Documentation of Pilot Project "Smart Campus"


Smart Campus
Wiener Netze GmbH, Austria

Margot Grim, e7, Austria
Contact details
Dipl.-Ing. Stefan Amann
e7 Energie Markt Analyse GmbH
Theresianumgasse 7/1/8
1040 Vienna, Austria

Disclaimer
The MaTriD project is supported by the European Commission in the Intelligent Energy for Europe Programme. 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 EACI nor the European Commission is responsible for any use that may be made of the information contained therein. The MaTriD project duration is from June 19, 2012 – December 18, 2014 (Contract Number: IEE/11/989/ST2.615952)
# Table of Content

1. **Background Information** ................................................................. 2
2. **Design Goals** ................................................................................. 3
3. **Work Organisation** ......................................................................... 5
   - 3.1 Team Composition ....................................................................... 5
   - 3.2 **ID facilitator: Role and Function** ............................................. 6
4. **Communication Among Team Members** ...................................... 8
   - 4.1 **Use of Building Information Model (BIM) Tools** .................... 8
   - 4.2 **File Sharing System** ................................................................. 9
   - 4.3 **Information Sharing** ............................................................... 9
   - 4.4 **Transfer of Knowledge** .......................................................... 9
5. **ID Strategy - Workflow** .............................................................. 11
   - 5.1 **Quality Assurance Plan & Quality Control Plan** ....................... 11
   - 5.2 **Setting Responsibilities, Milestones and Highlighting Critical Points in Every Design Phase** ........................................................................................................... 11
6. **Innovation and Demonstration** .................................................. 15
   - 6.1 **Innovative Solutions** ............................................................... 15
   - 6.2 **Demonstration (Results and Process)** ...................................... 17
     - 6.2.1 **Initial Situation** ................................................................. 17
     - 6.2.2 **Project Preparation** .......................................................... 19
     - 6.2.3 **The Competition** .............................................................. 20
   - 6.3 **Lessons Learned** ....................................................................... 22
   - 6.4 **Public Relations** ....................................................................... 22
1 Background Information

Name/acronym of the pilot project: Smart Campus

Client: Wiener Netze GmbH

Name of contact person: Peter Steczowicz

Function of contact person: Head of Organisational Development Consultancy

Location: Vienna

Type of the building: Headquarters, administration, operating area

Gross floor space in m²: 93,000 m² (19,000 m² administration, 38,000 m² operating area (workshops, test bays, depots, central warehouse, corresponding offices and administration areas), 36,000 m² other areas for e.g. exhibitions, conference etc.)

Staff: 1,400

To be completed: 2016

Further information: http://www.smart-campus.at

The existing buildings of Wiener Netze GmbH are in need of renovation. To refurbish these buildings within an economic range is hardly possible. For this reason the Wiener Netze GmbH decided to build a new building for their headquarters and to merge some of their facilities to shorten the distances between them.

While planning the main goals of the building, it became clear that the new building should also represent the matters that are important to the company. These matters are:

- **Smart Grids:** Smart load distribution and control of decentralized generators
- **Smart Meter:** With digital meters using remote readout the manner of consumption becomes transparent. On this basis specific tariff models can be established.
- **Smart Homes:** make an efficient use of energy possible

For the Wiener Netze the term “smart” means more than just a word, it is the guiding theme for their new construction.

Smart stands for an intelligent interaction of consumers, infrastructure and energy supply. The Wiener Netze GmbH wants to be exemplary in energy efficiency issues.
## 2 Design Goals

Table 1: Design goals per design phase.

