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LEED: Konsulentrapport

LEED: Kriterieoversigt

BREEAM: Konsulentrapport

BREEAM: Kriterieoversigt

DGNB: Konsulentrapport

DGNB: Kriterieoversigt

HQE: Konsulentrapport

HQE: Kriterieoversigt

Designteams notater om certificeringsordningerne

Faneblad 1

LEED® Assessment Report

Benchmark Center for the Danish Construction Sector
Danish Building Research Institute

06 April 2010

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1. Introduction

LEED Assessment Workshops were convened on 18-19 January 2010 and 20-21 January 2010 at the project building sites for the Vallensbaek Company House and at the Horten Office Building, respectively. Each workshop consisted of a one-and-one-half-day review of the subject project with the project design/construction team – along with representatives from the Benchmark Center for the Danish Construction Sector (BEC) and the Danish Building Research Institute (SBi) – for the purpose of attempting to determine the project's performance relative to the LEED-NC 2009 Green Building Rating System and to generate a dialogue with team members regarding the applicability of LEED criteria within the Danish context. These workshops included:

- An educational presentation by the facilitator (John Boecker) regarding the structure and content of LEED, interjected with discussion and an overview of project parameters.
- A comprehensive review of the project and how it related to each prerequisite and credit of the LEED-NC 2009 Green Building Rating System, including dialogue with the project team on a "credit-by-credit" basis, to assess whether or not compliance was (or could have been) achieved. This constituted the core of each workshop.
- A comprehensive preliminary LEED checklist was utilized during each workshop to record the results, including a list of items and comments pertaining to all applicable LEED "prerequisites" and "credits", along with an assessment of the number of points might be achieved for each credit.

The LEED-NC 2009 Green Building Rating System is divided into five core categories of assessment criteria, or credits, each with a maximum number of associated points that projects can earn, up to a total of 100 core points, as follows:

- Sustainable Sites (SS) 26 possible points
- Water Efficiency (WE) 10 possible points
- Energy & Atmosphere (EA) 35 possible points
- Materials & Resources (MR) 14 possible points
- Indoor Environmental Quality (IEQ) 15 possible points

100 total core points

Each category consists of a series of criteria, called "credits" that establish benchmarks for building performance; generally, these baseline levels of performance are established by referenced standards, primarily U.S.-based documents. For some credits, points can be earned if the benchmark is achieved, while in other cases, additional points can be earned by demonstrating incrementally higher levels of performance relative to the benchmark threshold. In this way, LEED serves as a performance-based system (or tool), and as such, it is not intended to be prescriptive; rather, project teams can choose which credits to pursue or not, and in some cases, certain credits may not be applicable to project conditions. Hence, all credits are optional. With that said, there also are eight "prerequisites", or mandatory provisions, distributed throughout the above five categories; the criteria (performance level) for all eight of these prerequisites must be met before projects can qualify for LEED certification.

Basic Certification is achieved by earning a minimum number of points; however, there are three additional levels of certification that projects can achieve by earning more points, as follows:

- LEED Certified - 40-49 points
- LEED Silver - 50-59 points
- LEED Gold - 60-69 points
- LEED Platinum - 80+ points

Points available for each credit are based upon "weighting" their role in addressing 13 different environmental impact indicators; global climate change is the environmental impact "weighted" the highest in LEED. In addition to the 100 points available within the above-referenced five core categories, 10 "bonus" points are available within two additional categories, as follows:

- Innovation & Design Process (ID) 6 possible "bonus" points
- Regional Priority (RP) 4 possible "bonus" points

The Innovation & Design category reserves five credits to encourage innovation. These "wild card" credits do not have defined criteria; rather, project teams can create their own criteria and earn up to 5 such innovation points if they can demonstrate that they have achieved an environmental or human health benefit not currently addressed by LEED via means that are measurable, quantifiable, documentable, and verifiable. Four additional Regional Priority points are available as "bonus points" for achieving credits from the above-categories that are deemed particularly important for each specific location.

It also should be noted that LEED was designed to recognize that each credit should not be perceived as a separate and independent issue; rather, many of the credits are deeply interrelated. Accordingly, the education component of LEED constantly stresses that project teams understand synergies between credits by encouraging an integrative design process that optimizes these reciprocal interrelationships, thereby discouraging project teams from conceiving each credit as an independent piece, or superimposed fragment. In other words, the point is not the "points".

Of utmost importance, though, is the realization that LEED was created to serve as a market transformation tool. In other words, the *raison d'être* of LEED, simply stated, is to transform the marketplace. To accomplish this, the development of LEED continues to be aimed at constantly staying one or two steps ahead of the marketplace. In other words, if a position too far ahead of the market is targeted, the system likely will be perceived as too difficult, and nobody will use it; on the other hand, if the system's criteria are positioned within the mainstream, the system is not transforming anything. So, as the market responds to LEED's influence and shifts in the direction of its choosing – in this case, towards green building practices – LEED criteria and performance levels also must constantly evolve in order to stay ahead of the marketplace . . . and LEED was designed to do exactly that. Therefore, LEED has been explicitly created to evolve and change on an established 3-year cycle; hence, the next updated version of LEED will be published in 2012, then 2015, and so on.

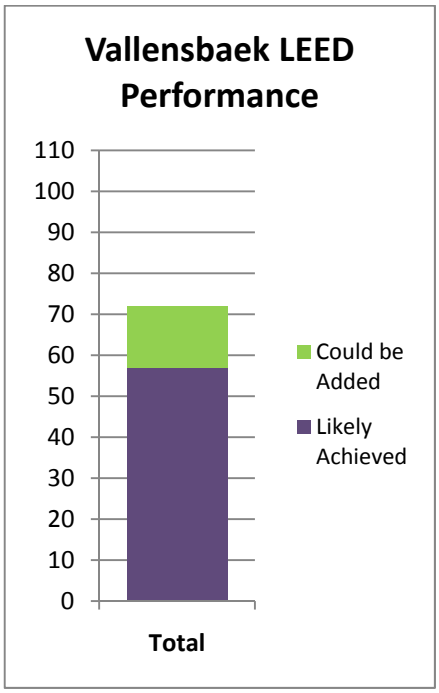
One last issue bears mentioning: LEED does not currently utilize assessors to determine credit achievement and award certification; rather, project teams complete submission forms electronically within a web-based shared workspace reserved for the project in LEED Online, the web-based tool created for documenting LEED projects. The Green Building Certification Institute (GBCI), an entity separate from the USGBC, utilizes independent third-party reviewers to assess LEED compliance and award certification, based upon these electronically-submitted documents that project teams complete via a four-step process of preliminary and final submissions/reviews.

Finally, several potential conflicts were observed between some of the U.S.-based referenced standards in LEED and Danish legal requirements and/or/construction traditions; these are identified and organized by credit category in Section 4 below.

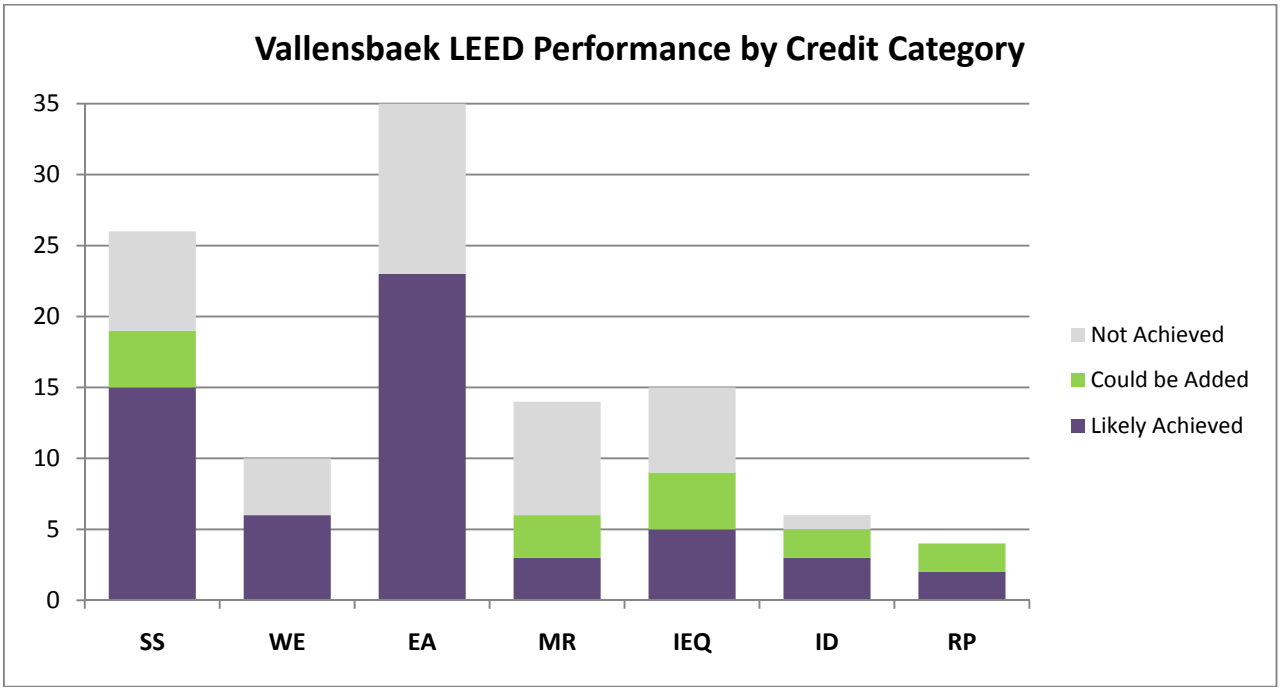
2. Vallensbæk Company House

This speculative office building appears to be aimed at the upper-mid level of the market for potential tenants looking for office space in a suburb of Copenhagen. The project's construction delivery methodology was developer driven – essentially design-build – so the developer/owner had significant control over design decisions and hence, the building's ultimate performance, and it is clear that this particular developer was aiming to produce a high-performance green building from the outset. Consequently, it also is clear that significant effort was exerted to achieve high levels of energy performance, targeting both reduced loads and energy efficiency measures well in excess of already-relatively-stringent Danish codes and common practice. Accordingly, less effort appears to have been focused on aesthetics, but the resulting building is simple, clean, efficient, effective, and economically successful from the standpoint of attracting and retaining tenants.

The developer's detailed knowledge of the building and its systems was extremely helpful during the LEED assessment workshop, as was the familiarity with the project's design and its components expressed by the engineers present at the workshop. As a result, the project's potential LEED certification level could be evaluated with a reasonably high level of confidence. The chart to the right indicates that in its current state, the project likely could achieve LEED Silver certification at 57 points; however, with additional efforts, either in the form of rather easily implemented strategies and documentation at present or during design (had the design team been aware of the criteria), it is likely that another 15 points might be achieved, qualifying for LEED Gold level certification with 72 total points.



The number of points by credit category that the team assessed as likely achievable is summarized in the chart below. More detailed explanations of the project's strengths and weaknesses in each category follow. Further, a detailed checklist documenting the team's assessment on a credit-by-credit basis is included in the Appendix of this report.



The project, in its current state, appears to have met the criteria of the Energy & Atmosphere category best – and to a relatively high degree – and performed least effectively in the Materials & Resources category, based upon the percentage of available points likely achieved in each core category as follows:

- Energy & Atmosphere (EA) 23 of 35 possible points = 65.71%
- Water Efficiency (WE) 6 of 10 possible points = 60.00%
- Sustainable Sites (SS) 15 of 26 possible points = 57.69%
- Indoor Environmental Quality (IEQ) 5 of 15 possible points = 33.33%
- Materials & Resources (MR) 3 of 14 possible points = 21.43%

However, the project relative success by credit category changes – and performance in the Sustainable Sites category appears best – when taking into consideration how many additional points likely could have been earned had the team known about the LEED criteria during the design phase, or could be achieved now with minimal effort, should the team choose to pursue certification, as follows:

- Sustainable Sites (SS) 19 of 26 possible points = 73.01%
- Energy & Atmosphere (EA) 23 of 35 possible points = 65.71%
- Water Efficiency (WE) 6 of 10 possible points = 60.00%
- Indoor Environmental Quality (IEQ) 9 of 15 possible points = 60.00%
- Materials & Resources (MR) 6 of 14 possible points = 42.86%

2.1 Sustainable Sites (SS)

The SS category can be seen as being comprised of credits associated with two primary concepts: Credits 1 through 5 address issues primarily associated with site location and planning, while EAp1 and Credits 6 through 8 focus more on site design and management decisions. The project appears to have done significantly better with the former, given the project's location in a relatively dense area with existing infrastructure, as indicated in the following list of likely earned credits (including 4 additional points that easily could have been earned with some minor adjustment and/or knowledge of credit criteria during design):

Site location and planning:

- SSc1: Site Selection 1 point
- SSc2: Development Density & Community Connectivity 5 points
- SSc4.1: Alternative Transportation, Public Transport. Access 6 points
- SSc4.2: Alternative Transportation, Bike Storage/Changing Rms. 1 point
- SSc4.3: Alternative Transportation, Low-Emit'g/Efficient Vehicles 3 points (could be added)

Site design and management:

- SSc5.2: Site Development, Maximize Open Space 1 point
- SSc6.2: Stormwater Design, Quality Control 1 point
- SSc8: Light Pollution Reduction 1 point (could be added)

The main reasons for the remaining credits not being assessed as earned include the following:

- Context – the site was not contaminated (SSc2)
- Site Constraints – limited site area for habitat protection/restoration and stormwater infiltration (SSc5.1 and SSc6.1)
- Project Type – minimizing parking capacity is challenging for speculative tenant buildings, and asphalt paving is common/economical (SSc4.3 and SSc7.1)
- Chosen solutions – black roofing (SSc7.2)
- Lack of documentation – need to create simulated photometric site plan (SSc8)

2.2 Water Efficiency (WE)
The WE category can be seen as being comprised of credits associated with two primary concepts: Credit 1 addresses outdoor water use, while WEp1 and Credits 2 through 3.3 focus more on indoor water use. The project better addressed the former, given the project's lack or landscaping irrigation, as indicated in the following list of likely earned credits:

Outdoor water:
- WEc1: Water efficient Landscaping 4 points

Indoor water:
- WEc3.1: Water Use Reduction, 30% Reduction 2 points

The main reasons for the remaining credits not being assessed as earned include the following:

- Chosen solutions – the project includes no rainwater or greywater harvesting systems and there was no focus on water use reductions or efficient plumbing fixture selection (WEc2, WEc3.2, and WEc3.3).

2.3 Energy & Atmosphere (EA)
The EA category can be seen as being comprised of credits associated with three primary concepts: The first two prerequisites and Credits 1, 3 & 5 address issues primarily associated with energy demand/ efficiency/ performance, while Credit 2 and 6 focus more on energy supply, and EAp3/EAc4 target refrigerant management. The project appears to have done extremely well with the first set of issues, given the developer's and project team's design focus on energy performance, while energy supply was not addressed at all, as indicated in the following list of likely earned credits:

Energy demand, efficiency, and performance:
- EAc1: Optimize Energy Performance 19 points
- EAc3: Enhanced Commissioning 2 points

Refrigerant management:
- EAc4: Enhanced Refrigerant Management 2 points

The main reasons for the remaining credits not being assessed as earned include the following:

- Chosen solutions – the cost of renewable energy generation and green power purchasing served to deter the pursuit of EAc2 and EAc6, while the lack of creating and implementing a robust Measurement & Verification plan, along with the associated measurement devices in the control system precluded achievement of EAc5.

2.4 Materials & Resources (MR)
The MR category can be seen as being comprised of credits associated with two primary concepts: MRp1 and Credits 1-2 address issues primarily associated with waste reduction, while Credits 3 through 7 focus more on materials impacts. The project was not assessed particularly strongly with either, since it appears that these were not areas of focus by the design team during construction, but it appears that 3 additional points could be included in the list of likely earned credits, as follows, if efforts are made to document compliance:

Waste reduction:
- MRc2.1-2: Construction Waste Management, Divert 75% 2 points (could be added)

Materials impacts:
- MRc4.1: Recycled Content, 10% combined pre/post-consumer 1 point
- MRc4.2: Recycled Content, 20% combined pre/post-consumer 1 point (could be added)
- MRc5.1-2: Regional Materials, 20% (by cost) 2 points

The main reasons for the remaining credits not being assessed as earned include the following:

- Context – the project did not reuse an existing building (MRc1)
- Chosen solutions – no FSC certified wood or salvaged materials were selected (MRc3 and MRc7), and only a small amount of rapidly renewable materials were specified (MRc6).

2.5 Indoor Environmental Quality (IEQ)

The IEQ category can be seen as being comprised of credits associated with two primary concepts: The two prerequisites and Credits 1 through 5 address issues primarily associated with indoor air quality (IAQ), while Credits 6 through 8 focus more on occupant comfort and productivity. The project appears to have done significantly better with the latter, but it appears that 4 additional points could be included in the list of likely earned credits, as follows, had design decisions and efforts to document compliance been made:

Indoor air quality:

- EQc1: Outdoor Air delivery Monitoring 1 point (could be added)
- EQc4.1: Low-Emitting Materials, Adhesives & Sealants 1 point (could be added)
- EQc4.2: Low-Emitting Materials, Paints & Coatings 1 point (could be added)
- EQc5: Indoor Chemical & Pollutant Source Control 1 point (could be added)

Occupant comfort and productivity:

- EQc6.2: Controllability of Systems, Thermal Comfort 1 point
- EQc7.1: Thermal Comfort, Design 1 point
- EQc7.2: Thermal Comfort, Verification 1 point
- EQc8.1: Daylight & Views, Daylight 75% of Spaces 1 point
- EQc8.2: Daylight & Views, Views for 90% of Spaces 1 point

The main reasons for the remaining credits not being assessed as earned include the following:

- Chosen solutions – Increased ventilation and capabilities for individual lighting controls were not part of the design criteria (EQc2 and EQc6.1), and a Construction IAQ Management Plan was not implemented (EQc3.1 -3.2); additionally low-emitting flooring and composite woods were not specified throughout (ERQc4.3-4.4).

