweden and UK. Predominantly service buildings have been accompanied, but also educational institutions, hotels, cultural/arts centres and apartment buildings.

TASKS	COSTS	COMMENTS
Concept and Pre-design	5 -10 % more	Based on experience
Detailed engineering	< 5 % more the first projects 5-10% less in the next projects	Based on experience – smoother process caused by more detailed concept design
Building costs	5 – 10 % more	3-6 % for Passive houses
Operational costs	40 – 90 % less	Based on experience
Building faults	10 – 30 % less	Because of better planning and better follow up during construction

Figure 2. Estimations of increased/ reduced costs connected to ID (Source: The ID Process Guide; www.integrateddesign.eu).

Good practice example and lessons learned from *Smart Campus*, Vienna, Austria

Before initiating the design phase, a "moodboard" was developed together M.O.O.CON by capturing the corporate identity in images which serve as a significant source of inspiration for architects. The Wiener Netze was perceived as: trust worthy, reliable, honest, assertive, practical, tolerant, cooperative. The new building should represent these characteristics in front of clients and the surroundings. To comply with these requirements an anonymous, two-stage competition for general planners was organized in Europe. Since the company's core business is energy supply, the project shall be exemplary without the employees losing their comfort. The target was to build an energy efficient building and to apply renewable energies wisely as well as to make users aware of their usage patterns. Some more details on the project and on the ID process.

- Type of the building: service building
- Gross floor space: 93,000 m²
- Staff: 1,400
- To be completed: 2016
- The administrative building is the biggest building with passive house quality in Europe.
- 50–60% of the energy used comes from renewable energy sources.
- Special emphasize was given to life cycle costs. The method **www.lzk-tool.at** revealed a high degree of accuracy since the investment costs for the winning project calculated before the competition still remained the same during the final design phase. The LCA helped choosing the right building materials.
- The design team was not composed by the same people during the whole process but the core team accompanied the project through the entire process.
- The multidisciplinary team increased the effectiveness of the design phase. Thanks to their expertise they were able to make decisions very quickly.
- The team created interfaces between individuals and activities in order to avoid problems during the process. Experts, decision makers, responsible for user matters as well as appraisers and civil engineers supported the core team in every phase of the project. The design of the detailed engineering serves as a good example. First a pool of user representatives and appraisers was established. Then regular weekly meetings were held and suitable people from the pool were chosen to share their user or expert perspective and to help with the detailed engineering. This way high user satisfaction could be ensured.

Good practice example and lessons learned from *Hotel in Milos*, Greece

The construction of a hotel in a coastal area with an archeological interest which should also have a high energy and environmental performance preserving at the same time the local biodiversity was a major chal-

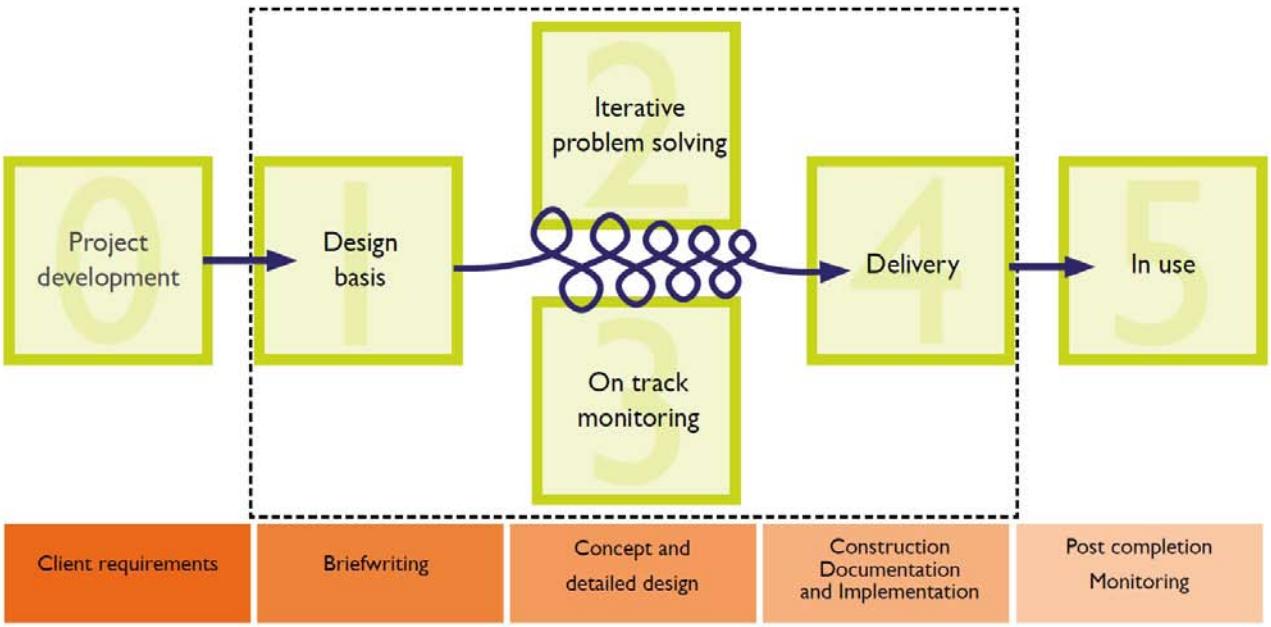

Figure 3. Overview of the ID process. The creative problem solving process (2) runs parallel in time with monitoring the progress according to the goals (3) (Source: The ID Process Guide; www.integrateddesign.eu).

lenge for the design process. The owner in cooperation with the architect, the engineers and the consultants adopted the ID principles from the early stages of the process.