<table>
<thead>
<tr>
<th>Design goal</th>
<th>Describe the goal and the set-point values if applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aesthetics</strong></td>
<td><em>Before initiating the design phase, we developed a &quot;moodboard&quot; together with the strategic consultation company 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 (see Figure 1)</em></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Figure 1 - moodboard" /></td>
</tr>
<tr>
<td></td>
<td><em>The new building should represent these characteristics in front of clients and the surroundings.</em></td>
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<td></td>
<td><em>To comply with these requirements an anonymous, two-stage competition for general planners was organized in Europe.</em></td>
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<tr>
<td></td>
<td><em>The main entrance will be decorated with an artwork manifesting clear associations with &quot;grids/nets&quot;. It will be chosen from designs presented in a competition among co-workers.</em></td>
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<tr>
<td><strong>Accessibility</strong></td>
<td><em>Most areas are freely accessible and no barriers keep disabled people from spending time or working in the building.</em></td>
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<td></td>
<td><em>This means that all office workplaces as well as almost the entire workshop and depot area are freely accessible.</em></td>
</tr>
<tr>
<td><strong>Cost-effectiveness</strong></td>
<td><em>Previously to the planning, a budget for life cycle costs was determined which is based on functional and spatial allocation plans. The requirements set here are to be met.</em></td>
</tr>
</tbody>
</table>


### Design goal

<table>
<thead>
<tr>
<th>Description</th>
<th>Description of the goal and the set-point values if applicable</th>
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</thead>
</table>
| **Cost-effectiveness**                                                      | Since the company’s core business is energy supply, the project shall be **exemplary** without the employees loosing their comfort. The target is to build an energy efficient building and to apply renewable energies wisely as well as to make users aware of their usage patterns.  
  
  **Administration building:** Passive house  
  **Workshops and depots:** Near Zero Energy Building  
  **Monitoring:** a monitoring system measures all consumptions |
| **Functional/operational goals**                                             | The main target was to merge the company’s facilities and thus to create synergies between the administration and the workshops/depots.  
  
  **High flexibility** of the entire building (workshops and offices)  
  **A comprehensive functional and spatial allocation plan within a detailed requirements planning** was elaborated before the general planning took place.  
  
  The entire management and their employees determined the different roles within the project |
| **Historic preservation**                                                   | Several buildings of the new location are listed for historic preservation |
| **Productivity**                                                           | The main objective is to increase the potential for synergies through establishing a common facility.  
  
  **The existing buildings do not meet the requirements of today’s working processes.** The new building shall be adapted to future working processes.  
  
  **Happy employees** are highly important. For this reason areas for communicating and comfort zones were emphasized |
| **Safety**                                                                 | **Access safety:** Doormen guard the main entrance 24 hours. All entries are secured with online-locks.  
  
  **The fire safety** exceeds the official requirements, its regulations were elaborated in close cooperation with the fire brigade and appraisers.
### Design goal

<table>
<thead>
<tr>
<th></th>
<th>Describe the goal and the set-point values if applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sustainability</strong></td>
<td>The building shall exhibit high environmental, economic and sociocultural quality standards. To meet these standards the building shall comply with the requirements of the certification scheme ÖGNI/DGNB Gold. For each sustainability criterion specific target values were defined. This way the certification is obtained by achieving high quality standards especially in those areas that are important to the company and not by merely collecting points. The initial design was already awarded a preliminary certification in gold.</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>The company wants to be a role model who offers high quality and energy efficiency standards to their employees. These standards should also be consistently applied in the building operation and life cycle costs. Since the usage patterns influence the energy efficiency to a great degree, the co-workers should use energy carefully. To achieve this a research programme was initiated (see 3.2 preliminary draft design phase)</td>
</tr>
</tbody>
</table>

### 3 Work Organisation

#### 3.1 Team Composition

**Was the design team composed by the same people during the whole process?**

*No, but the core team accompanied the project through the entire process. If required experts of different areas were invited.*

**Did the multidisciplinary team increase the effectiveness of the design phase?**

*Yes, thanks to their expertise they were able to make decisions quicker without losing their professionalism.*

**Did the multidisciplinary team try to create interfaces between individuals and activities to avoid further problems during the process?**

*Yes, 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 is ensured.

Is a multidisciplinary team useful in the beginning of the design activities?