2.6 Innovation & Design Process (ID) and Regional Priority (RP)

It is likely that the project can achieve the following 5 innovation credits, each earning one “bonus” point, in addition to the credits and points outlined above for the five core credit:

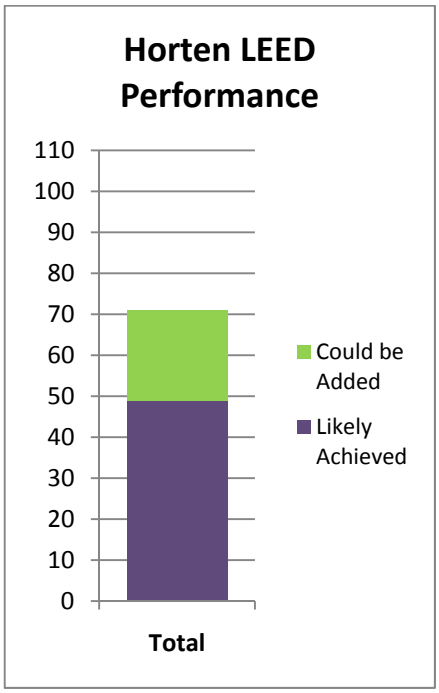
- Exemplary performance relative to SSc4.1 by providing double transit ridership
- Exemplary performance relative to MRc5 by achieving 30% regional materials
- Implementing an active public education program regarding green building strategies
- Implementing a green housekeeping program

It also is likely that at least two of the four available remaining “bonus” points can be earned by achieving the requirements for credits identified by a regional green building council in Denmark as having particular environmental importance for the project’s region. Candidates that might be considered for qualifying as regional priorities for Denmark might include SSc2, SSc4.1, EAc1, and others to be determined.

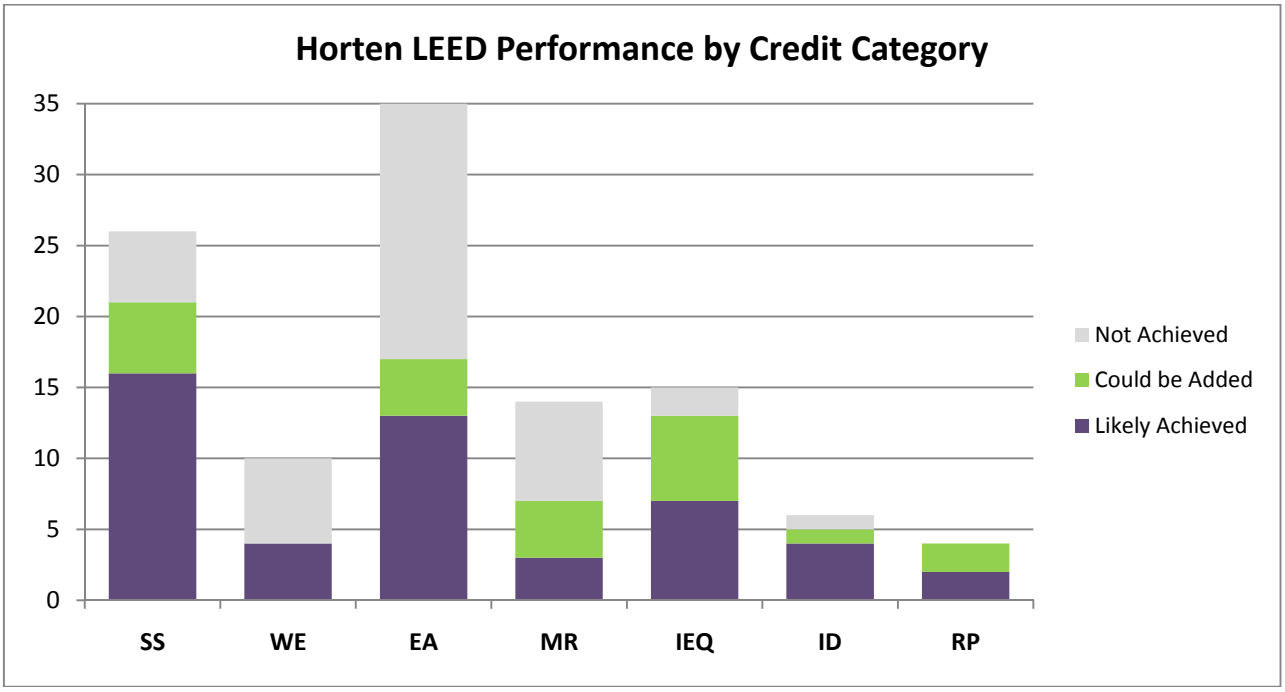
3. Horten Office Building

This office building clearly implemented a strong design concept associated with achieving a high level of aesthetic quality tied to the building's performance. Unlike Vallensbaek, it appears that the construction team had far less involvement during the design phases and that design solutions were strongly driven by the tenant's programmatic needs in order to accommodate a specific professional firm. The design team was aiming to produce a green building, but perhaps without identified criteria. Consequently, although it is clear that significant effort was exerted to achieve energy savings, it does not appear as if design decisions were informed by energy modelling simulations of various parameters. Accordingly, significant effort appears to have been focused on integrating aesthetic quality with a number of innovative technologies to augment energy performance, particularly with regard to the building's facade and envelope components.

The architect's detailed knowledge of the building was extremely helpful during the LEED assessment workshop, but since hands-on design engineers were not present, a lack of familiarity with the project's specific components (and design parameters) resulted in only a modicum level of confidence in the level of LEED certification achievable by the project. The chart to the right indicates that in its current state, it likely could achieve LEED Certification at 49 points, one point short of Silver; however, with additional efforts, either in the form of rather easily implemented strategies and documentation at present or during design (had the design team been aware of the criteria), it is likely that another 22 points might be achieved, qualifying for LEED Gold level certification with 71 total points.



The number of points by credit category that the team assessed as likely achievable is summarized in the chart below. More detailed explanations of the project's strengths and weaknesses in each category follow. Further, a detailed checklist documenting the team's assessment on a credit-by-credit basis is included in the Appendix of this report.



The project, in its current state, appears to have met the criteria of the Sustainable Site category best – and to a relatively high degree – and performed least effectively in the Materials & Resources category, based upon the percentage of available points likely achieved in each core category as follows:

- Sustainable Sites (SS) 16 of 26 possible points = 61.54%
- Indoor Environmental Quality (IEQ) 7 of 15 possible points = 46.67%
- Water Efficiency (WE) 4 of 10 possible points = 40.00%
- Energy & Atmosphere (EA) 13 of 35 possible points = 37.14%
- Materials & Resources (MR) 3 of 14 possible points = 21.43%

However, the project relative success by credit category changes – and performance in the Indoor Environmental Quality category appears best – when taking into consideration how many additional points likely could have been earned had the team known about the LEED criteria during the design phase, or could be achieved now with minimal effort, should the team choose to pursue certification, as follows:

- Indoor Environmental Quality (IEQ) 13 of 15 possible points = 86.67%
- Sustainable Sites (SS) 21 of 26 possible points = 80.77%
- Energy & Atmosphere (EA) 17 of 35 possible points = 48.57%
- Materials & Resources (MR) 7 of 14 possible points = 50.00%
- Water Efficiency (WE) 4 of 10 possible points = 40.00%

3.1 Sustainable Sites (SS)

The SS category can be seen as being comprised of credits associated with two primary concepts: Credits 1 through 5 address issues primarily associated with site location and planning, while EAp1 and Credits 6 through 8 focus more on site design and management decisions. The project appears to have done significantly better with the former, given the project's location in a relatively dense area with existing infrastructure, as indicated in the following list of likely earned credits (including 5 additional points that easily could have been earned with some minor adjustment and/or knowledge of credit criteria during design):

Site location and planning:

- SSc1: Site Selection 1 point
- SSc2: Development Density & Community Connectivity 5 points
- SSc4.1: Alternative Transportation, Public Transport. Access 6 points
- SSc4.2: Alternative Transportation, Bike Storage/Changing Rms. 1 point
- SSc4.3: Alternative Transportation, Low-Emit'g/Efficient Vehicles 3 points (could be added)
- SSc4.4: Alternative Transportation, Parking Capacity 2 points (could be added)

Site design and management:

- SSc5.2: Site Development, Maximize Open Space 1 point
- SSc6.2: Stormwater Design, Quality Control 1 point
- SSc7.1: Heat Island effect, Non-Roof 1 point

The main reasons for the remaining credits not being assessed as earned include the following:

- Context – the site was not contaminated (SSc2)
- Site Constraints – limited site area for habitat protection/restoration and stormwater infiltration (SSc5.1 and SSc6.1)
- Chosen solutions – black roofing (SSc7.2)
- Lack of documentation – need to create simulated photometric site plan (SSc8); it also appears that exterior uplighting at the entrance would preclude credit achievement

3.2 Water Efficiency (WE)

The WE category can be seen as being comprised of credits associated with two primary concepts: Credit 1 addresses outdoor water use, while WEp1 and Credits 2 through 3.3 focus more on indoor water use. The project better addressed the former, given the project's lack or landscaping irrigation, as indicated in the following list of likely earned credits:

Outdoor water:
- WEc1: Water efficient Landscaping 4 points

Indoor water:
- WEp1: Water Use Reduction, 20% Reduction 0 points

The main reasons for the remaining credits not being assessed as earned include the following:

- Chosen solutions – the project includes no rainwater or greywater harvesting systems and there was no focus on water use reductions or efficient plumbing fixture selection (WEc2, WEc3.1 - WEc3.3).

3.3 Energy & Atmosphere (EA)

The EA category can be seen as being comprised of credits associated with three primary concepts: The first two prerequisites and Credits 1, 3 & 5 address issues primarily associated with energy demand/ efficiency/ performance, while Credit 2 and 6 focus more on energy supply, and EAp3/EAc4 target refrigerant management. The project appears to have done reasonably well with the first set of issues, given the project team's design intent for achieving energy savings, while energy supply could be addressed, as indicated in the following list of likely earned credits (including 4 additional points that perhaps could be earned with some minor adjustment, along with knowledge of credit criteria during design and Owner involvement in power purchasing):

Energy demand, efficiency, and performance:
- EAc1: Optimize Energy Performance 11 points
- EAc3: Enhanced Commissioning 2 points

Energy supply:
- EAc6: Green Power 2 points (could be added)

Refrigerant management:
- EAc4: Enhanced Refrigerant Management 2 points (could be added)

The main reasons for the remaining credits not being assessed as earned include the following:

- Chosen solutions – the cost of renewable energy generation served to deter the pursuit of EAc2, while the lack of creating and implementing a robust Measurement & Verification plan, along with the associated measurement devices in the control system precluded achievement of EAc5.

3.4 Materials & Resources (MR)

The MR category can be seen as being comprised of credits associated with two primary concepts: MRp1 and Credits 1-2 address issues primarily associated with waste reduction, while Credits 3 through 7 focus more on materials impacts. The project was not assessed particularly strongly with either, since it appears that these were not areas of focus by the design team during construction, but it appears that 4 additional points could be included in the list of likely earned credits, as follows, if efforts are made to document compliance:

Waste reduction:
- MRc2.1-2: Construction Waste Management, Divert 75% 2 points (could be added)

Materials impacts:
- MRc4.1: Recycled Content, 10% combined pre/post-consumer 1 point
- MRc4.2: Recycled Content, 20% combined pre/post-consumer 1 point (could be added)

- MRc5.1-2: Regional Materials, 20% (by cost) 2 points
- MRc7: Certified Wood 1 point (could be added)

The main reasons for the remaining credits not being assessed as earned include the following:

- Context – the project did not reuse an existing building (MRc1)
- Chosen solutions – no salvaged or rapidly renewable materials were selected or specified (MRc3 and MRc6).

3.5 Indoor Environmental Quality (IEQ)
The IEQ category can be seen as being comprised of credits associated with two primary concepts: The two prerequisites and Credits 1 through 5 address issues primarily associated with indoor air quality (IAQ), while Credits 6 through 8 focus more on occupant comfort and productivity. The project appears to have done significantly better with the latter, but it appears that 6 additional points could be included in the list of likely earned credits, as follows, had design decisions and efforts to document compliance been made, thereby resulting in both sets of issues being addressed quite strongly:

Indoor air quality:

- EQc3.1: Construction IAQ Mgmt. Plan, During Construction 1 point
- EQc3.2: Construction IAQ Mgmt. Plan, Before Occupancy 1 point (could be added)
- EQc4.1: Low-Emitting Materials, Adhesives & Sealants 1 point (could be added)
- EQc4.2: Low-Emitting Materials, Paints & Coatings 1 point (could be added)
- EQc4.3: Low-Emitting Materials, Flooring Systems 1 point (could be added)
- EQc4.4: Low-Emitting Materials, Composite Wood & Agrifiber 1 point (could be added)
- EQc5: Indoor Chemical & Pollutant Source Control 1 point (could be added)

Occupant comfort and productivity:

- EQc6.1: Controllability of Systems, Lighting 1 point
- EQc6.2: Controllability of Systems, Thermal Comfort 1 point
- EQc7.1: Thermal Comfort, Design 1 point
- EQc7.2: Thermal Comfort, Verification 1 point
- EQc8.1: Daylight & Views, Daylight 75% of Spaces 1 point
- EQc8.2: Daylight & Views, Views for 90% of Spaces 1 point

The main reasons for the remaining credits not being assessed as earned include the following:

- Chosen solutions – Outdoor air delivery monitoring with CO2 sensors and increased ventilation were not part of the design criteria (EQc1 and EQc2.

3.6 Innovation & Design Process (ID) and Regional Priority (RP)
It is likely that the project can achieve the following 5 innovation credits, each earning one “bonus” point, in addition to the credits and points outlined above for the five core credit:

- Exemplary performance relative to SSc4.1 by providing double transit ridership
- Exemplary performance relative to MRc5 by achieving 30% regional materials
- A significant and detailed acoustical analysis was conducted
- Implementing an active public education program regarding green building strategies

It also is likely that at least two of the four available remaining “bonus” points can be earned by achieving the requirements for credits identified by a regional green building council in Denmark as having particular environmental importance for the project’s region. Candidates that might be considered for qualifying as regional priorities for Denmark might include SSc2, SSc4.1, EAc1, and others to be determined.

4. Overall Conclusions

The Vallensbaek Company House excelled in the Energy & Atmosphere category, while the Horten Office Building excelled in the Indoor Environmental Quality category. This makes sense for both projects, given the Vallensbaek team's design phase focus on energy issues, while the Horten team focused on indoor air quality and human comfort/productivity issues, since they were designing for a specific high-end tenant.

Both projects also performed quite well in the Sustainable Sites category, which makes sense as well, given the relatively dense urban and semi-urban locations of these projects, including high levels of access to public transportation and existing infrastructure. On the other hand, neither project performed very well in the Water Efficiency and Materials & Resources categories, primarily due to a lack of focus on these issues during the design phase.

As currently constructed, it is likely that the Vallensbaek project could achieve 57 points or LEED Silver certification (at a high level, only three points shy of Gold), while the Horten project likely could achieve 49 points, or LEED Certified (also at a high level, only one point shy of Silver). However, both projects could be assessed a full level higher had their design and construction teams been afforded access to the rating system (and its criteria) during the design phase, since design decisions could have been based on specific performance targets. Accordingly, the Vallensbaek project likely could achieve 72 points, while the Horten project likely could achieve 71 points, which would result in both projects achieving LEED Gold.

Consequently, it can be concluded from these assessments that the primary reason for not achieving credit compliance, by far, can be attributed to design decisions being made without identified performance targets, therefore alignment with the associated credit criteria and requirements often could not be achieved. It also might be worth noting that, as a result, associated environmental benefits were similarly limited.

Lastly, the applicability of LEED criteria (the credit intents) appears in no way to conflict with Danish building design and construction practices. However, since the credit requirements in LEED currently are based on demonstrating performance levels relative to benchmarks established primarily by U.S.-based referenced standards, adapting LEED to the Danish context would benefit from substituting different referenced standards for a number of credits, and in some cases, revising metrics and/or performance thresholds. In this regard, the primary conflicts or problems observed between the LEED requirements (based on U.S referenced standards) and Danish legal requirements/construction traditions include the following:

Sustainable Sites (SS):

- SSp1: The current requirements for Erosion and Sedimentation Control, based upon U.S. EPA's BMPs, likely should be aligned with Danish regulations and practices.
- SSc2: Given the generally higher level of density in Denmark, the density requirements may need to be adjusted for closer alignment with the Danish context.
- SSc3: The current requirements for determining brownfield status, based upon U.S. ASTM Environmental Site Assessment criteria, likely should be aligned with Danish regulations and practices.
- SSc4.3: Given the generally higher fuel-efficiency of automobiles in Denmark, the U.S. referenced standard for compliant vehicles may need to be adjusted for stronger applicability to the Danish context.
- SSc6.2: The current requirements for determining stormwater quality, based upon U.S. BMP's, likely should be aligned with Danish regulations and practices.

Water Efficiency (WE):

- WEc2 and WEc3: The current benchmark requirements for water efficiency, based upon U.S. EPACT regulations, likely should be aligned with EU/Danish regulations and practices.

Energy & Atmosphere (EA):

- EAp1 and EAc3: Commissioning (Cx): The primary difference in Denmark is that documentation related to Cx activities consists of a set of separate documents, so creating a single consolidated Cx methodology needs to be developed for the Danish context to define a more formalized process that can be specified in the bidding documents to clarify the roles of the Cx Authority and Contractors. It should be noted that apparently, Danish practice often consists of hiring a consulting engineer (not as part of design team) to review project CDs and provide field observations, a process that closely approximates Cx as defined in LEED; the OPR is somewhat different as a brief, but the BOD is quite similar, and it is fairly common for Danish "Quality Assurance" contracts and activities to closely align with LEED Cx requirements, except that often, these services are provided by the design team.
- EAc1: The U.S.-based referenced standard and modeling protocols for demonstrating energy savings, as defined by ASHRAE 90.1 Appendix G, likely should be modified to more closely align with Danish regulations and practices. Also, assuming a .77 conversion factor for Danish energy consumption relative to North America, it is likely that the performance thresholds should be revised for Danish standards. Additionally, Danish practice usually includes the provision of hot water supply from a district central plant, so the District energy System (DES) protocols for demonstrating compliance would need to be implemented and/or integrated into credit requirements and performance thresholds.
- EAc6: Since currently there is no equivalent for Green-e internationally, a Danish (or international) standard should be developed to define what would be equivalent to Green-e.

Materials & Resources (MR):

- MRc5: Perhaps include additional distance limits that expand the 500-mile (800 km) limit for materials shipped by various modes of transportation, such as trains and ships, etc.

Indoor Environmental Quality (IEQ):

- IEQp1 and IEQp2: The current requirements for ventilation, based upon U.S. ASHRAE 62, likely should be aligned with Danish regulations and practices. Additionally, natural ventilation likely should be addressed with provisions other than those in ASHRAE 62.
- EQc4: The U.S.-based LEED referenced standards that define emissions limits for adhesives, sealants, paints, coatings, and flooring likely should be aligned with EU or Danish regulations and practices.
- EQc7.1: The current thermal comfort ranges and criteria, based upon U.S. ASHRAE 55, likely should be aligned with Danish regulations and practices.