- Owner: MILOS COVE SA
- Location: Milos island, Greece
- Type of the building: five star hotel
- Gross floor space: 3,800 m²
- Investment costs: 4.5 million €
- Year of completion: to be completed 2016

About the ID process: The multidisciplinary team was consisted from the very early phases of the project and this helped to developing good cooperation between the members. Identifying, stating and overcoming problems is a major challenge in the ID processes. The basic steps that are followed are these:

- Kick off meeting with multidisciplinary design team, discussion of needs and demands. Assessment of the current situation by performing reports. Definition of project goals.
- Workshops and meeting between architect, engineers and consultant to propose improvement solutions.
- Meetings with developer to present and discuss the concepts.

Lessons learned from ID process: The agreement of the owner and the design team for proceeding with ID from the early design phase is crucial. The new approaches have to be introduced, defined and incorporated as soon as possible and this demands willingness and good cooperation between the team members. At first the team was sceptical about the procedure, but the positive results and the facilitation of problem solving convinced them about the procedure and the investment.

Figure 4. Smart Campus (Source: Holzbauer und Partner ZT – GmbH).

General lessons learned and suggestions from European pilot projects

Every partner has evaluated each pilot project and gathered information about lessons learned. In almost all pilot projects good communication has been mentioned as one of the key activities to achieve a great project result. Good communication between the project team members in the initial interaction phases dramatically reduces system interaction problems during subsequent phases, as well as improves a team's common understanding of the potential future building development and operation problems and possible related solutions.

It is important that the client understands the advantages and benefits of applying an ID process. In **Figure 2** tasks and related costs can be found. Furthermore the role of an ID facilitator is crucial. If a facilitator becomes involved – as early as possible – various elements can still be influenced and directed.

All design team members must understand how they are expected to contribute in the various planning phases to the whole team. There is a huge need of clarity about what the design team has to do and how the ID process works. A major challenge is to keep the iterative solution methodology ongoing and not falling back into the traditional way of working.

The result of several projects was that there is a need of a better file sharing system, where project team members can work in parallel in the same documents at the same time. Various programs linked to BIM-system have been used.

In **Table 1** results of a SWOT-analysis of ID processes can be found.

GreenBuilding Integrated Design Award 2014

In 2014 the GB ID Award has been awarded. The objective of the Award was to give European visibility to outstanding integrated design processes. It was granted on 1 April 2014 in Frankfurt during the IEECB conference.

The winner of the GB ID Award 2014 is Wirtschaftsagentur Wien and ATP architects engineers with the building aspern IQ in Vienna, Austria. Commendations go to i) Kobra Team d.o.o. and Protim Ržišnik Percd.o.o with the Plus Energy Business Building Kobra in Slovenia and ii) the Municipality of Evrotas (Greece) and National and Kapodistrian University of Athens with the Bassourakos Building-Cultural Center.

Table 1. Results from the MaTrID pilot projects have been analyzed by the SWOT method (Source: The ID Process Guide; www.integrateddesign.eu).

Strengths	Weaknesses	Opportunities	Threats
ID is an Iterative process which secures that all energy related issues will be handled before the process leave for the next step. The outcome of the planning process will be more thorough and consist of fewer contradictions and inconsistencies. This in turn will result in fewer last minute changes and fewer building faults.	Relatively unknown in the construction industry. Difficult to change traditional way of planning and constructing. Demands good communication. Demands an ID facilitator, which is a new role in the planning process. The project manager needs to share responsibility and mandate to the ID facilitator. Increased planning costs.	EU directive about NZEB will increase the market for NZEB buildings and ID is an effective method for reaching NZEB energy demands. The ID process gather expertise from different work fields resulting in synergies. Fewer last minute changes and fewer building faults will show that in total the ID process is cost effective. Future improvements of the method is relatively simple, e.g. it would be easy to add a process for increased accessibility for disabled people.	Lack of knowledge and information about ID and the benefits using it among stakeholders. Difficulties in finding the right way of using ID for each single project. Client willingness of paying more for the planning process. For best results it is important to use ID from the very beginning of the project, preferably even before there is a drawing. This can be a threat, as many projects demand a drawing to achieve funding.

Recommendations

- **Capacity Building**: There is a need for educational and informational activities towards potential clients and construction project developers about the advantages of using the ID process in conjunction with planning. With a higher level of understanding of the benefits using ID, clients and the project developers will use the method and give the design team the mandate required to fully succeed. Furthermore there is a need for educational activities directed at members of the design team, e.g. architects, engineers, project manager, facility manager and future buildings users. Focus in these activities should be on how ID functions and on the advantages that come about when using the ID process in conjunction with planning a construction project.
- **Environmental certification schemes**: ID should be promoted according to environmental certification schemes. One of the main purposes with all schemes is to promote buildings with high environmental performance targets. ID is a very powerful tool to achieve these targets. An ID certification scheme could be created or integrated into existing schemes which benchmarks the stages of a construction project and certifies that particular ID steps have been achieved up to specific points in the process. This would create a solid framework upon which designers, engineers, contractors and project managers could structure a design process, and demonstrate their application of ID within a project.
- Local authorities could take their leading role in the introduction of NZEB. Public procurement is one of the most important instruments that local authorities have to achieve sustainability targets. ID could be indicated as a beneficial asset. ■

Figure 5. Hotel in Milos (Source: ALD Architects).

All information

Please visit **www.integrateddesign.eu** for comprehensive information.

Legal disclaimer

This project was co-funded by the Intelligent Energy for Europe Programme of the European Union. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.