Yes, therefore a general planning competition and no architecture competition was organized. The competition required high technical building standards and evaluated those strictly. Close cooperation with experts from technical building services and electrical engineering was the key to a successful competition entry. Immediately after the competition, the ID facilitator called weekly meetings, where users and designers participated, experts and appraisers were invited when necessary. These meetings helped them to feel part of the team.

3.2 ID facilitator: Role and Function

Describe the role of the ID facilitator during the development of the pilot project.

M.O.O.CON GmbH is responsible for the coordination of tasks and activities of the persons involved in the project and has been the ID facilitator since the project was initiated.

Table 2: Role of the ID Facilitator per design phase.

<table>
<thead>
<tr>
<th>Design phase</th>
<th>Describe the involvement of the ID Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial planning phase</td>
<td>Variant study which compared the existing building’s refurbishment with the construction of a new building on several locations based on a LCC-evaluation. <strong>Requirements planning:</strong> Together with the awarding authority and the users the ID facilitator analysed the organisation process of the existing facilities which are to be merged into the new location to create synergies. On this basis the requirements were detected. Upon these a comprehensive space and function allocation plan with the required organisational structure and processes was elaborated. Additionally, targets for sustainability criteria were defined with the help of experts (e7). These criteria are to be complied with during the design and construction phase. <strong>Feasibility:</strong> The feasibility of the requirements was tested. If they were not feasible, they were optimized. Real estates were found</td>
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<tr>
<td>Design phase</td>
<td>Describe the involvement of the ID Facilitator</td>
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</table>
|              | and compared, the budget for life cycle costs was calculated (together with e7).  
Coordination of following enquiries: use of ground water, thermal response test, explosive ordnance detection (the property was attacked during the World War 2), chemical expert report, feasibility of transport of the excavations by train → Due to the property’s difficult situation, several possibilities (on the existing and other sites) were analysed and compared intensively.  
M.O.O.CON and e7 evaluated the entries of the anonymous, two-stage and open general planning competition and checked them for their architectural, functional, sustainable and life cycle targets. The design which achieved these targets the best won. |
| Concept design phase | Coordination of all people, experts and reviewers involved in the project, - involvement of user representatives, building operators and facility managers and many appraisers: Fire safety, test bay planning, earthing design, etc.  
Making decisions by considering operational aspects.  
Next to the design project another research project was initiated by e7 and the awarding authority. This project shall develop an optimized user-feedback-system for the Smart Campus which motivates users to behave energy efficiently (to open windows and use sunshades in a reasonable way, to choose the correct indoor temperature, etc.) The ID facilitator is the link between the project and the research team and is responsible for the continuous application of research results in the actual planning. |
| Detailed design phase | The same tasks as in the concept design phase, plus:  
Submission: Before reaching this important mile stone, the ID facilitator discussed the design in detail with different user groups. |
| Awarding Procedure | Coordination and definition of the sustainability criteria required for the competition  
- Fair selection procedures were determined  
- The companies’ sustainability criteria were checked.  
- This was all done with the help of experts: Ecology, law, economy, purchasing  
- Coordination of appointments and contents for the required users’ and experts’ inputs/approvals (e.g. design of test bays, operation, control room, etc.) |
### Design phase

<table>
<thead>
<tr>
<th>Construction phase</th>
<th>Describe the involvement of the ID Facilitator</th>
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<tbody>
<tr>
<td></td>
<td>Control of compliance with previously planned quality standards</td>
</tr>
<tr>
<td></td>
<td>Pursuance of a continuous change management.</td>
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<tr>
<td></td>
<td>Coordination of the measurements and quality assurance together with the general planner.</td>
</tr>
</tbody>
</table>

### Communication among Team Members

#### 4.1 Use of Building Information Model (BIM) Tools

When more than one BIM tool were used during the design, did problems occur when sharing the numerical model with other team members?

*The HVAC-planning was done with a BIM software programme. The model was not shared.*

Can you briefly share your experience in using BIM tools by pointing out the lessons you have learnt?

*The HVAC-planners could reduce their time pressure by using BIM-tools, since its element-based drawings include all masses and service catalogues are elaborated at the flick of a switch.*

Do you think that the software’s level of development is adequate for practical use?