Innovation & Design Process (ID) / Regional Priority (RP):

- Regional priority: The Danish Green Building Council should identify which credits should qualify by virtue of their particular environmental importance for the region.

Faneblad 2

LEED: Kriterieoversigt

Kategori/Kriterie	Point
Sustainable Sites	26
Prerequisite 1 Construction Activity Pollution Prevention Required	krav
Credit 1 Site Selection	1
Credit 2 Development Density and Community Connectivity	5
Credit 3 Brownfield Redevelopment	1
Credit 4.1 Alternative Transportation—Public Transportation Access	6
Credit 4.2 Alternative Transportation—Bicycle Storage and Changing Rooms	1
Credit 4.3 Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
Credit 4.4 Alternative Transportation—Parking Capacity	2
Credit 5.1 Site Development—Protect or Restore Habitat	1
Credit 5.2 Site Development—Maximize Open Space	1
Credit 6.1 Stormwater Design—Quantity Control	1
Credit 6.2 Stormwater Design—Quality Control	1
Credit 7.1 Heat Island Effect—Nonroof	1
Credit 7.2 Heat Island Effect—Roof	1
Credit 8 Light Pollution Reduction	1
Water Efficiency	10
Prerequisite 1 Water Use Reduction Required	krav
Credit 1 Water Efficient Landscaping	4
Credit 2 Innovative Wastewater Technologies	2
Credit 3 Water Use Reduction	4
Energy and Atmosphere	35
Prerequisite 1 Fundamental Commissioning of Building Energy Systems R equired	krav
Prerequisite 2 Minimum Energy Performance Required	krav
Prerequisite 3 Fundamental Refrigerant Management Required	krav
Credit 1 Optimize Energy Performance	19
Credit 2 On-site Renewable Energy	7
Credit 3 Enhanced Commissioning	2
Credit 4 Enhanced Refrigerant Management	2
Credit 5 Measurement and Verification	3
Credit 6 Green Power	2
Materials and Resources 14 Possible Points	14
Prerequisite 1 Storage and Collection of Recyclables R equired	krav
Credit 1.1 Building Reuse—Maintain Existing Walls, Floors and Roof	3
Credit 1.2 Building Reuse—Maintain Existing Interior Nonstructural Elements	1
Credit 2 Construction Waste Management	2
Credit 3 Materials Reuse	2
Credit 4 Recycled Content	2
Credit 5 Regional Materials	2
Credit 6 Rapidly Renewable Materials	1
Credit 7 Certified Wood	1
Indoor Environmental Quality 15 Possible Points	15

LEED: Kriterieoversigt

Kategori/Kriterie	Point
Prerequisite 1 Minimum Indoor Air Quality Performance Required	krav
Prerequisite 2 Environmental Tobacco Smoke (ETS) Control Required	krav
Credit 1 Outdoor Air Delivery Monitoring	1
Credit 2 Increased Ventilation	1
Credit 3.1 Construction Indoor Air Quality Management Plan—During Construction	1
Credit 3.2 Construction Indoor Air Quality Management Plan—Before Occupancy	1
Credit 4.1 Low-Emitting Materials—Adhesives and Sealants	1
Credit 4.2 Low-Emitting Materials—Paints and Coatings	1
Credit 4.3 Low-Emitting Materials—Flooring Systems	1
Credit 4.4 Low-Emitting Materials—Composite Wood and Agrifiber Products	1
Credit 5 Indoor Chemical and Pollutant Source Control	1
Credit 6.1 Controllability of Systems—Lighting	1
Credit 6.2 Controllability of Systems—Thermal Comfort	1
Credit 7.1 Thermal Comfort—Design	1
Credit 7.2 Thermal Comfort—Verification	1
Credit 8.1 Daylight and Views—Daylight	1
Credit 8.2 Daylight and Views—Views	1
Totalt antal “kernepoint”	100
Innovation in Design 6 Possible Points	6
Credit 1 Innovation in Design	5
Credit 2 LEED Accredited Professional	1
Regional Priority 4 Possible Points	4
Credit 1 Regional Priority	4

Faneblad 3

Byggeriets Evaluerings Center

The Benchmark Centre for the Danish Construction Sector

Testing Sustainability Evaluation Systems in Denmark

BREEAM

breeam

ARUP

The Benchmark Centre for the Danish Construction Sector

Testing Sustainability Evaluation Systems in Denmark

BREEAM

Vallensbæk Company House & Horten Headquarters

March 2010

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Appendices

Appendix A

Vallensbæk Results

Appendix B

Horten Results

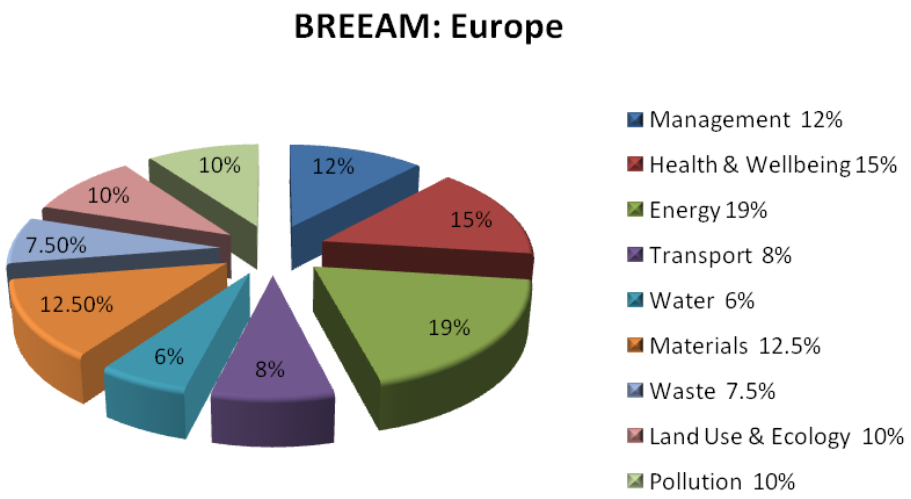
1 Introduction

Arup have been asked by The Benchmark Centre for the Danish Construction Sector to review Vallensbæk Company House and Horten Headquaters in Copenhagen, Denmark against the BREEAM Europe Commercial 2009 Offices assessment guidelines using the post construction evidence requirements.

Vallensbæk Company House is a four story office block with two main wings totalling 6,000m^2. The building contains a common foyer, canteen with a capacity of 120, 30 person auditorium along with one 18 person and two 12 person meeting rooms. The low-energy building has a high level of insulation, energy efficient windows, and improved air permeability. The building is heated with district heating combined with a ventilation system with heat recovery.

Horten Headquaters is a six story office block with 10,000m^2 floor area. The building is occupied by the law firm Horten who were involved in the design from early in the project. All office spaces are on the perimeter of the building taking advantage of natural light. The energy efficient building has high quality insulation and glazing with user controlled shading. The building is heated via the district heating system.

The BREEAM assessment is grouped into 10 sectors which each have specific credit requirements and contribute to a weighted percentage of the final score as illustrated below. The regulations can be downloaded from http://www.breeam.org/login.jsp ;



It is not the brief of this study to carry out a formal certified BREEAM assessment, rather to perform a post construction review to measure the potential current rating of the building and to outline the potential achievable credits.

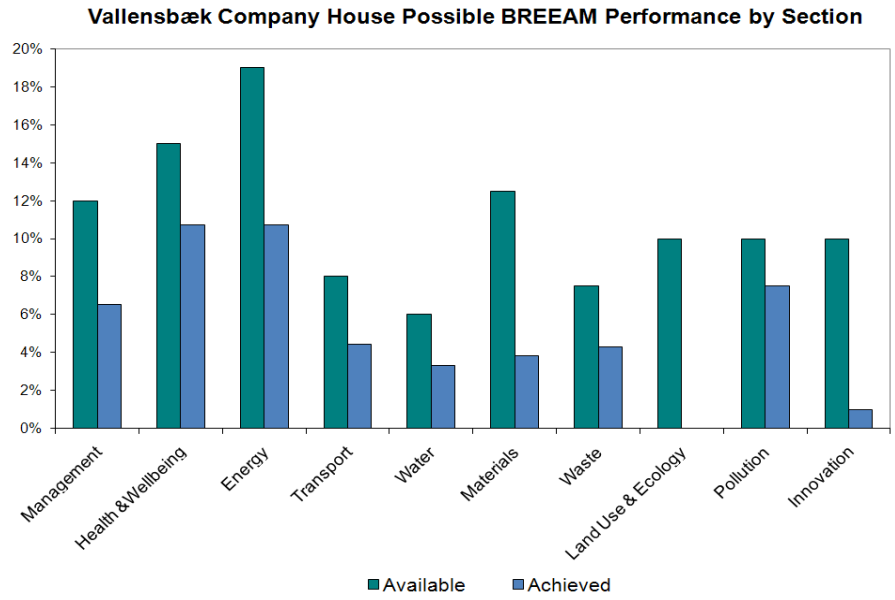
Copies of the assessment documentation have been included as appendices. Key assumptions that require confirmation are highlighted within the report together with tables of credits which outlines the potential achievable credits.

It must be noted that this will not be reviewed by the BRE and no final certification will be awarded for the BREEAM assessment.

2 Vallensbæk

2.1 Summary of Building's Assessment Performance

Vallensbæk Company House would achieve **34.65%** giving a **PASS** rating and could possibly achieve a final score of **52.41%**. This translates into a final BREEAM rating of **GOOD.**



2.2 Management

3 credits were achieved which equates to 3.27% and 6 credits could have been achieved which equates to 6.55% credits. 5 of 11 credits were considered not achievable.

Three credits were not initially achieved as the evidence requirements were outside standard practise. Several were thought achievable if considered from the initial stages of the project and would have little financial impact on the project.

The majority of construction site impacts were met however transport monitoring and timber sourcing ruled out two credits. These along with the development of a tenant oriented building user guide and a life cycle cost analysis were not produced as it was not considered standard practise in the region.

2.3 Health & Wellbeing

7 credits were achieved which equates to 7.5% and 10 credits could have been achieved which equates to 10.71% credits. 4 of 14 credits were considered not achievable.

Four credits were not initially achieved as the evidence requirements were outside standard practise. Three of these credits were considered achievable if reports and modelling was produced from the initial stages of the project. These would have little financial impact.

Lighting zones and controls credit was not achieved as they are outside local regulations.

Credit Hea 3 relating to glare control was not achieved and responsibility of this would have to be considered from the initial stages.

It was felt that the building acoustics would not meet the requirements.

The thermal comfort and thermal zoning credits have been achieved through mechanical ventilation system.

Credits relating to lighting levels, indoor air quality and contamination were all met under Danish regulations.

2.4 Energy

10 credits were achieved which equates to 8.26% and 13 credit could have been achieved which equates to 10.74% credits. 10 of 23 credits were considered not achievable.

Credit Ene 4 regarding external lighting could be achieved if changes were now made or it was considered from early in the project. The financial impact on the project would be dependable on the project stage that it was considered and the lighting requirements.

If a LZC (Low and zero carbon) report was produced at the outset of the project one credit could be achieved. As no onsite electricity is produced no more credits can be achieved. The report would have little financial impact on the project.

The building electrical sub-metering system met the requirements to achieve all of the available credits.

Eight of the available fifteen credits regarding Ene 1 energy efficiency have been met through the local assessment methods. To achieve more credits could have large financial impacts and must be considered from the initial start of the project.

2.5 Transport

3 credits were achieved which equates to 2.67% and 5 credits could have been achieved which equates to 4.44% credits. 4 of 9 credits were considered not achievable.

Proximity to public transport ruled out a possible two credits however the proximity to amenities such as doctors, postal facilities and bank/cash machine met the requirements.

The safety for both cyclist and pedestrians met the local regulations.

The local bus service has achieved one of the requirements for modes of transport.

Development of a travel plan could achieve one additional credit with little financial impact.

Additional car parking spaces would have to be provided to meet the requirements. This was affected by the office uses and occupancy levels. As this would be a large financial investment and use of land this credit would not be aimed to be achieved.

2.6 Water

3 credits were achieved which equates to 2.0% and 5 credits could have been achieved which equates to 3.33% credits. 4 of 9 credits were considered not achievable.

Through the Wat 1 water consumption spreadsheet regarding flow rates one credit was achieved. The calculations do not include kitchens and as the majority of office buildings in the country have complete kitchens true consumptions figures cannot be shown.

The use of sub-metering and manual water for the local plans achieves two credits.

Major leak detection and sanitary supply shutoff credits were considered achievable however may have a big financial impact on the project and would have to be considered from the outset.

As a feasibility study into onsite water treatment systems was not completed no credits could be awarded for Wat 8. It was considered that this could be taken from a municipality approach from the initial stages of developments.

2.7 Materials

0 credits were achieved which equates to 0.0% and 4 credits could have been achieved which equates to 3.85% credits. 9 of 13 credits were considered not achievable.

No credits were achieved as the majority of the credits were considered outside standard practise in the region. As it is new build two of the credits were automatically ruled out.

Responsible sourcing of materials is not part of the industry in the region and would be extremely difficult to achieve. This may also have a large financial impact on the project. This also links to insulation selection which had one credit thought achievable if considered from the early stages.

It was felt that the approach to robustness is different in the region to that of the BREEAM however if considered from early stages was felt that it may be achievable.

2.8 Waste

4 credits were achieved which equates to 4.29% and 4 credits could have been achieved which equates to 4.29% credits. 3 of 7 credits were considered not achievable.

As the use of recycled aggregates with a clear % is not standard practise in the region and industry it was considered extremely difficult to achieve.

Waste management requirements both onsite and for building occupants have been met. The local recycling and waste management procedures exceed the requirements.

2.9 Land Use & Ecology

0 credits were achieved which equates to 0.0% and no additional credits were considered achievable. 10 of 10 credits were considered not achievable.

None of the land footprint is on an area of land which had previously been developed in the last 50 years and was not considered contaminated which ruled out two credits.

As no ecological report has been produced no credit can be awarded.

If an ecology assessment was produced at the start of the project these credits man have been achieved. As this is not standard practise the cost may vary compared to the uk market from which the regulations were developed.

2.10 Pollution

8 credits were achieved which equates to 6.67% and 9 credits could have been achieved which equates to 7.5% credits. 3 of 12 credits considered not achievable.

Refrigeration selection and leak detection system met all of the requirements however depending on regional suppliers can have financial impact. The leak detection system is standard practise in the region.

As the building runs on district heating and 8 credits have been achieved in Ene 1 energy efficiency one of three available credit have been awarded for the reduced NOx emissions.

The noise attenuation credit requirements have been exceed while working with the municipality. It was considered that it would be worth applying for an innovation credit.

Night time light pollution could easily be achieved at a low cost.

Two credits regarding flood risk were achieved however to achieve the third credit regarding surface water run-off attenuation would be at a high cost and was not considered appropriate.

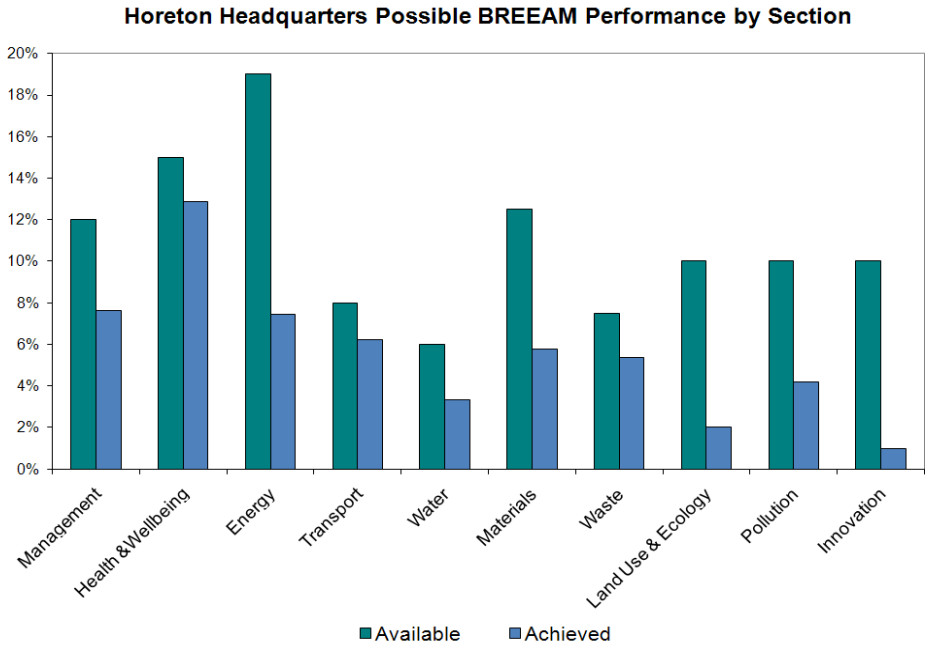
2.11 Innovation

0 credits were achieved which equates to 0.0% and 1 credit regarding noise pollution could have been achieved which equates to 1.0% credits. 9 of 10 credits were considered not achievable.

3 Horten

3.1 Summary of Building's Assessment Performance

Horten Headquaters would achieve **33.75%** giving a **PASS** rating against the BREEAM Europe Commercial 2009 Environmental and Sustainability Standard. From the review we feel that the building could possibly achieve a final score of **55.78%**. This translates into a final BREEAM rating of **VERY GOOD.**



3.2 Management

3 credit were achieved which equates to 3.27% and 7 credits could have been achieved which equates to 7.64% credits. 4 of 11 credits were considered not achievable.

Three credits were not initially achieved as the evidence requirements were outside standard practise. Several were thought achievable if considered from the initial stages of the project and would have little financial impact on the project.

The majority of construction site impacts were met however a CO2 report and timber sourcing ruled out two credits. These along with the building user guide and a life cycle cost analysis were not considered standard practise in the region however were felt achievable.

3.3 Health & Wellbeing

10 credits were achieved which equates to 10.71% and 12 credits could have been achieved which equates to 12.86% credits. 2 of 14 credits were considered not achievable.

Potential for natural ventilation was ruled out as none of the windows are can be opened.

Credits relating to view out, glare control and lighting were all achieved.

The buildings acoustics were considered from the initial stages of the project and it was felt that if an acoustician was involved this credit could be achieved.

Thermal comfort credits have been achieved through the mechanical ventilation system however thermal zoning credits were ruled out by the veranda workstations.

Credits relating to lighting levels, indoor air quality and contamination were all met under Danish regulations.

3.4 Energy

5 credits were achieved which equates to 4.13% and 9 credits could have been achieved which equates to 7.43% credits. 14 of 23 credits were considered not achievable.

If a LZC (Low and zero carbon) report was produced at the outset of the project one credit could be achieved. As no onsite electricity is produced no more credits can be achieved. The report would have little financial impact on the project.

The building electrical sub-metering system met the requirements to achieve one credit and the second credit was felt to be achievable if considered at the start of the project. This would have a minimal financial impact on the project.

Credit Ene 4 relating to external lighting could not be achieved due to client requirements.

Four of the available fifteen credits regarding Ene 1 energy efficiency have been met through the local assessment methods. To achieve more credits could have large financial impacts and be considered from the initial start of the project.

3.5 Transport

5 credits were achieved which equates to 4.44% and 7 credits could have been achieved which equates to 6.22% credits. 2 of 9 credits were considered not achievable.

Proximity to public transport, doctors, postal facilities and bank/cash machine has met the requirements.

The safety for both cyclist and pedestrians met the local regulations for lighting however access to the bike racks rules this credit unachievable.

The local bus service location meets one the requirements and the addition of car sharing and marketing/notice board would achieve the second credit at little additional cost.

Development of a travel plan would achieve one additional credit with little financial impact.

One credit can be awarded for car parking however the second cannot due to no limitations/controls on parking spaces in undercover parking.

3.6 Water

2 credits were achieved which equates to 1.33% and 7 credits could have been achieved which equates to 3.33% credits. 4 of 9 credits were considered not achievable.

Through the Wat 1 water consumption spreadsheet regarding flow rates one credit was achieved. The calculations do not include kitchens and as the majority of office buildings in the country have complete kitchens true consumptions figures cannot be shown.

The use of sub-metering was considered achievable at a minimal additional cost.

Major leak detection and sanitary supply shutoff credits were considered achievable however may have a financial impact on the project and would have to be considered from the outset.

As a feasibility study into onsite water treatment systems was not completed no credits could be awarded for Wat 8. It was considered that this could be taken from a municipality approach from the initial stages of developments.

As there are no watering system the irrigation system credit has been achieved.

3.7 Materials

0 credits were achieved which equates to 0.00% and 6 credits could have been achieved which equates to 6.77% credits. 7 of 13 credits were considered not achievable.

After discussing the hard landscaping and boundary protection credit was felt achievable and documentation would produced if considered from the initial stages of the project.

Responsible sourcing of materials is not part of the industry in the region however it was felt that one credit would be achieve. This may also have a large financial impact on the project.

Being a new build the re-use of building facade and structure credits were not achieved.

It was felt that the approach to robustness is different in the region to that of the BREEAM however if considered from early stages was felt that it may be achievable.

3.8 Waste

5 credits were achieve which equates to 5.36% and 5 credits could have been achieved which equates to 5.36% credits. 2 of 7 credits were considered not achievable.

As the use of recycled aggregates with a clear % is not standard practise in the region and industry it was considered extremely difficult to achieve.

Waste management requirements both onsite and for building occupants have been met. The local recycling and waste management procedures exceed the requirements.

3.9 Land Use & Ecology

2 credits were achieved which equates to 2.00% and no aditional credits were considered achievable. 8 of 10 credits were considered not achievable.

The building is on re-used land that was not considered contaminated so one of the two available credits was achieved.

As no ecological report has been produced no credit can be awarded and therefore the impact on site ecology and biodiversity cannot be monitored for improvement.

An ecology assessment was produced at the start of the project and it was believed that Checklist A4 would meet the requirements. As this is not standard practise the cost may vary compared the uk market from which the regulations were developed.

3.10 Pollution

3 credits were achieve which equates to 2.50% and 5 credits could have been achieved which equates to 4.17% credits. 7 of 12 credits were considered not achievable.

Refrigeration selection and leak detection system met all of the requirements however depending on regional suppliers can have financial impact. It was said that the leak detection system is standard practise in the region.

As the building runs on district heating and only 4 credits have been achieved in Ene 1 energy efficiency no credits have been awarded for the reduced NOx emissions.

Noise attenuation was considered from early in the project and from discussions was felt to meet the credit requirements even though an assessment did not take place.

Night time light pollution does not meet the requirements.

No credits were achieved regarding flood risk due to the site location and flooding information provided.

3.11 Innovation

0 credits were achieved which equates to 0.00% and 1 credits could have been achieved which equates to 1.00% credits. 9 of 10 credits were considered not achievable.

Credit Wat 2 - The water metering system with pulsed output was thought to meet the credit requirements.

4 Conclusions

In order to improve the score and achieve several of the unachieved credits the projects would require significant improvements in materials and land use and ecology credit areas from the initial stages of the project. Had these requirements been known and considered at the time of development we are confident that these additional credits could be achieved.

In the Management credit group several credits would not be achieved in most projects in the region as the evidence requirements are outside standard practise, however these would be achievable if considered from the initial stages of the project. They would have little financial impact.

The credit groups with a large positive impact were Health & Wellbeing and Energy & Pollution. The most negative impact was for the Land Use and Ecology credit group where few credits were achieved. This credit group is also impacted by the local regional approach to town and site development.

As with projects in the UK the ability to achieve many of the Health and Wellbeing credits will vary from project to project. Credits relating to lighting levels, indoor air quality and contamination generally have to meet local regulations however credits relating to view out and thermal comfort are project dependant.

The energy credit group has a large influence on the project and can be affected by many other credit groups such as Materials and Health & Wellbeing. This credit group should be considered early in the project and it is recommended that work between the architects and mechanical and electrical engineers begins at the initial stages.

There were several credits considered as conflicting with the Danish Regulations and construction traditions. The majority of these centred on community heating, waste management, material supply/re-use and regional development. It was also found that several credits were considered standard practise. These generally related to the pollution.

Transport credits are mostly influenced by the site location and layout. Several credits such as parking and cyclist and pedestrian safety can be easily achieved if considered early in the project.

It was felt that site feasibility studies done by the municipality impact on several credits including the Water and Land Use & Ecology credit groups and that BREEAM's credit requirements may need to be reviewed.

Several of the credits were considered standard practise in the region relating to local regulations and building practise. These included lighting levels, indoor air quality and contamination along with waste management.

Overall it can be seen that several credits can be achieved with little additional work if considered from the initial stages. However there are several credits that would have a high financial impact on the project and would be ruled out if the project were attempting to achieve a high rating.

Appendix A

Vallensbæk Results

ARUP

Final Score & Rating Achieved

BREEAM Scheme: Europe 2009: Offices
BREEAM Registration No.: 001
Building Name: Vallensbaek Company House
BREEAM Assessor: ARUP Cardiff

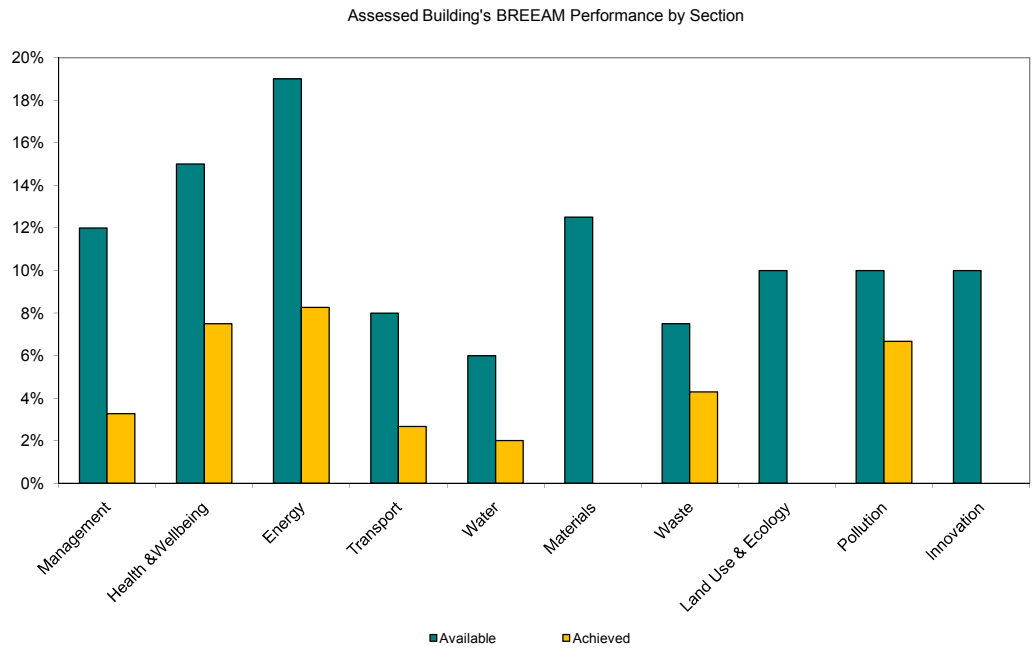
Stage of Assessment	BREEAM Score	BREEAM Rating
Final - Post Construction Stage	34.65%	PASS

Minimum BREEAM Standards

Rating Level	Pass >30%	Good >45%	Very Good >55%	Excellent >70%	Outstanding >85%
Minimum Standards Achieved	YES	NO	NO	NO	NO

Building Performance by Section

	Environmental weighting	Credits available	Credits achieved	% Achieved	Weighted Score
Management	12.00%	11.00	3.00	27.27%	3.27%
Health & Wellbeing	15.00%	14.00	7.00	50.00%	7.50%
Energy	19.00%	23.00	10.00	43.48%	8.26%
Transport	8.00%	9.00	3.00	33.33%	2.67%
Water	6.00%	9.00	3.00	33.33%	2.00%
Materials	12.50%	13.00	0.00	0.00%	0.00%
Waste	7.50%	7.00	4.00	57.14%	4.29%
Land Use & Ecology	10.00%	10.00	0.00	0.00%	0.00%
Pollution	10.00%	12.00	8.00	66.67%	6.67%
Innovation	10.00%	10.00	0.00	0.00%	0.00%
				Total	34.65%
				Exemplary Level credits achieved	0.00%
				Total Innovation credits achieved	0.00%
				Total BREEAM Score	34.65%



ARUP

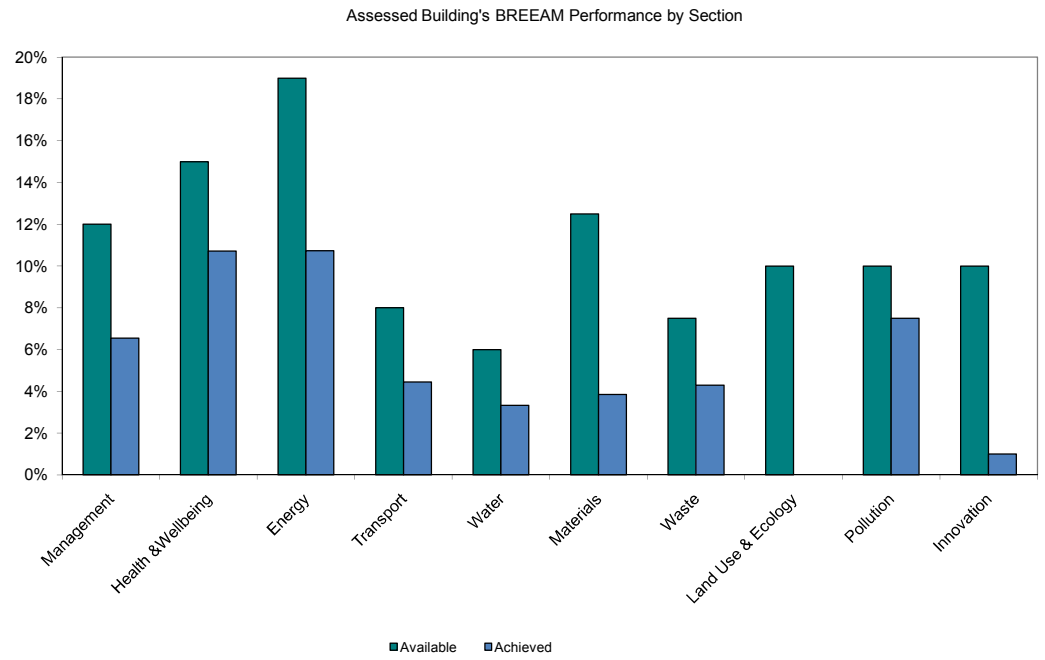
Possible Final Score & Rating Achieved

BREEAM Scheme: Europe 2009: Offices	**BREEAM Registration No.:** 001
Building Name: Vallensbaek Company House	**BREEAM Assessor:** ARUP Cardiff

Stage of Assessment	BREEAM Score	BREEAM Rating
Final - Post Construction Stage	**52.41%**	**GOOD**

Minimum BREEAM Standards					
Rating Level	Pass >30%	Good >45%	Very Good >55%	Excellent >70%	Outstanding >85%
Minimum Standards Achieved	YES	YES	NO	NO	NO

Building Performance by Section					
	Environmental weighting	Credits available	Credits achieved	% Achieved	Weighted Score
Management	12.00%	11.00	6.00	54.55%	6.55%
Health & Wellbeing	15.00%	14.00	10.00	71.43%	10.71%
Energy	19.00%	23.00	13.00	56.52%	10.74%
Transport	8.00%	9.00	5.00	55.56%	4.44%
Water	6.00%	9.00	5.00	55.56%	3.33%
Materials	12.50%	13.00	4.00	30.77%	3.85%
Waste	7.50%	7.00	4.00	57.14%	4.29%
Land Use & Ecology	10.00%	10.00	0.00	0.00%	0.00%
Pollution	10.00%	12.00	9.00	75.00%	7.50%
Innovation	10.00%	10.00	1.00	10.00%	1.00%
				Total	**51.41%**
				Exemplary Level credits achieved	**1.00%**
				Total Innovation credits achieved	**1.00%**
				Total BREEAM Score	**52.41%**



ARUP

BREEAM Scheme: Europe 2009: Offices
Building Name: Vallensbaek Company House
BREEAM Registration No.: 001

Ref	Title	BREEAM Europe: Offices Criteria	Number of BREEAM credits available	Total BREEAM credits achieved	Possible BREEAM credits achieved	Forecast BREEAM Rating					Denmark & European Standard Ref	Comments/Actions
						Pass	Good	Very Good	Excellent	Outstanding		
						YES	YES	NO	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Management												
Man 1	**Commissioning**	One credit where evidence provided demonstrates that sufficient time and resources will be allocated for commissioning prior to handover in the construction programme to ensure efficient operation of all the services within the building. Two credits where, in addition to the above, evidence provided demonstrates that commissioning will be carried out in line with best practice commissioning codes and that seasonal commissioning will be carried out during the first year of occupation, post construction (or post fit out).	**2**	**1**	**2**	0	0	0	1	2	Press to view	One credit can be awarded. To achieve the second credit evidence must be provided to demonstrate that commissioning has been carried out in line with best practice commissioning codes and that seasonal commissioning will be carried out during the first year of occupation, post construction. Please refer to the Danish Reference document for European and Danish standards references.
Man 2	**Constructors' Environmental & Social Code of Conduct**	One credit where evidence provided demonstrates that there is a commitment to comply with best practice site management principles. Two credits where evidence provided demonstrates that there is a commitment to go beyond best practice site management principles.	**2**	**0**	**1**	0	0	0	0	0		No credit could be awarded however it was felt that one credit could be achieved if it was considered from the initial stages of the project. It was also noted that not all is standard practise in Denmark. Additional work is not relevant for the region.
Man 3	**Construction Site Impacts**	One credit where evidence provided demonstrates that 2 or more of items a-g (listed below) are achieved. Two credits where evidence provided demonstrates that 4 or more of items a-g (listed below) are achieved. Three credits where evidence provided demonstrates that 6 or more of items a-g are achieved: a. Monitor, report and set targets for CO2 or energy arising from site activities b. Monitor, report and set targets for CO2 or energy arising from transport to and from site c. Monitor, report and set targets for water consumption arising from site activities d. Implement best practice policies in respect of air (dust) pollution arising from the site e. Implement best practice policies in respect of water (ground and surface) pollution occurring on the site f. Main contractor has an environmental materials policy, used for sourcing of construction materials to be utilised on site g. Main contractor operates an Environmental Management System. One additional credit where evidence provided demonstrates that at least 80% of site timber is responsibly sourced and 100% is legally sourced.	**4**	**2**	**2**	0	0	0	1	2		Two credit can be awarded as a report has been produced. It was noted that this covers energy on site is monitored includeing heating, water, lighting, dust, air (which are linked in with municipality regs and permits). It was said to be considered standard practise in the area. This is done through reports to H&S who do spot checks. There is abn environmental management system on site which does not cover materialsn. No monitoring transport onsite has taken place. No credits achieved on timber sourcing - site timber was not highly used.
Man 4	**Building user guide**	One credit where evidence provided demonstrates the provision of a simple guide that covers information relevant to the tenant/occupants and non-technical building manager on the operation and environmental performance of the building.	**1**	**0**	**1**	0	1	1	1	1		No credit could be awared as a building user guide that meets BREEAM requirements has not been produced and is not standard practise in the region. It was felt that this could be achieved if it was considered from early in the project.
Man 12	**Life Cycle Cost Analysis**	One credit where evidence provided demonstrates that a Life Cycle Cost (LCC) analysis based on the feasibility study proposals has been undertaken on the building design at a strategic and system level. Two credits where, in addition to the above, evidence provided demonstrates that the results of the feasibility study and consideration of LCC have been implemented.	**2**	**0**	**0**	0	0	0	0	0		No credit could be awared as a Life Cycle Cost Analysis that meets BREEAM requirements has not been produced and is not standard practise in the regoin. It was discussed that this would consider as an industry in the future once other industries have made it mandatory and developed further.
Health & Wellbeing												
Hea 1	**Daylighting**	One credit where evidence provided demonstrates that at least 80% of floor area in each occupied space is adequately daylit.	**1**	**0**	**1**	0	0	0	0	0	Press to view	No credit can be awarded. It was noted that this is standard practice to have natural daylighting but not 80% within building. Only permanent workspace. Modelling could be produced to achieve the credit. - (FUTURE OPTIONS - Fiber Optics to possibly used in the future.) If considered from early in the project this would have been considered and could be achieved.
Hea 2	**View Out**	One credit where evidence provided demonstrates that all relevant building areas have an adequate view out.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded. Currently this does not get considered during the design process. It was thought that this credit could easily be achieved if considered from the outset.
Hea 3	**Glare Control**	One credit where evidence provided demonstrates that an occupant-controlled shading system (e.g. internal or external blinds) is fitted in relevant building areas.	**1**	**0**	**0**	0	0	0	0	0		No credit can be awarded. In the region this comes under the standard tenant agreement and generally only installed in rooms controlled (owned) by the building owner. All other areas left to be installed by tenant. *Occupied space: A room or space within the assessed building that is likely to be occupied for 30 minutes or more by a building user and, with respect to this issue, where it would be desirable to limit the potential for glare or provided a system of glare control.'*
Hea 4	**High frequency lighting**	One credit where evidence provided demonstrates that high frequency ballasts are installed on all fluorescent and compact fluorescent lamps.	**1**	**1**	**1**	1	1	1	1	1		To be looked into further - detail into lighting not available at meeting.
Hea 5	**Internal and external lighting levels**	One credit where evidence provided demonstrates that all internal and external lighting, where relevant, is specified in accordance with the appropriate illuminance levels (in lux) in accordance with national best practice guides.	**1**	**1**	**1**	0	0	0	0	0	Press to view	This credit can be awarded as it meets the Dansk Standard (DS700).
Hea 6	**Lighting zones & controls**	One credit where evidence provided demonstrates that, in all relevant building areas, lighting is appropriately zoned and occupant controllable.	**1**	**0**	**0**	0	0	0	0	0		This credit cannot be achieved as the lighting zones and controles have do not provide the user controls that meet BREEAM requirements. It was noted that Danish standards have larger area zone per person (15m2) to uk zone. Motion sensors setup for the office space.