*For the purpose mentioned above it is suffice.*

Can you point out some shortcomings you found when using BIM tools?

*No shortcomings.*
4.2 File Sharing System

How do you evaluate the efficiency of your file sharing system?

The file transfer system is based on a FTP-server with predetermined folder structure (similar to the folder structure of Windows). This is considered good, but there are still improvements to be made. The biggest disadvantage is that the system does not allow the download nor upload of multiple files. An e-mail-function will be added to the platform during the execution phase, the shortcomings noted shall be improved.

The system was chosen to reduce the time investment, but the relevant documents shall be filed and documented in a logical way.

Would you considerate using more advanced systems for file sharing after the experience you have gained in this project?

Yes, I can’t imagine handling the large amounts of data we exchanged and filed in the course of this project without a file exchange system.

4.3 Information Sharing

How efficiently did you share information during the project? How would you evaluate the efficiency?

Good - in the weekly meetings with users, planners and experts of different areas, who were invited when necessary, we exchanged information quickly and without any complications. We developed a very good team culture and meet regularly to attend social events (dinners, sports).

Would you considerate using more advanced systems for information sharing after the experience you have gained in this project?

Yes, but the personal contact should not be reduced.

4.4 Transfer of Knowledge

ID processes enable the transfer of knowledge by increasing the specialists’ understanding for the work conditions and thus expanding their knowledge of it. The aim of this knowledge transfer is to provide better ID processes in the future by increasing awareness and creating a better understanding during all stages of the planning process.
Describe how the transfer of knowledge took place between architects, engineers and developer.

The transfer of knowledge was mainly achieved on a personal level through meetings, votings and conferences. If we needed somebody new for a specific planning phase, we held meetings with the general planner, the most important technical planners, the user representative and the ID facilitator before hiring to gather all the information she or he needed. Voting and conferences via telephone supported the transfer of knowledge.

We also exchanged information digitally as described above (4.3) via our platform or e-mail.
5  ID Strategy - Workflow

5.1 Quality Assurance Plan & Quality Control Plan

Which instruments did you use for controlling quality to

- define targets and to stick to them
- define the course of the project, the interfaces and the evaluation points of individual entries?

We developed a catalogue of objectives which is based on the ÖGNI/DGNB certification scheme to cover sustainability issues. Every sustainability criterion received a target value which was evaluated from an economic, environmental and company-specific perspective. We added targets to the catalogue of objectives like life cycle costs, functional and spatial allocation plans. From the general planning competition on, the fulfilment of this catalogue became mandatory, as a sort of requirement catalogue or quality assurance plan and formed part of the contract. If an objective was not met, it had to be compensated and the reasons for it had to be explained thoroughly.

If a milestone (concept design, detailed design, etc.) was reached, the fulfilment of the targets and the quality was examined comprehensively. An examination report with traffic-light system depicting the level of achievements was elaborated to bring the results of this evaluation into written form. After the plan was revised and the problems pointed out in the examination point were solved, the milestone was definitely reached.

Additionally user representatives were invited to give feedback and influence the design.

A project management was put in charge to evaluate and supervise the technical quality and the costs.

5.2 Setting Responsibilities, Milestones and Highlighting Critical Points in Every Design Phase

The ID facilitator is supported in the coordination of the entire process by a person responsible for a specific planning phase. She or he is responsible for the correct and punctual implementation of the tasks planned for a specific phase.

A milestone is a formal checkpoint which is determined by the planning team in the beginning of the design phase. A milestone can be the official acceptance by a contracting authority or the transmission of one or several documents. After the achievement of one milestone is confirmed, the next planning phase can be initiated.

A critical point is an unexpected situation which occurs in a specific phase. Please describe the solutions found and discussed in the design team.
Table 3: Responsibilities, milestones, critical points and outcomes per design phase.