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						YES	YES	NO	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Hea 7	**Potential for natural ventilation**	One credit where evidence provided demonstrates that fresh air is capable of being delivered to the occupied spaces of the building via a natural ventilation strategy, and there is sufficient user-control of the supply of fresh air.	**1**	**0**	**0**	0	0	0	0	0		No credit can be awarded as the building has a Mechanical ventilation system inplace. (Discuss with BRE - *2. The strategy is capable of providing at least two levels of user-control on the supply of fresh air to the office space with higher rates of ventilation achievable to remove short-term odours and/or prevent summertime overheating.)*-- One credit could be awarded if calculations were done from the early stages of the project and all relevant areas meet requirements.
Hea 8	**Indoor air quality**	One credit where air intakes serving occupied areas avoid major sources of external pollution and recirculation of exhaust air.	**1**	**1**	**1**	0	0	0	0	0	Press to view	One credit can be awarded as all relevant Danish standards have been met.
Hea 9	**Volatile Organic Compounds**	One credit where evidence provided demonstrates that the emissions of VOCs and other substances from key internal finishes and fittings comply with best practice levels.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded as relevant evidence cannot be provided however it was noted that this is considered standard practise for the for region there for this credit could have been achieved.
Hea 10	**Thermal comfort**	One credit where evidence provided demonstrates that an analytical measurement and evaluation of the thermal comfort levels of the building has been carried out using the PMV and PPD indices in accordance with EN ISO 7730:2005. Two credits where evidence provided demonstrates that thermal comfort levels in occupied spaces of the building are assessed at the design stage to evaluate appropriate servicing options, ensuring appropriate thermal comfort levels are achieved.	**2**	**2**	**2**	0	0	0	0	0	Press to view	Two credits can be awarded as thermal modelling has been completed (detailed, general, 3 individual room to local standard practise) - similar approach to ARUP IES - BE06 made by SPI and mandatory - BSIM made by BRE
Hea 11	**Thermal zoning**	One credit where evidence provided demonstrates that local occupant control is available for temperature adjustment in each occupied space to reflect differing user demands.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awarded as a relevant areas have been zoned. Drawings can be provided marking areas.
Hea 12	**Microbial contamination**	One credit where evidence provided demonstrates that the risk of waterborne and airborne legionella contamination has been minimised.	**1**	**1**	**1**	0	0	0	0	0	Press to view	One credit can be awarded as the Danish standards have been met. This is standard practise in the region.
Hea 13	**Acoustic Performance**	One credit where evidence provided demonstrates that the building achieves appropriate indoor ambient noise levels in offices areas. In addition, for fully fitted buildings only: Appropriate airborne sound insulation levels are achieved between acoustically sensitive spaces and occupied spaces, sufficient to ensure adequate privacy.	**1**	**0**	**0**	0	0	0	0	0		No credit can be awared as no Acoustician has been assigned to the project.
Energy												
Ene 1	**Energy Efficiency**	Up to fifteen credits where evidence provided demonstrates an improvement in the energy performance of the building's fabric and service based on the percentage improvement in the assessed designs' predicted Building Energy Performance Index (BEPI) over the Current Standards Building Energy Performance Index (CSBEPI), as defined for the local Energy Performance Certificate OR	**15**	**8**	**8**	0	0	0	6	10	Press to view	8 credits can be awareded as it was confirmed from local a assessment and rating of building giving a 25% improvement.
Ene 2	**Sub-metering of Substantial Energy Uses**	One credit where evidence provided demonstrates the provision of direct sub-metering of energy uses within the building.	**1**	**1**	**1**	0	0	1	1	1		One credit can be awarded as a list was provided showing measurement for electricity per tenant.
Ene 3	**Sub-metering of high energy load Areas and Tenancy**	One credit where evidence provided demonstrates sub-metering of energy consumption by tenancy/building function area is installed within the building.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awarded as a list was provided showing measurement for electricity per tenant.
Ene 4	**External Lighting**	One credit where energy-efficient external lighting is specified and all light fittings are controlled for the presence of daylight.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded as the external lighing has not been designed/calculated to BREEAM requirments. Original calcs were done for occupied hours. As building tenants may use the building during night and as the specs and lighting don't meet the requriements this credit cannot be awarded. Daylight censors can be provided. If considered from the intial stages of the project this credit is considered to achieveable.
Ene 5	**Low zero carbon technologies**	One credit where evidence provided demonstrates that a feasibility study considering local (on-site and/or near site) low or zero carbon (LZC) technologies has been carried out and the results implemented. Two credits where evidence provided demonstrates that the first credit has been achieved and there is a 10% reduction in the building's CO_2 emissions as a result of the installation of a feasible local LZC technology. Three credits where evidence provided demonstrates that the first credit has been achieved and there is a 15% reduction in the building's CO_2 emissions as a result of the installation of a feasible local LZC technology.	**3**	**0**	**1**	0	0	0	1	1		No credit can be awareded as no LZC report has been produced and the property is not supplied by a source that BREEAM reward credits. It is not currently part of local legislation. LZC report could be produced and the introduction of technologies to achieve further credits.----- District heating used created by Biomass from waste incineration so this would have to be considered when these credits are developed. *see regs on waste incineration.*
Ene 8	**Lifts**	Up to two credits are available where evidence provided demonstrates the installation of energy-efficient lift(s).	**2**	**0**	**1**	0	0	0	0	0		No credit can be awared as no lift analysis has been produced. It was felt that this credit could be achieved if considered from the early stages.
Transport												
Tra 1	**Provision of public transport**	Up to four credits can be awarded based on the proximity of the development to a public transport node with a good service frequency. Determined using the BREEAM Public Transport Table	**2**	**0**	**1**	0	0	0	0	0		Close to 500m train station. (580m driven distance on GPS). Trains running every 10mins in one direction 15 other. Discussed with BREEAM and jointly assumed one credit achieved.
Tra 2	**Proximity to amenities**	One credit where evidence provided demonstrates that the building is located within 500m of accessible local amenities appropriate to the building type and its users.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awarded as the site meets the requirements. Town centre within train station. Includes Bank/Cash machine, Doctors surgery/medical centre (GP), post box. Postal also done within building.
Tra 3	**Alternative modes of transport**	Two credits can be awarded where one of the following measures has been implemented to encourage the use of alternatives to the private car for commuting: Option 1 – provision of compliant cycle storage spaces according to the number of building users and of compliant facilities including showers, changing facilities and lockers for clothes and drying space for wet clothes	**2**	**1**	**1**	0	0	0	0	0	Press to view	One credit can be awarded as the site is within 300m of the local bus service that meets teh requirements. Option 1 - first credit achievable, second NA----Option 2 - Consultation with local authority has been done during stage B, link with municipality bycicle plan. Achieved
Tra 4	**Pedestrian and cycle safety**	One credit where evidence provided demonstrates that the site layout has been designed in accordance with best practice to ensure safe and adequate cycle access. One credit where evidence provided demonstrates that the site layout has been designed in accordance with best practice to ensure safe and adequate pedestrian access.	**1**	**1**	**1**	0	0	0	0	0	Press to view	One credit can be awarded as all the relevant regulations have been met. CEN EN 12464-2 Lighting of work places - Part 2: Outdoor work places, 2007. Done in link with police and municipality. Working with local organisations to meet the safest possible options for pedestrian and cycle safety. Regional and municipality link/communication as site is being developed.

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						YES	YES	NO	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Tra 5	**Travel plan**	One credit where evidence is provided to demonstrate that a travel plan has been developed and tailored to the specific needs of the building users.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awareded as no travel plan the meets the requirmenst has been produced. The municipality along with the developer have worked on creating the transport systems/facilities. Local and Denmark traffic updates are available online. It could be possible to provide a link on intranet within the office along with working around issues and how they may/will be followed through into the project. Again district plan influence - Earliest stages of the project.
Tra 6	**Maximum car parking capacity**	Two credits where evidence provided demonstrates that the number of parking spaces provided for the building has been limited.	**2**	**0**	**0**	0	0	0	0	0		No credit can be awarded. To meet the requirment more parking spaces would have to be provided. Designed for 80 parking spaces building users. One tenant is running courses and require additional parking spaces making the requirement = 134 total.
Water												
Wat 1	**Water Consumption**	Up to three credits where evidence provided demonstrates that the specification includes taps, urinals, WCs and showers that consume less potable water in use than standard specifications for the same type of fittings.	**3**	**1**	**1**	0	0	1	1	2		One credit can be awareded. Ref spreadsheet for flow rates. - Denmark general offices contain kitchens.
Wat 2	**Water meter**	One credit where evidence provided demonstrates that a water meter with a pulsed output will be installed on the mains supply to each building/unit.	**1**	**1**	**1**	0	0	0	1	1		One credit can be awared. Not currently connected to BMS, sub-metering in place.
Wat 3	**Major leak detection**	One credit where evidence provided demonstrates that a leak detection system is specified or installed on the building's water supply.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarede however the credit is able to be achieved as it is possible to add to cellar and easy option to add to system.
Wat 4	**Sanitary supply shut off**	One credit where evidence provided demonstrates that proximity detection shut-off is provided to the water supply to all toilet areas.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded. It was noted that this is generally done in schools but not in offices. Could be added if required however would be at high cost.
Wat 6	**Irrigation systems**	One credit where evidence provided demonstrates that a low-water irrigation strategy/system has been installed, or where planting and landscaping is irrigated via rainwater or reclaimed water.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awared. Local plants, irrigation system for site is being developed further. No irrigation system in place or required.
Wat 8	**Sustainable on-site water treatment**	One credit where evidence provided demonstrates that a feasibility study considering sustainable on-site water treatment systems has been carried out and the results implemented. Two credits where evidence provided demonstrates that the first credit has been achieved and 30% of the building/development's wastewater is treated to tertiary standards	**2**	**0**	**0**	0	0	0	0	0		No credit can be awarded as there is no system in place. It was noted that this is not considered practical to undergo research and treatment onsite. More logical to look at this from a municipality approach.
Materials												
Mat 1	**Materials Specification (major building elements)**	Up to four credits are available where nationally recognised LCA tool or the Green Guide to Specification has been used to evaluate a range of material options for the major building elements	**4**	**0**	**2**	0	0	0	0	0	Press to view	No credits can be awarded as no calculations have be done. Two credits have been assumed from detail entered into the Mat 1 calculator. Assumptions to be made on spreadsheet that we can create and calculate. - Windows=aluminium frame, Wall 1(80%)=concrete, insulation, concrete, wall 2 (20%)= , Roof= concrete, insulation, asphalt, Upper floors = concrete, prefab-hollow core, 70%30%mix(confirm with Elaine on this material), - See attached worksheet
Mat 2	**Hard landscaping and boundary protection**	One credit where evidence provided demonstrates that a nationally recognised LCA tool or the Green Guide to Specification has been used to evaluate a range of material options for the external hard landscaping and boundary protection specifications	**1**	**0**	**0**	0	0	0	0	0		Assumptions have been made. More detail to be provided.
Mat 3	**Re-use of building façade**	One credit is awarded where evidence provided demonstrates that at least 50% of the total façade (by area) is reused and at least 80% of the reused façade (by mass) comprises in-situ reused material.	**1**	**0**	**0**	0	0	0	0	0		Not achievable. New build project.
Mat 4	**Re-use of building structure**	One credit is awarded where evidence provided demonstrates that a design reuses at least 80% of an existing primary structure and for part refurbishment and part new build, the volume of the reused structure comprises at least 50% of the final structure's volume.	**1**	**0**	**0**	0	0	0	0	0		Not achievable. New build project.
Mat 5	**Responsible sourcing of materials**	Up to 3 credits are available where evidence provided demonstrates that 80% of the assessed materials in the following building elements are responsibly sourced: a. Structural Frame	**3**	**0**	**0**	0	0	0	0	0		No credit can be awarded as it is not standard practice from suppliers in the area. Long term market changes will improve this as in UK.
Mat 6	**Insulation**	One credit where evidence provided demonstrates that thermal insulation products used in the building have a low embodied impact relative to their thermal properties, determined by the Green Guide to Specification ratings. One credit where evidence provided demonstrates that thermal insulation products used in the building have been responsibly sourced.	**2**	**0**	**1**	0	0	0	0	0		No credit can be awarded as material specs were not available. One credit could be achieved if material specs were supplied as materials disscussed generally pass requirements. Poly used in precast concrete. Rockwool (& glass wool) in roofing and piping. Getting certificates to confirm may be difficult in other credits.
Mat 7	**Designing For Robustness**	One credit where protection is given to vulnerable parts of the building such as areas exposed to high pedestrian traffic, vehicular and trolley movements.	**1**	**0**	**1**	0	0	0	0	0		Not currently achievable. Was considered in initial design and could be taken into consideration if documented from an early stage. Kick plates are not standard in the region.
Waste												
Wst 1	**Construction Site Waste Management**	One credit where evidence provided demonstrates that a site waste management plan has been developed and implemented. Two credits where evidence provided demonstrates that the first credit has been achieved and waste reduction is a key priority of the site waste management plan. Three credits where evidence provided demonstrates that a significant majority of non-hazardous construction waste generated by the development will be diverted from landfill and reused or recycled.	**3**	**2**	**2**	0	0	0	0	0		Two credits can be awarded. Local regulations have high recycling standards and current onsite construction waste management. Already standard practice however may not have been documented to meet BREEAM regs. Some waste goes to incineration, sorting externally. Normal procedure. To provide documentation may require additional work but wont change standard practice. Economic target, internal. 90% of waste to be recycled.
Wst 2	**Recycled aggregates**	One credit where evidence provided demonstrates the significant use of recycled or secondary aggregates in 'high-grade' building aggregate uses.	**1**	**0**	**0**	0	0	0	0	0		No credit can be awared as this is not specified due to general standard and practice in the region. May not be able to specify in the detail required. There will be no change to current practice. Hard to give %.

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						YES	YES	NO	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Wst 3	**Recyclable waste storage**	One credit where a central, dedicated space is provided for the storage of the building's recyclable waste streams.	**1**	**1**	**1**	0	0	0	1	1		One credit can be awarded as as there is a dedicated waste recycle storage area in place. May need to confirm signage and other non influential credit requirements.
Wst 5	**Composting**	One credit where evidence provided demonstrates there is a vessel on site for composting food waste, and adequate storage for such waste generated by the building's users and operation. OR	**1**	**0**	**0**	0	0	0	0	0		No credit can be awarded as there is no composting waste system. Local research has been done and has found that it is more efficient to use it as a fuel for community heating systems.
Wst 6	**Floor Finishes**	One credit where carpets and other floor finishes are specified by the future occupant or, in tenanted areas of speculative buildings, where carpets or floor finishes are installed in a limited show area only.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awareded. It was said that it is typical that tenant communication has begun early and has asked/confired for it to be installed.
Land Use & Ecology												
LE1	**Re-use of land**	One credit where evidence provided demonstrates that the majority of the footprint of the proposed development falls within the boundary of previously developed land.	**1**	**0**	**0**	0	0	0	0	0		No credit can be awarded as the site did not meet the Re-use requirements. Was a former scout camp of portable cabins and forestry area.
LE2	**Contaminated land**	One credit is awarded where evidence provided demonstrates that the land used for the new development has, prior to development, been defined as contaminated and where adequate remedial steps have been taken to decontaminate the site prior to construction.	**1**	**0**	**0**	0	0	0	0	0	Press to view	No credit can be awareded as the site was not classed as contaminated.
LE3	**Ecological value of site AND Protection of ecological features**	One credit is awarded where evidence provided demonstrates that the construction zone is defined as land of low ecological value and all existing features of ecological value will be fully protected from damage during site preparation and construction works.	**1**	**0**	**0**	0	0	0	0	0		No credit can be awarded as an ecologiacl report that meets the requirements has not been produced. Ecological info has been done from district planning. They inform if any local/threatened species on site and if further investigation is required. This project did not require any further investigation.
LE4	**Impact on Site Ecology**	One credit where the design team (or client) has appointed a suitably qualified ecologist to advise and report on enhancing and protecting the ecological value of the site; and implemented the professional's recommendations for general enhancement and protection of site ecology.	**5**	**0**	**0**	0	0	0	2	2		No credit can be awarded as no ecology report was created and linked in with district planning. Not normal practice in the region.
LE6	**Long term impact on biodiversity**	One credit where the client has committed to achieving the mandatory requirements listed in the manual and at least two of the additional requirements. Two credits where the client has committed to achieving the mandatory requirements listed in the manual and at least four of the additional requirements.	**2**	**0**	**0**	0	0	0	0	0		As above - UK oriented regulations.
Pollution												
Pol 1	**Refrigerant GWP - Building services**	One credit where evidence provided demonstrates the use of refrigerants with a global warming potential (GWP) of less than 5 or where there are no refrigerants specified for use in building services.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awarded. Evidence was provided confirming that the GWP=3.3 ODP=0. Was noted that it is not general common practise. Commented as very good product. - Supplier=Bundgaard
Pol 2	**Preventing refrigerant leaks**	One credit where evidence provided demonstrates that refrigerant leaks can be detected or where there are no refrigerants specified for the development. One credit where evidence provided demonstrates that the provision of automatic refrigerant pump down is made to a heat exchanger (or dedicated storage tanks) with isolation valves. Or where there are no refrigerants specified for the development.	**2**	**2**	**2**	0	0	0	0	0		Two credits can be warded. This was said to be standard practise.
Pol 4	**NOx emissions from heating source**	One credit where evidence provided demonstrates that the maximum dry NOx emissions from delivered space heating energy are ≤100 mg/kWh (at 0% excess O2). Twp credits where evidence provided demonstrates that the maximum dry NOx emissions from delivered space heating energy are ≤70 mg/kWh (at 0% excess O2).	**3**	**1**	**1**	0	0	0	0	0		District heating system being used. 1 credit given as 8 credits achieved in Ene 1 - *Where the local authority requires district heating to be used for the project, one point can be awarded by default where the project has achieved at least 8 points under Ene 1.*
Pol 5	**Flood risk**	Two credits where evidence provided demonstrates that the assessed development is located in a zone defined as having a low annual probability of flooding.	**3**	**2**	**2**	0	0	0	0	0	Press to view	Two credits can be awarded. Flood map shown, site is 6m above sea level. Other areas in the region are of high risk level.
Pol 6	**Minimising watercourse pollution**	One credit where evidence provided demonstrates that effective on site treatment such as Sustainable Drainage Systems (SUDs) or oil separators have been specified in areas that are or could be a source of watercourse pollution.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awarded. Site plan provided showing required info. Standard practise.
Pol 7	**Reduction of Night Time Light Pollution**	Where evidence provided demonstrates that the external lighting design is in compliance with best practice guidance from the Commission Internationale D'éclairage (CIE).	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded as it is not standard practise. Info is to be produced from drawing. Daylight sensors in place. One credit could easily be achieve if required.
Pol 8	**Noise Attenuation**	One credit where evidence provided demonstrates that new sources of noise from the development do not give rise to the likelihood of complaints from existing noise-sensitive premises and amenity or wildlife areas that are within the locality of the site.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awarded as from the initial stages working with the municipality the development has been setup to help reduce the noise polution to surrounding required areas. Will be consider for innovation credit as building is acting as sound barrier to surrounding houses.
Innovation												
Man 3	**Construction Site Impacts**	Evidence provided demonstrates that all of the items a-g listed previously are achieved and at least 80% of site timber is responsibly sourced and 100% is legally sourced.	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable
Hea 1	**Daylighting**	One additional innovation credit where evidence provided demonstrates that at least 80% of the office floor area has achieved increased daylight levels. In addition, in retail developments, at least 50% by floor area of the common spaces and 35% by floor	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable
Hea 9	**Volatile Organic Compounds**	One additional innovation credit where evidence provided demonstrates that all internal finishes and fittings specified in the building have been tested against and meet the relevant standards for Volatile Organic Compound (VOC) emissions.	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable

Ref	Title	BREEAM Europe: Offices Criteria	Number of BREEAM credits available	Total BREEAM credits achieved	Possible BREEAM credits achieved	Forecast BREEAM Rating					Denmark & European Standard Ref	Comments/Actions
						Pass	Good	Very Good	Excellent	Outstanding		
						YES	YES	NO	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Ene 1	**Energy efficiency**	One additional innovation credit where an energy modelling carried out using a Dynamic Simulation Modelling software demonstrates the building is designed to be a carbon neutral building (i.e. in terms of building services energy demand). Two additional innovation credits can be awarded where evidence provided demonstrates the building is designed to be a True zero carbon building (in terms of building services and operational energy demand).	**2**	**0**	**0**	0	0	0	0	0		Considered not achievable
Ene 5	**Low or Zero Carbon Technologies**	One additional innovation credit where evidence provided demonstrates that a local LZC energy technology has been installed in line with the recommendations of the above feasibility study and this method of supply results in a 20% reduction in the buildin	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable
Tra 3	**Alternative modes of transport**	One additional innovation credit where evidence provided demonstrates that two of the options above have been implemented.	**1**	**0**	**1**	0	0	0	0	0		No credit is achieved however it is was considerd achieveable through discussions into 1. Car sharing on intranet, posters and info for tenants regarding car sharing. 2. Addition to lease agreement docs stating that they have dedicated space that can be used to develop the facilities
Wat 2	**Water Meter**	One additional innovation credit where evidence provided demonstrates that sub meters with a pulsed output are fitted to allow the metering of individual water-consuming plant or building areas	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable
Mat 1	**Materials Specification**	One additional innovation credit where evidence provided demonstrates that a nationally recognised LCA tool or the Green Guide to Specification has been used to evaluate a range of material options for all the building elements.	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable
Mat 5	**Responsible Sourcing of Materials**	Where, in addition to the standard BREEAM requirements, 95% of the applicable materials, comprised within the applicable building elements, have been responsibly sourced.	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable
Pol 4	**NOx emissions of heating source**	One additional innovation credit where evidence provided demonstrates that the plant installed to meet the building's space heating demand has zero dry NOx emission levels at 0% excess O2.	**1**	**0**	**0**	0	0	0	0	0		Considered not achievable

Appendix B

Horten Results

ARUP

Final Score & Rating Achieved

BREEAM Scheme: Europe 2009: Offices	**BREEAM Registration No.:** 0002
Building Name: Horten Headquarters	**BREEAM Assessor:** ARUP Cardiff

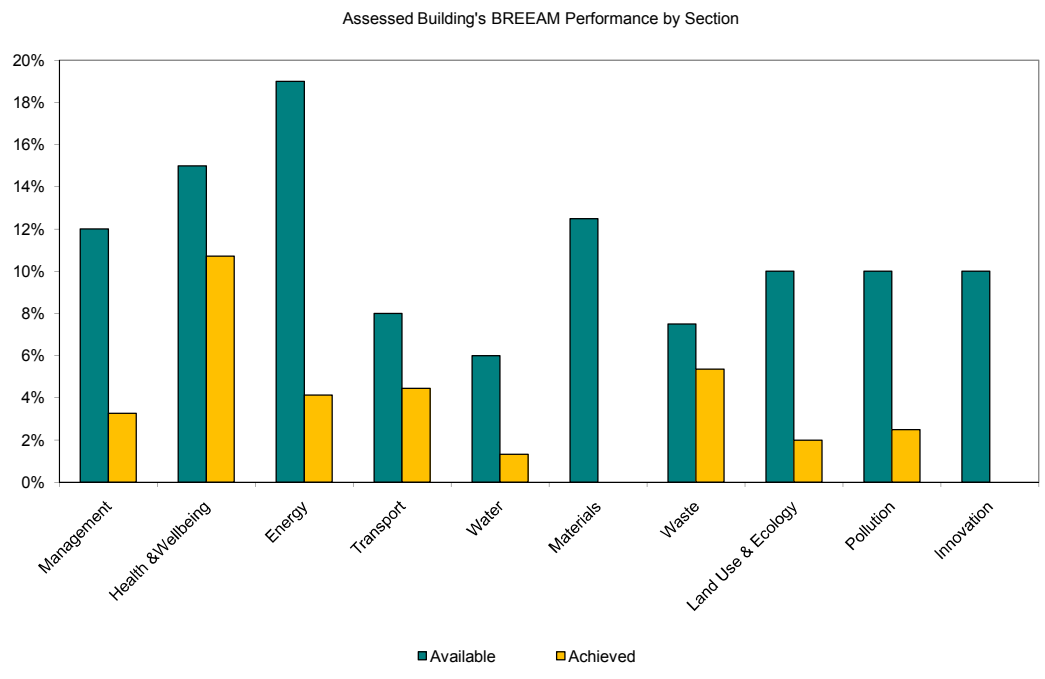
Stage of Assessment	BREEAM Score	BREEAM Rating
Final - Post Construction Stage	**33.75%**	**PASS**

Minimum BREEAM Standards

Rating Level	Pass >30%	Good >45%	Very Good >55%	Excellent >70%	Outstanding >85%
Minimum Standards Achieved	YES	NO	NO	NO	NO

Building Performance by Section

	Environmental weighting	Credits available	Credits achieved	% Achieved	Weighted Score
Management	12.00%	11.00	3.00	27.27%	3.27%
Health & Wellbeing	15.00%	14.00	10.00	71.43%	10.71%
Energy	19.00%	23.00	5.00	21.74%	4.13%
Transport	8.00%	9.00	5.00	55.56%	4.44%
Water	6.00%	9.00	2.00	22.22%	1.33%
Materials	12.50%	13.00	0.00	0.00%	0.00%
Waste	7.50%	7.00	5.00	71.43%	5.36%
Land Use & Ecology	10.00%	10.00	2.00	20.00%	2.00%
Pollution	10.00%	12.00	3.00	25.00%	2.50%
Innovation	10.00%	10.00	0.00	0.00%	0.00%
				Total	**33.75%**
				Exemplary Level credits achieved	**0.00%**
				Total Innovation credits achieved	**0.00%**
				Total BREEAM Score	**33.75%**



ARUP

Possible Final Score & Rating Achieved

BREEAM Scheme: Europe 2009: Offices	**BREEAM Registration No.:** 0002
Building Name: Horten Headquarters	**BREEAM Assessor:** ARUP Cardiff

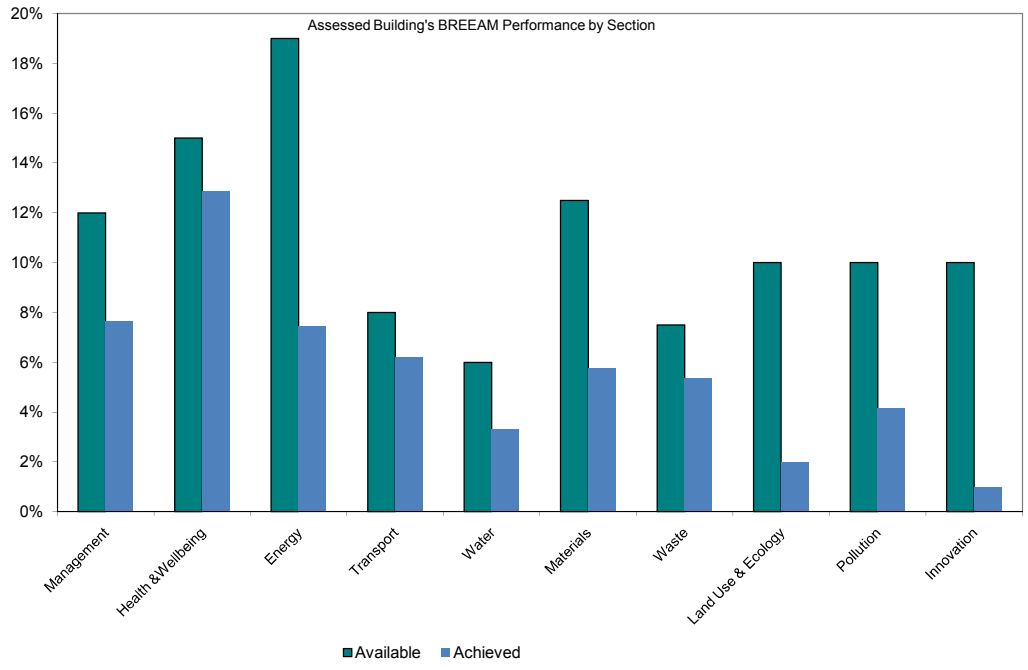
Stage of Assessment	BREEAM Score	BREEAM Rating
Final - Post Construction Stage	**55.78%**	**VERY GOOD**

Minimum BREEAM Standards

Rating Level	Pass >30%	Good >45%	Very Good >55%	Excellent >70%	Outstanding >85%
Minimum Standards Achieved	YES	YES	YES	NO	NO

Building Performance by Section

	Environmental weighting	Credits available	Credits achieved	% Achieved	Weighted Score
Management	12.00%	11.00	7.00	63.64%	7.64%
Health & Wellbeing	15.00%	14.00	12.00	85.71%	12.86%
Energy	19.00%	23.00	9.00	39.13%	7.43%
Transport	8.00%	9.00	7.00	77.78%	6.22%
Water	6.00%	9.00	5.00	55.56%	3.33%
Materials	12.50%	13.00	6.00	46.15%	5.77%
Waste	7.50%	7.00	5.00	71.43%	5.36%
Land Use & Ecology	10.00%	10.00	2.00	20.00%	2.00%
Pollution	10.00%	12.00	5.00	41.67%	4.17%
Innovation	10.00%	10.00	1.00	10.00%	1.00%
				Total	**54.78%**
				Exemplary Level credits achieved	**1.00%**
				Total Innovation credits achieved	**1.00%**
				Total BREEAM Score	**55.78%**



ARUP

BREEAM Scheme: Europe 2009: Offices
Building Name: Horten Headquarters
BREEAM Registration No.: 0002

Ref	Title	BREEAM Europe: Offices Criteria	Number of BREEAM credits available	Total BREEAM credits achieved	Possible BREEAM credits achieved	Possible BREEAM Rating					Denmark Standard Ref	Comments/Actions
						Pass	Good	Very Good	Excellent	Outstanding		
						YES	YES	YES	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Management												
Man 1	Commissioning	One credit where evidence provided demonstrates that sufficient time and resources will be allocated for commissioning prior to handover in the construction programme to ensure efficient operation of all the services within the building. Two credits where, in addition to the above, evidence provided demonstrates that commissioning will be carried out in line with best practice commissioning codes and that seasonal commissioning will be carried out during the first year of occupation, post construction (or post fit out).	2	1	1	0	0	0	1	2	Press to view	One credit can be awarded. The second credit cannot be awarded as commissioning was not in place from the initial stages.
Man 2	Constructors' Environmental & Social Code of Conduct	One credit where evidence provided demonstrates that there is a commitment to comply with best practice site management principles. Two credits where evidence provided demonstrates that there is a commitment to go beyond best practice site management principles.	2	1	2	0	0	0	0	0		One credit can be awarded as a commitment to comply with best practise was confirmed. If working beyond standard office hours, only internal low noise work done. Safety and security meetings were held weekly. Safe and adequate security=complete, consultation=developer communicated, danish standard.
Man 3	Construction Site Impacts	One credit where evidence provided demonstrates that 2 or more of items a-g (listed below) are achieved. Two credits where evidence provided demonstrates that 4 or more of items a-g (listed below) are achieved.	4	1	2	0	0	0	1	2		One credit can be awarded as at least 2 of the items have been completed. A second credit was considered achieveable if a CO2 reports not developed during project. Site timber.
Man 4	Building user guide	One credit where evidence provided demonstrates the provision of a simple guide that covers information relevant to the tenant/occupants and non-technical building manager on the operation and environmental performance of the building.	1	0	1	0	1	1	1	1		No credit could be awared as a building user guide that meets BREEAM requirements has not been produced and is not standard practise in the region. It was felt that this could be achieved if it was considered from early in the project.
Man 12	Life Cycle Cost Analysis	One credit where evidence provided demonstrates that a Life Cycle Cost (LCC) analysis based on the feasibility study proposals has been undertaken on the building design at a strategic and system level. Two credits where, in addition to the above, evidence provided demonstrates that the results of the feasibility study and consideration of LCC have been implemented.	2	0	1	0	0	0	0	0		No credit could be awared as a Life Cycle Cost Analysis that meets BREEAM requirements has not been produced and is not standard practise in the regoin. It was discussed that this credit could be achieved if taken into consideration from the initial stages of the project.
Health & Wellbeing												
Hea 1	Daylighting	One credit where evidence provided demonstrates that at least 80% of floor area in each occupied space is adequately daylit.	1	1	1	0	0	0	0	0	Press to view	One credit can be awarded. All office spaces have natural daylighting. Main aim of project. Levels calculated. Exemplery levels achieved in LEED.
Hea 2	View Out	One credit where evidence provided demonstrates that all relevant building areas have an adequate view out.	1	1	1	0	0	0	0	0		One credit can be awarded as all office areas have a view out that meets requirements. Floor plan loayout was provided.
Hea 3	Glare Control	One credit where evidence provided demonstrates that an occupant-controlled shading system (e.g. internal or external blinds) is fitted in relevant building areas.	1	1	1	0	0	0	0	0		One credit can be awarded each office and south facing area, inculding front of building have user controlled shading. North facing and atrium do not have shading.
Hea 4	High frequency lighting	One credit where evidence provided demonstrates that high frequency ballasts are installed on all fluorescent and compact fluorescent lamps.	1	1	1	1	1	1	1	1		One credit can be awarded as specifications were provided stating that all lighting is high frequency
Hea 5	Internal and external lighting levels	One credit where evidence provided demonstrates that all internal and external lighting, where relevant, is specified in accordance with the appropriate illuminance levels (in lux) in accordance with national best practice guides.	1	1	1	0	0	0	0	0	Press to view	One credit can be awarded as all DS700 requirements have been met.
Hea 6	Lighting zones & controls	One credit where evidence provided demonstrates that, in all relevant building areas, lighting is appropriately zoned and occupant controllable.	1	1	1	0	0	0	0	0		One credit can be awarded as all requirements have been met.
Hea 7	Potential for natural ventilation	One credit where evidence provided demonstrates that fresh air is capable of being delivered to the occupied spaces of the building via a natural ventilation strategy, and there is sufficient user-control of the supply of fresh air.	1	0	0	0	0	0	0	0	Press to view	No credit can be awarded as there are no openable windows throughout the building.
Hea 8	Indoor air quality	One credit where air intakes serving occupied areas avoid major sources of external pollution and recirculation of exhaust air.	1	1	1	0	0	0	0	0		One credit can be awarded as all relevant Danish standards have been met.
Hea 9	Volatile Organic Compounds	One credit where evidence provided demonstrates that the emissions of VOCs and other substances from key internal finishes and fittings comply with best practice levels.	1	0	1	0	0	0	0	0		No credit can be awarded as relevant evidence cannot be provided however it was noted that this is considered standard practise for the for region there for this credit could have been achieved.
Hea 10	Thermal comfort	One credit where evidence provided demonstrates that an analytical measurement and evaluation of the thermal comfort levels of the building has been carried out using the PMV and PPD indices in accordance with EN ISO 7730:2005. Two credits where evidence provided demonstrates that thermal comfort levels in occupied spaces of the building are assessed at the design stage to evaluate appropiate servicing options, ensuring appropiate thermal comfort levels are achieved.	2	2	2	0	0	0	0	0	Press to view	Two credits can be awarded as thermal modelling has been completed in accordance with requirements.
Hea 11	Thermal zoning	One credit where evidence provided demonstrates that local occupant control is available for temperature adjustment in each occupied space to reflect differing user demands.	1	0	0	0	0	0	0	0		No credit can be awarded as each room has controls that allow the occupant to overide the standard settings however varandah workstations rule this credit unachievable.
Hea 12	Microbial contamination	One credit where evidence provided demonstrates that the risk of waterborne and airborne legionella contamination has been minimised.	1	1	1	0	0	0	0	0	Press to view	One credit can be awarded as the Danish standards have been met. This is standard practise in the region.
Hea 13	Acoustic Performance	One credit where evidence provided demonstrates that the building achieves appropriate indoor ambient noise levels in offices areas. In addition, for fully fitted buildings only: Appropriate airborne sound insulation levels are achieved between acoustically sensitive spaces and occupied spaces, sufficient to ensure adequate privacy.	1	0	1	0	0	0	0	0		No credit can be awared as no acoustician has been assigned to the project. Through discussions we felt that if testing was carried out it would meet the requirements. Currently no testing has taken place. Local internal accoustic regs have been followed and accoustics was considered throughout design.