<table>
<thead>
<tr>
<th>Design phase</th>
<th>Responsible(s) in charge for the phase</th>
<th>Milestone(s)</th>
<th>Critical point(s)</th>
<th>Outcome(s)</th>
</tr>
</thead>
</table>
| Initial planning phase | MOOCON                                  | • Functional and spatial allocation plan                                       | • Conviction of all managers that the merging of different locations into one new location signifies a fresh start.  
• The merging of several facilities implies a comprehensive process of reorganisation  
• Finding of a new location  
• Comparison of different locations | • Many internal discussions and information  
• Comprehensive involvement in the processes and structures of different locations and subcontractors.  
• Comparison of different locations |
| Competition phase      | MOOCON, e7; general planner             | • Winning project                                                            | • Examination of the required criteria, especially the budget for life cycle costs, the thermal-energetic quality, the architectural and functional quality.  
• Site clearance (explosive ordnance detection) | • Comprehensive preliminary examination, additional calculations of the energy consumption parameter and life cycle costs of every project.  
• Risk quantification regarding the explosive ordnance |
| Concept design phase   | general planner, MOOCON e7              | • preliminary draft  
• design  
• submission | A project of this magnitude reveals many critical points. In regard of integral design, | • Meetings on a regular basis |
<table>
<thead>
<tr>
<th>Detailed design phase</th>
<th>General planner, MOOCON e7</th>
<th>Defined procedure</th>
<th>Time delay caused by appeal of the awarding-procedure</th>
<th>Use of an additional time slot kept as reserve</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Defined procedure</td>
<td>Time delay caused by appeal of the awarding-procedure</td>
<td>Use of an additional time slot kept as reserve</td>
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<tr>
<td></td>
<td></td>
<td>Call for tenders issued</td>
<td>Time delay caused by appeal of the awarding-procedure</td>
<td>Use of an additional time slot kept as reserve</td>
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<td></td>
<td></td>
<td>Awarding</td>
<td>Cost compliance</td>
<td>Reductions of the quality to lower costs are not permitted</td>
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<td></td>
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<td></td>
<td>Re-organisation of the user</td>
<td>Re-organisation of the plan without augmenting costs or the delay in time due to flexible floor plans and designers</td>
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 energy efficiency and sustainability following critical points were detected:
 • Compliment with the budget for life cycle costs, the maximum investment limit and the thermal-energetic criteria.
 • Timely involvement of the research project investigating user-centred building automation
 • Phase-adapted involvement of the user
 • Commitment of the entire team to meet determined targets

 Variant study concerning the investment and subsequent costs
 Clear responsibilities and descriptions of procedures and processes
 The research project shall constantly keep the design team informed.
 *Convincing people by saying: "Let’s do it different this time!"
 Optimising the building services at a reasonable cost and meeting the target of maximising the use of alternative energy sources.
<table>
<thead>
<tr>
<th>Construction phase</th>
<th>Executor, MOOCON</th>
<th>Until now:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Excavation pit is finished</td>
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<td>• Transport of the excavated material by train</td>
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<td></td>
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<td>• Explosive ordnance (would imply time delays and higher costs)</td>
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<td>• Neighbours complaint because of the dust/noise</td>
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<td>• Intensive negotiations concerning the transport of the excavated material by train with the construction firm → was implemented</td>
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<td></td>
<td></td>
<td>• No explosive ordnance was found</td>
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<tr>
<td></td>
<td></td>
<td>• No neighbours complaint about the dust and noise coming from the construction site (this was a requirement in the specifications for tenders)</td>
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</table>
6 Innovation and Demonstration

6.1 Innovative Solutions

The buildings’ excellent innovation is observed in many different areas.

Energy efficiency and construction ecology

The administrative building is 19,000m² large. This makes it the biggest building with passive house quality in Europe, the workshops, depots, conference rooms and other secondary areas are near zero energy buildings.

A life cycle assessment helped choosing the right building materials.

The Wiener Netze GmbH wants to become a role model in efficient energy use and sustainability by implementing these measures.