Ref	Title	BREEAM Europe: Offices Criteria	Number of BREEAM credits available	Total BREEAM credits achieved	Possible BREEAM credits achieved	Possible BREEAM Rating					Denmark Standard Ref	Comments/Actions
						Pass	Good	Very Good	Excellent	Outstanding		
						YES	YES	YES	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Energy												
Ene 1	**Energy Efficiency**	Up to fifteen credits where evidence provided demonstrates an improvement in the energy performance of the buildings's fabric and service based on the percentage improvement in the assessed designs' predicted Building Energy Performance Index (BEPI) over the Current Standards Building Energy Performance Index (CSBEPI), as defined for the local Energy Performance Certificate OR Up to fifteen credits where there is no operational National energy Calculation Methodology (NCM) in the country of assessment, evidence provided demonstrates an improvement in the energy performance efficiency of the building's fabric and services through the use of a recognised energy Dynamic Simulation Modelling (DSM) software OR Up to ten credits where there is no National energy Calculation Methodology in the country of assessment, evidence provided demonstrates an improvement in the energy efficiency of the building's fabric and services using Checklist A7 and that the building achieves lower operational related CO2 emissions.	**15**	**4**	**4**	0	0	0	6	10	Press to view	4 credits can be awarded as a 10% improvement has been achieved and confirmed.
Ene 2	**Sub-metering of Substantial Energy Uses**	One credit where evidence provided demonstrates the provision of direct sub-metering of energy uses within the building.	**1**	**1**	**1**	0	0	1	1	1		One credit can be awarded as the BMS system provides enough contol to meet requirements. CTS - central condition and controling
Ene 3	**Sub-metering of high energy load Areas and Tenancy**	One credit where evidence provided demonstrates sub-metering of energy consumption by tenancy/building function area is installed within the building.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded however it was considered achieveable if considered from the initial stages of the project. CTS monitors would be each area.
Ene 4	**External Lighting**	One credit where energy-efficient external lighting is specified and all light fittings are controlled for the presence of daylight.	**1**	**0**	**0**	0	0	0	0	0		No credit can be awarded as the external lighting exceeds the requirements. External lighting is in place, 2 x expanded ceilings lit up by ground lighting. Lighting specs not on hand. Light up all 5 floors so assumption made that the credit will not be achieved. Could possibly achieved however research into local products.
Ene 5	**Low zero carbon technologies**	One credit where evidence provided demonstrates that a feasibility study considering local (on-site and/or near site) low or zero carbon (LZC) technologies has been carried out and the results implemented. Two credits where evidence provided demonstrates that the first credit has been achieved and there is a 10% reduction in the building's CO2 emissions as a result of the installation of a feasible local LZC technology. Three credits where evidence provided demonstrates that the first credit has been achieved and there is a 15% reduction in the building's CO2 emissions as a result of the installation of a feasible local LZC technology. Or alternatively: A maximum of one credit where evidence provided demonstrates that a contract with an energy supplier is in place to provide sufficient electricity used within the assessed building/development to meet the above criteria from a 100% renewable energy source. (Note: a standard Green Tariff will not comply)	**3**	**0**	**1**	0	0	0	1	1		No credit can be awareded as no LZC report has been produced and the property is not supplied by a source that BREEAM reward credits. LZC report is not standard in the region. Community disctrict heating throughout area. Local municipality control this in areas like district heating that is a mix of biomas, waste heating (waste incineration ref regs).
Ene 8	**Lifts**	Up to two credits are available where evidence provided demonstrates the installation of energy-efficient lift(s).	**2**	**0**	**2**	0	0	0	0	0		No credit can be awarded . User demand research/assessment has been completed however research into energy efficiency has not been looked into. If considered from initial stages this could have been put into place. Report lift specs may cover current.
Transport												
Tra 1	**Provision of public transport**	Up to four credits can be awarded based on the proximity of the development to a public transport node with a good service frequency. Determined using the BREEAM Public Transport Table	**2**	**2**	**2**	0	0	0	0	0		Two credits can be awarded as the site has all public transport requirements covered. Bus stop 200m away that runs every 10mins.
Tra 2	**Proximity to amenities**	One credit where evidence provided demonstrates that the building is located within 500m of accessible local amenities appropriate to the building type and its users.	**1**	**1**	**1**	0	0	0	0	0		One credit can be awarded as all credit requirements have been met.
Tra 3	**Alternative modes of transport**	Two credits can be awarded where one of the following measures has been implemented to encourage the use of alternatives to the private car for commuting: Option 1 – provision of compliant cycle storage spaces according to the number of building users and of compliant facilities including showers, changing facilities and lockers for clothes and drying space for wet clothes	**2**	**1**	**2**	0	0	0	0	0	Press to view	One credit can be awarded as the property currently has occupany 200, 20 bike racks in place, 20 lockers, 5-10 showers, drying space also provided. The second credit was considerd achieveable if car sharing marketing/notice board were introduced.
Tra 4	**Pedestrian and cycle safety**	One credit where evidence provided demonstrates that the site layout has been designed in accordance with best practice to ensure safe and adequate cycle access. One credit where evidence provided demonstrates that the site layout has been designed in accordance with best	**1**	**0**	**0**	0	0	0	0	0	Press to view	No credits can be awarded due to the access/path to the bike storage area. The pathway (50m) from main road to the cycle rack is not wide enough and the entrance point to the racks is a vehicle access point.
Tra 5	**Travel plan**	One credit where evidence is provided to demonstrate that a travel plan has been developed and tailored to the specific needs of the building users.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded as no report has been produced. Corespondance took place during the disctict planning stages of the project. One credit is considered achievable as the travel plan would have been produced if considered during the intial stages of the project.
Tra 6	**Maximum car parking capacity**	Two credits where evidence provided demonstrates that the number of parking spaces provided for the building has been limited.	**2**	**1**	**1**	0	0	0	0	0		One credit can be awarded as dedicated parking spaces are in the parking area on the street out the front of the building along with parking in the basement. This parking area is part of the area parking which is over 500. Municipality and tenant parking requirements/requests. The second credit cannot be awarded as there is no limitations/control of the parking spaces.
Water												
Wat 1	**Water Consumption**	Up to three credits where evidence provided demonstrates that the specification includes taps, urinals, WCs and showers that consume less potable water in use than standard specifications for the same type of fittings.	**3**	**1**	**1**	0	0	1	1	2		One credit can be awarded. Assumptions made for shower flow rate. Rainwater harvesting discussed. Wat 1 calculator used, 5.44m3/person/year see pdf.
Wat 2	**Water meter**	One credit where evidence provided demonstrates that a water meter with a pulsed output will be installed on the mains supply to each building/unit.	**1**	**0**	**1**	0	0	0	1	1		No credit can be awarded. Water metering is not currently in place. Was discussed and felt that it could have been included if considered from the initial stages of the project.
Wat 3	**Major leak detection**	One credit where evidence provided demonstrates that a leak detection system is specified or installed on the building's water supply.	**1**	**0**	**1**	0	0	0	0	0		No credit can be awarded. As with Wat 2 no major leak detection system in place, could have been included if considered from the initial stages of the project.

Ref	Title	BREEAM Europe: Offices Criteria	Number of BREEAM credits available	Total BREEAM credits achieved	Possible BREEAM credits achieved	Possible BREEAM Rating					Denmark Standard Ref	Comments/Actions
						Pass	Good	Very Good	Excellent	Outstanding		
						YES	YES	YES	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Wat 4	Sanitary supply shut off	One credit where evidence provided demonstrates that proximity detection shut-off is provided to the water supply to all toilet areas.	1	0	1	0	0	0	0	0		No credit can be awarded. As with Wat 2 no major leak detection system in place, could have been included if considered from the initial stages of the project.
Wat 6	Irrigation systems	One credit where evidence provided demonstrates that a low-water irrigation strategy/system has been installed, or where planting and landscaping is irrigated via rainwater or reclaimed water.	1	1	1	0	0	0	0	0		One credit can be awarded. No irrigation system in place and all plants are manually watered.
Wat 8	Sustainable on-site water treatment	One credit where evidence provided demonstrates that a feasibility study considering sustainable on-site water treatment systems has been carried out and the results implemented. Two credits whre evidence provided demonstrates that the first credit has been achieved and 30% of the building/development's wastewater is treated to tertiary standards	2	0	0	0	0	0	0	0		No credit can be awarded. Not very relivent to Danish systems.
Materials												
Mat 1	Materials Specification (major building elements)	Up to four credits are available where nationally recognised LCA tool or the Green Guide to Specification has been used to evaluate a range of material options for the major building elements	4	0	2	0	0	0	0	0	Press to view	See figures for calcs/assumptions. External walls, Windows, roof, upper floors. - TO BE CALCULATED --------- No credits can be awarded as no calculations have be done. Calculator to be passed on. Assumptions to be made on spreadsheet that we can create and calculate. - Windows=aluminium frame, Wall 1(80%)=concrete, insulation, concrete, wall 2 (20%)= , Roof= concrete, insulation, asphalt, Upper floors = concrete, prefab-hollow core, 70%30%mix(confirm with Elaine on this material).
Mat 2	Hard landscaping and boundary protection	One credit where evidence provided demonstrates that a nationally recognised LCA tool or the Green Guide to Specification has been used to evaluate a range of material options for the external hard landscaping and boundary protection specifications	1	0	1	0	0	0	0	0		No credit can be awarded as material specs could not be provided to confirm %'s. One credit can be assumed as achievable as the outside pavement, ashfelt, travatine-70% were said to high % and if considered from the initial project stages would be confirmed.
Mat 3	Re-use of building façade	One credit is awarded where evidence provided demonstrates that at least 50% of the total façade (by area) is reused and at least 80% of the reused façade (by mass) comprises in-situ reused material.	1	0	0	0	0	0	0	0		N/A
Mat 4	Re-use of building structure	One credit is awarded where evidence provided demonstrates that a design reuses at least 80% of an existing primary structure and for part refurbishment and part new build, the volume of the reused structure comprises at least 50% of the final structure's volume.	1	0	0	0	0	0	0	0		N/A
Mat 5	Responsible sourcing of materials	Up to 3 credits are available where evidence provided demonstrates that 80% of the assessed materials in the following building elements are responsibly sourced:	3	0	1	0	0	0	0	0		No credit can be assigned as it is not standard in the region. One credit was considered achievable if considered from the outset of the project.
Mat 6	Insulation	One credit where evidence provided demonstrates that thermal insulation products used in the building have a low embodied impact relative to their thermal properties, determined by the Green Guide to Specification ratings.	2	0	1	0	0	0	0	0		Rockwool used throughout, apart from facade. Assumption made that this credit could be achieved if attempted from early stage.
Mat 7	Designing For Robustness	One credit where protection is given to vulnerable parts of the building such as areas exposed to high pedestrian traffic, vehicular and trolley movements.	1	0	1	0	0	0	0	0		No credit can be awarded. Kickplates and protection not generally used in the area. Kitchens to have the required kickplates etc. Main corridores and doors do not have kickplates. One credit could be achieved it considered early in the project and added.
Waste												
Wst 1	Construction Site Waste Management	One credit where evidence provided demonstrates that a site waste management plan has been developed and implemented. Two credits where evidence provided demonstrates that the first credit has been achieved and waste reduction is a key priority of the site waste management plan. Three credits where evidence provided demonstrates that a significant majority of non-hazardous construction waste generated by the development will be diverted from landfill and reused or recycled.	3	3	3	0	0	0	0	0		Three credits can be awarded. Local regulations have high recycling standards and current onsite construction waste management. Already standard practice however may not have been documented to meet BREEAM regs. Some waste goes to incineration, sorting externally. Normal procedure. To provide documentation may require additional work but wont change standard practice.
Wst 2	Recycled aggregates	One credit where evidence provided demonstrates the significant use of recycled or secondary aggregates in 'high-grade' building aggregate uses.	1	0	0	0	0	0	0	0		No credit can be awared as this is not specified due to general standard and practice in the region. May not be able to specify in the detail required. There will be no change to current practice. Hard to give %.
Wst 3	Recyclable waste storage	One credit where a central, dedicated space is provided for the storage of the building's recyclable waste streams.	1	1	1	0	0	0	1	1		One credit can be awareded as 50m^2 storage in basement. Easy access. Near car parking, showers and changing facilities, server room.
Wst 5	Composting	One credit where evidence provided demonstrates there is a vessel on site for composting food waste, and adequate storage for such waste generated by the building's users and operation. OR	1	0	0	0	0	0	0	0		No credit can be awarded as there is no composting waste system. Unknown, not built into the design. Kitchen may seperate waste. Local research has been done and has found that it is more efficient to use it as a fuel for community heating systems.
Wst 6	Floor Finishes	One credit where carpets and other floor finishes are specified by the future occupant or, in tenanted areas of speculative buildings, where carpets or floor finishes are installed in a limited show area only.	1	1	1	0	0	0	0	0		One credit can be awarded as the tenant was known prior to completion. Floor finishes added.
Land Use & Ecology												
LE1	Re-use of land	One credit where evidence provided demonstrates that the majority of the footprint of the proposed development falls within the boundary of previously developed land.	1	1	1	0	0	0	0	0		One credit can be awarded as a building on site was knocked down several years prior to new construction start date.
LE2	Contaminated land	One credit is awarded where evidence provided demonstrates that the land used for the new development has, prior to development, been defined as contaminated and where adequate remedial steps have been taken to decontaminate the site prior to construction.	1	0	0	0	0	0	0	0	Press to view	No credit can be awarded as the land was not considered contaminated through assessments.
LE3	Ecological value of site AND Protection of ecological features	One credit is awarded where evidence provided demonstrates that the construction zone is defined as land of low ecological value and all existing features of ecological value will be fully protected from damage during site preparation and construction works.	1	1	1	0	0	0	0	0		One credit can be awarded as the site is an old industrial site. Assuming checklist A4 is completed to meet requirements - The region has this completed by the municipality with the regional investigation for development
LE4	Impact on Site Ecology	One credit where the design team (or client) has appointed a suitably qualified ecologist to advise and report on enhancing and protecting the ecological value of the site; and implemented the professional's recommendations for general enhancement and protection of site ecology.	5	0	0	0	0	0	2	2		No credit can be awarded as no ecology report was created and linked in with district planning. Not normal practice in the region.
LE6	Long term impact on biodiversity	One credit where the client has committed to achieving the mandatory requirements listed in the manual and at least two of the additional requirements.	2	0	0	0	0	0	0	0		No credit can be awarded as no ecologist has been involved.
Pollution												

Ref	Title	BREEAM Europe: Offices Criteria	Number of BREEAM credits available	Total BREEAM credits achieved	Possible BREEAM credits achieved	Possible BREEAM Rating					Denmark Standard Ref	Comments/Actions
						Pass	Good	Very Good	Excellent	Outstanding		
						YES	YES	YES	NO	NO		
						Minimum required credits by BREEAM issue and rating						
Pol 1	Refrigerant GWP - Building services	One credit where evidence provided demonstrates the use of refrigerants with a global warming potential (GWP) of less than 5 or where there are no refrigerants specified for use in building services.	1	1	1	0	0	0	0	0		One credit can be awarded. Evidence is to be provided but was confirmed that the GWP=met requirements, ODP=0. Was noted that it is not general common practise.
Pol 2	Preventing refrigerant leaks	One credit where evidence provided demonstrates that refrigerant leaks can be detected or where there are no refrigerants specified for the development. One credit where evidence provided demonstrates that the provision of automatic refrigerant pump down is made to a	2	1	2	0	0	0	0	0		One credit can be awarded as an alarm system already in place. If shutdown system in place second credit could be awarded. Assumed that shutdown is not in place.
Pol 4	NOx emissions from heating source	One credit where evidence provided demonstrates that the maximum dry NOx emissions from delivered space heating energy are ≤100 mg/kWh (at 0% excess O2). Twp credits where evidence provided demonstrates that the maximum dry NOx emissions from delivered space heating energy are ≤70 mg/kWh (at 0% excess O2). Three credits where evidence provided demonstrates that the maximum dry NOx emissions from delivered space heating energy are ≤40 mg/kWh (at 0% excess O2).	3	0	0	0	0	0	0	0		Information may be able to be supplied by local authority - No possible credit awarded, district heating information to be looked into.
Pol 5	Flood risk	Two credits where evidence provided demonstrates that the assessed development is located in a zone defined as having a low annual probability of flooding.	3	0	0	0	0	0	0	0	Press to view	From email regarding discussions with geological team, this credit was confirmed as not achievable.
Pol 6	Minimising watercourse pollution	One credit where evidence provided demonstrates that effective on site treatment such as Sustainable Drainage Systems (SUDs) or oil separators have been specified in areas that are or could be a source of watercourse pollution.	1	1	1	0	0	0	0	0		One credit can be awarded. Standard practise.
Pol 7	Reduction of Night Time Light Pollution	Where evidence provided demonstrates that the external lighting design is in compliance with best practice guidance from the Commission Internationale D'éclairage (CIE).	1	0	0	0	0	0	0	0		No credit can be awarded as the current external lighting (uplighting) does not meet requirements. Tenants want lighting on every night. No credits are possible.
Pol 8	Noise Attenuation	One credit where evidence provided demonstrates that new sources of noise from the development do not give rise to the likelihood of complaints from existing noise-sensitive premises and amenity or wildlife areas that are within the locality of the site.	1	0	1	0	0	0	0	0		No credit can be awarded. Do not believe that the building would exceed the requirements however required testing has not been completed. Could be achieved.
Innovation												
Man 3	Construction Site Impacts	Evidence provided demonstrates that all of the items a-g listed previously are achieved and at least 80% of site timber is responsibly sourced and 100% is legally sourced.	1	0	0	0	0	0	0	0		Considered not achievable
Hea 1	Daylighting	One additional innovation credit where evidence provided demonstrates that at least 80% of the office floor area has achieved increased daylight levels. In addition, in retail developments, at least 50% by floor area of the common spaces and 35% by floor	1	0	0	0	0	0	0	0		Considered not achievable
Hea 9	Volatile Organic Compounds	One additional innovation credit where evidence provided demonstrates that all internal finishes and fittings specified in the building have been tested against and meet the relevant standards for Volatile Organic Compound (VOC) emissions.	1	0	0	0	0	0	0	0		Considered not achievable
Hea 14	Office Space (BREEAM Retail & Industrial Schemes only)	An exemplary credit can be awarded where all the measures detailed above have been achieved for at least 80% of the development's office space floor area.	0			0	0	0	0	0		
Ene 1	Energy efficiency	One additional innovation credit where an energy modelling carried out using a Dynamic Simulation Modelling software demonstrates the building is designed to be a carbon neutral building (i.e. in terms of building services energy demand).	2	0	0	0	0	0	0	0		Considered not achievable
Ene 5	Low or Zero Carbon Technologies	One additional innovation credit where evidence provided demonstrates that a local LZC energy technology has been installed in line with the recommendations of the above feasibility study and this method of supply results in a 20% reduction in the buildin	1	0	0	0	0	0	0	0		Considered not achievable
Tra 3	Alternative modes of transport	One additional innovation credit where evidence provided demonstrates that two of the options above have been implemented.	1	0	0	0	0	0	0	0		Considered not achievable
Wat 2	Water Meter	One additional innovation credit where evidence provided demonstrates that sub meters with a pulsed output are fitted to allow the metering of individual water-consuming plant or building areas	1	0	1	0	0	0	0	0		One credit was considered achievable if aimed from the initial stages of the project.
Mat 1	Materials Specification	One additional innovation credit where evidence provided demonstrates that a nationally recognised LCA tool or the Green Guide to Specification has been used to evaluate a range of material options for all the building elements.	1	0	0	0	0	0	0	0		Considered not achievable
Mat 5	Responsible Sourcing of Materials	Where, in addition to the standard BREEAM requirements, 95% of the applicable materials, comprised within the applicable building elements, have been responsibly sourced.	1	0	0	0	0	0	0	0		Considered not achievable
Wst 1	Construction Site Waste Management	Europe 2008: Industrial	1	0	0	0	0	0	0	0		Considered not achievable
Pol 4	NOx emissions of heating source	One additional innovation credit where evidence provided demonstrates that the plant installed to meet the building's space heating demand has zero dry NOx emission levels at 0% excess O2.	1	0	0	0	0	0	0	0		Considered not achievable