Renewable energies

- According to the requirements 30% of the energy consumption has to come from renewable energy sources, now 50-60% of the energy used comes from these sources.
  - Cooling (100% ground water), Ground water heat pump produces heat
  - Photovoltaic systems with a power rating of approximately 300 kWp (the involvment of co-workers in form of employee-investment-models is in discussion)
  - Solar power for warm water (showers)
- LED vs. standard → The object is illuminated mainly by LED.
Research project: user-centred building automation

The Wiener Netze GmbH will not only implement of a passive house and near zero energy building, but it also wants it to achieve the energy consumption of these energy standards in reality. Since this goal depends mainly on the users, e7 initiated a research project that shall explore the different possibilities to motivate people to act energy efficiently. To achieve this a comprehensive user survey was conducted to find out which methods are the best to motivate users to act energy efficiently. This resulted in feedback panels and self-explanatory visual instructions located in the centre of rooms. The influence of user behaviour on energy consumption was estimated simultaneously to determine the potential for energy saving in situations where some of the employees behave energy efficiently. Thus the energy consumption of different user behaviours was examined by developing a building simulation. The research project also investigated the technical possibilities that exist to control procedures, give feedback, calculated investments and subsequent costs. After comparing different designs and their potential for saving energy in a life cycle cost analysis, the results revealed that feedback systems become economic within a time span of 30 years, if they are accepted by the employees. These facts convinced us to integrate a feedback system into the design. This system was integrated in the planning in cooperation with the planners.

For more information see http://www.e-sieben.at/de/projekte/1105_smart_campus.php

Feedback system for users to convey people to use energy efficiently

Compliance with life cycle costs

In this project it is important to emphasize the issue of the life cycle costs. Before initiating the general planning competition, we determined the budget for life cycle costs on the basis of the space and function allocation plan and the objectives set for achieving the desired building quality and sustainability. During the general planning competition and after reaching different
mile stones, the budget for life cycle costs was checked. The method with the www.lzk-tool.at revealed a high degree of accuracy since the investment costs for the winning project calculated before the competition still remain the same during the final design phase. The question whether the calculated amount for subsequent costs is realistic, can only be answered when the building is in operation.

Level of acceptance among neighbours
Prior involvement of local politics, invitation of the neighbourhood to exhibit the competition publically. Progresses are reported regularly in local neighbourhood news papers. Until now (end of excavation phase), no complaints have been reported.

6.2 Demonstration (Results and Process)

6.2.1 Initial Situation

Different locations
Energy standard in existing buildings
6.2.2 Projektvorbereitung

Variantenstudie basierend auf Lebenslaufkosten-Rechnungen verschiedener Standorte

- Neubau NETZ am WEG ab, Adaption BGS, Wsnew in TT
- Neubau NETZ und BGS am WEG ab, Wsnew in TT
- Neubau DION und BGS am WEG ab (Vorläuferslösung: TT)
- Neubau DION am Gate 2 und Adaption BGS

Die neue Standortwahl basierte auf diesen Ergebnissen.
6.2.3 The Competition

*Inputs of the secondary level*
**Preliminary check**

**Energy efficiency**

Specific heat demand HWB*-line in kWh/m²a

Specific cooling demand KB* in kWh/m²a

**Life cycle costs**
The winning project

Abbildung 1: The winning project: Smart Campus (source: Holzbauer und Partner ZT – GmbH)

6.3 Lessons Learned

New approaches, processes, technologies need to be incorporated into the design process as early as possible, if this is not done it will be discussed and the decision will have to be explained many times, new ideas might not even be implemented (since at a certain point changes would imply much more work and costs).

The interpretation of life cycle costs from different variants (e.g. general planning competition, technologies or feedback systems) helps the awarding authority to come to a decision. Even though the awarding authority was sceptical at first and not sure if the investments are worth it, it was convinced later and are also willing to invest more if the investments pay off in the longer run.

6.4 Public Relations

The Wiener Netze GmbH created a website to document the project. Information to the press especially neighbourhood newspapers was released on a regular basis. This interactive approach also contributed to the fact that no complaints were reported until now.