Faneblad 4

BREEAM: Kriterieoversigt

Kategori/kriterie		Point	Vægtning
Management		11	12 %
Man 1	Commissioning	2	
Man 2	Considerate Constructors	2	
Man 3	Construction Site Impacts	4	
Man 4	Building user guide	1	
Man 12	Life Cycle Costing	2	
Health & Wellbeing		14	15 %
Hea 1	Daylighting	2	
Hea 2	View Out	1	
Hea 3	Glare Control	1	
Hea 4	High frequency lighting	1	
Hea 5	Internal and external lighting levels	1	
Hea 6	Lighting zones & controls	1	
Hea 7	Potential for natural ventilation	1	
Hea 8	Indoor air quality	1	
Hea 9	Volatile Organic Compounds	1	
Hea 10	Thermal comfort	1	
Hea 11	Thermal zoning	1	
Hea 12	Microbial contamination	1	
Hea 13	Acoustic Performance	1	
Energy		24	19 %
Ene 1	Reduction of CO2 Emissions	15	
Ene 2	Sub-metering of Substantial Energy Uses	1	
Ene 3	Sub-metering of high energy load Areas and Tenancy	1	
Ene 4	External Lighting	1	
Ene 5	Low zero carbon technologies	3	
Ene 6	Building fabric performance & avoidance of air infiltration	1	
Ene 8	Lifts	2	
Transport		14	8 %
Tra 1	Provision of public transport	4	
Tra 2	Proximity to amenities	1	
Tra 3	Alternative modes of transport	2	
Tra 4	Pedestrian and cycle safety	2	
Tra 5	Travel plan	1	
Tra 6	Maximum car parking capacity	2	
Tra 7	Travel information point	1	
Tra 8	Deliveries & manoeuvring	1	
Water		11	6 %
Wat 1	Water Consumption	3	
Wat 2	Water meter	1	
Wat 3	Major leak detection	1	

Kategori/kriterie		Point	Vægtning
Wat 4	Sanitary supply shut off	1	
Wat5	Water recycling	2	
Wat 6	Irrigation systems	1	
Wat 8	Sustainable on-site water treatment	2	
Materials		13	12,5 %
Mat 1	Materials Specification (major building elements)	4	
Mat 2	Hard landscaping and boundary protection	1	
Mat 3	Re-use of building façade	1	
Mat 4	Re-use of building structure	1	
Mat 5	Responsible sourcing of materials	3	
Mat 6	Insulation	2	
Mat 7	Designing For Robustness	1	
Waste		7	7,5 %
Wst 1	Construction Site Waste Management	3	
Wst 2	Recycled aggregates	1	
Wst 3	Recyclable waste storage	1	
Wst 5	Composting	1	
Wst 6	Floor Finishes	1	
Land Use & Ecology		10	10 %
LE1	Re-use of land	1	
LE2	Contaminated land	1	
LE3	Ecological value of site AND Protection of ecological features	1	
LE4	Mitigating ecological impact	5	
LE6	Long term impact on biodiversity	2	
Pollution		13	10 %
Pol 1	Refrigerant GWP - Building services	1	
Pol 2	Preventing refrigerant leaks	2	
Pol 3	Refrigerant GWP - Cold storage	1	
Pol 4	NOx emissions from heating source	3	
Pol 5	Flood risk	3	
Pol 6	Minimising watercourse pollution	1	
Pol 7	Reduction of Night Time Light Pollution	1	
Pol 8	Noise Attenuation	1	
Innovation		10	10 %
Man 3	Construction Site Impacts		
Hea 1	Daylighting		
Hea 9	Volatile Organic Compounds		
Ene 1	Reduction of CO2 Emissions		
Ene 5	Low zero carbon technologies		
Tra 3	Alternative modes of transport		
Wat 2	Water meter		
Mat 1	Materials Specification (major building elements)		
Mat 5	Responsible sourcing of materials		
Wst 1	Construction Site Waste Management		
Pol 4	NOx emissions from heating source		
Total		127	

Faneblad 5

Final Report

Sustainable Building Certification in Denmark – Evaluation of the German DGNB System

For
The Benchmark Centre for the Danish Construction Sector
and
Danish Building Research Institute

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Title of the Study: Sustainable Building Certification in Denmark – Evaluation of the German DGNB System

Client: The Benchmark Centre for the Danish Construction Sector and Danish Building Research Institute

April 2010

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1 Introduction

Sustainability has become an emerging topic for the building and construction industry and for the real estate sector worldwide. During the last decade, several green or sustainable rating tools for buildings have been developed by different organizations. Amongst the newest systems, the “German Sustainable Building Certificate” plays an increasing role for awarding frontrunners and marking excellent building performance. The German system has been jointly developed by the German Ministry of Building and Transport and the German Sustainable Building Council / Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB). The first certificates for office buildings were handed out in January 2009.

The German system is based on the high expertise and long experience of the building sector to provide sustainable solutions to the real estate sector. The principles of the systems are:

- Equal rating of environmental, economic and socio-cultural aspects and consideration of technical performance and planning quality
- Performance based evaluation of sustainability criteria
- Life cycle approach for environmental and economic criteria

The DGNB system consists of six qualities, five of them contribute to the final grade:

1. Ecological Quality: The ecological quality covers the impacts on the global and local environment and the utilization of resources and waste arising. The life cycle assessment of the building has the greatest impact within this category.
2. Economical Quality: The economical quality is evaluated by the life cycle costs contain ing benchmarks for construction and operation costs.
3. Socio-cultural and Functional Quality: Criterion on health, user comfort and satisfaction, functionality and design are considered.
4. Technical Quality: The implementation of technical measurements such as fire and noise protection and ease of deconstruction, recycling and maintenance of the building are evaluated.
5. Process Quality: Performance of the planning process and the quality of the construction activities are evaluated.

The quality of the location is evaluated independently of the above five quality criteria and results in a separate grade.

Currently 49 performance based criterion are distributed amongst the qualities. All criteria are considered in this evaluation. While most criteria are applied completely in this project, some are considered only with a screening method. This is due to complexity or the close reference to German building standards of few criteria. A description of the criteria can be found in the annex.

In this study two office buildings are evaluated using the DGNB system for new office buildings. This system is developed for the certification of sustainable buildings which have been constructed not longer than five years ago.

2 Company House

The Company House is situated at the Future Business Park in Vallensbæk south of Copenhagen. On a gross floor space of 7037 m² small businesses can enjoy the benefits of larger companies such as meeting rooms, auditorium, cafeteria and training facilities.

The building is arranged in the shape of an „H“ and consists of four floors. While the rooms of the wings are designed as offices, the connection bridge contains shared facilities and a hallway. Modern ribbon windows in the aluminum façade and a high insulation standard lead to a low heating demand.

According to the DGNB rating scheme for office buildings 2009 the Company House receives a certificate in **silver** which can be obtained from Figure 1. The overall performance is **69 %** for the building and 64 % for the quality of the location.

The highest contribution to the building's scoring is its low life cycle costing, where the Company House has a performance of 88 %. Additionally the good results of the life cycle assessment of the building compared to the reference house also account for a good ecological performance. Comparable low values in the socio-cultural and the process quality are due to the fact that some topics were not considered by the design team.

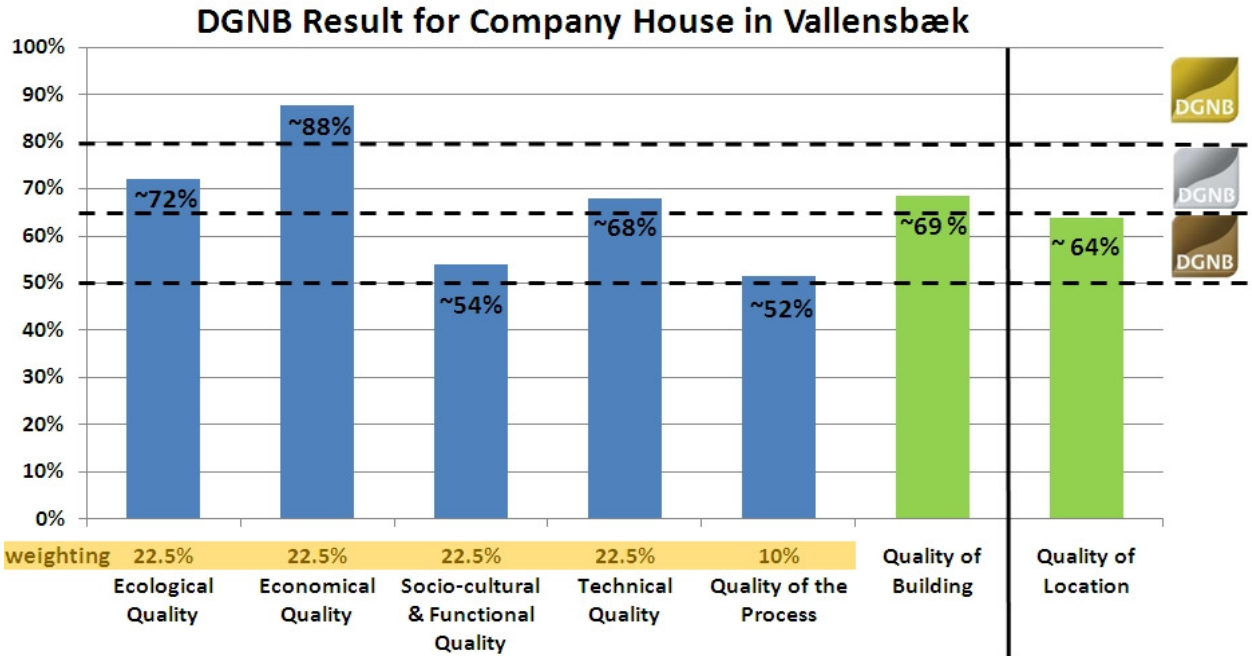


Figure 1: DGNB Scoring for Company House

If all topics had been known from the beginning and additional costs for simulations and tests after completion had also been considered, the potential would be a certificate in **gold**. Potentials that would have lead to a old Certification are personalized adjusting options for the HVAC systems,a higher consideration of sustainability experience during the selection of the design team in the bid invitation and awarding process, art within architecture and more sustainable material selection. In addition, simulations of indoor air quality and noise would have lead to higher building performance. The relative potentials can be obtained from the tables 1-3 in the annex.

2.1 Ecological Quality

The ecological quality has a target achievement of 72 % with these strength and weaknesses:

+ The results of the life cycle assessment account for a high performance since the Company House has ~30 % less energy demand compared to the reference building.

o The water consumption is average for office buildings. Though no water reutilization concept is recognised as being installed in the building, infiltration of rainwater and water saving installations are considered.

- Grassland was turned into construction area and for this transformation no compensation in form of planted trees in the converted area took place. Furthermore, the construction timber is lacking any certification such as PEFC or FSC.

2.2 Economical Quality

The result on the economical performance is 88 %, which is a good scoring resulting from high value stability because of flexible room conception and good life cycle costing through low construction and operation costs. The low energy demand of the building has a positive influence on the evaluation of the life cycle costing. No weaknesses are identified on the application of these criteria to the Company House.

2.3 Socio-cultural and Functional Quality

In this category the result of 54 % is at average levels. The following distinguishes the strengths from the weaknesses:

+ The design of the building considers good thermal comfort during summer and winter time. Excessively hot inside temperatures in summer time and cold inside temperatures in winter time are minimized. Area efficiency is high, representing the relation between usable and gross floor space. Ribbon windows and optimized artificial lighting result in a good visual comfort and the comfort of bicycle users is high because of compliance to legal regulations in this regard.

- Influence on HVAC-system is designed on a room level, but not on workplace level. Acoustical comfort and indoor air quality measurements are neglected. Architectural competition and art within architecture as part of the bidding process has not taken place. Subjective safety and outside air quality also results in low performances.

2.4 Technical Quality

The technical quality has a high performance with 68 % and only a few weaknesses in the cleaning and deconstruction topics:

+ Fire and noise protection exceed legal requirements.

- Low values in the ‘Ease of cleaning and maintenance of the structure’ because cleaning of outside window needs to be done by a lift and no inside dust reduction appliances are installed. Also no recycling concept was generated within the planning stage.

2.5 Quality of Process

The quality of the planning process results in a relatively low performance of 52 %.

+ In the planning stage, Establishment of preconditions for optimized use and operation was considered in form of a hand book and object documentation was considered as well. Systematic commissioning was also applied.
- Only few sustainability considerations during bid awarding and tendering were made and there was no consideration of noise, dust, soil protection on construction site. During the planning, no recycling and water concept was developed and not architectural competition took place.

2.6 Quality of Location

The separate evaluation of the location results with 64 %, obtaining a very good bronze level. Mainly, the presence of the E20 highway in close vicinity to the location leads to deduction of points:

+ There is good media, energy and telecommunication infrastructure within the area.
- Conditions at the micro location are low because the outside air and noise is negatively affected by the highway nearby.

3 Horten Building

The office building with around 10.000 m² space is located at Tuborg Havn in the north of Copenhagen in the suburb Hellerup.

The building closes towards the south and opens up towards the north. The three-dimensional façade in fiberglass and travertine works as a screen against the sun and reduces solar irradiation while still providing a view of the water and allowing for high daylight availability. The facade is a sandwich construction with a centre of high-insulating foam covered by two layers of fiberglass material.

On the inside, single offices for lawyers are arranged on the eastern and western side of the five stories aboveground. The interior of the building is designed with an open structure encouraging informal meetings. A cafeteria is on the first floor and below ground there is a three storey park garage. Since the building is designed for law firms, high acoustical comfort is taken into consideration.

Following the DGNB rating scheme for office buildings 2009, the Horten building receives a certification in **bronze** as stated in Figure 2 below. The building achieves an overall performance of **62%** for the building itself, and 77% for the quality of the location which equals to a silver certification.

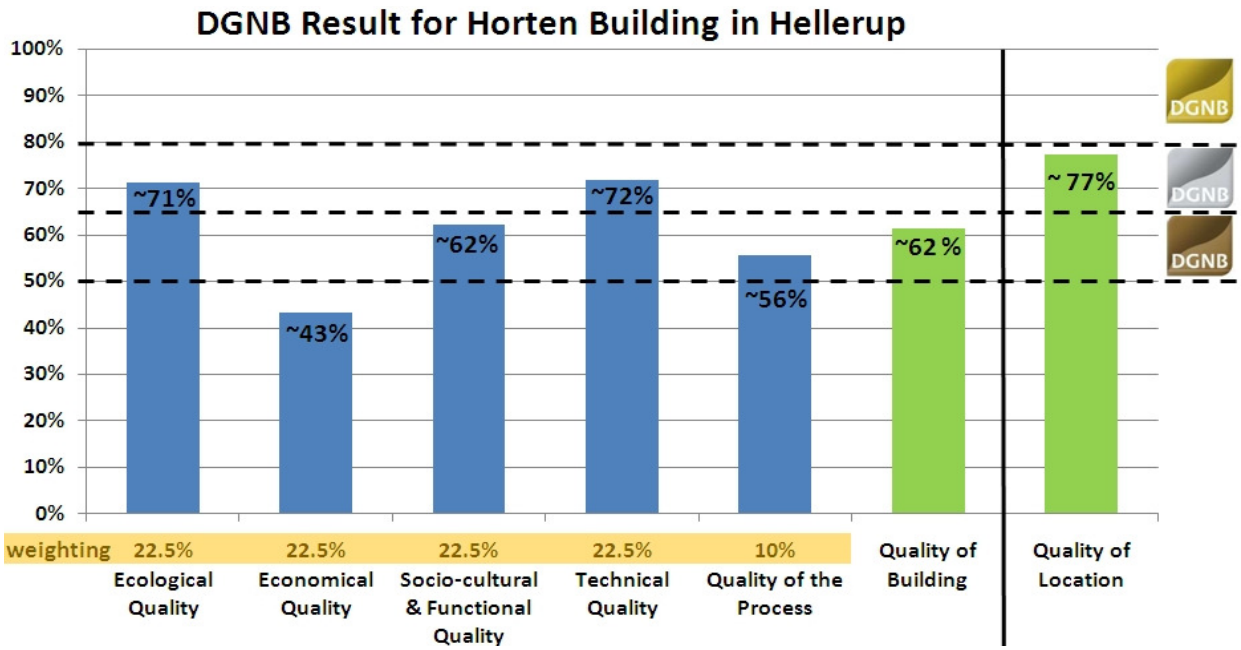


Figure 2: DGNB Scoring for Horten Building

The Horten building shows specific strengths in the topics of ecological quality and technical quality with more than 70% for both criteria groups. The good results of the life cycle assessment ensure the high ecological quality and the attention especially to the noise and fire protection counts for the sound technical quality. Only a low value is observed in the topic economical quality which is due to the high construction costs. The socio-technical criteria show a result of 62 %. While the building is perfectly designed for the employment of lawyers, the adaptation to other usage is very limited.

As was the case for the building in Vallensbæk, if all the criteria for DGBN Certificationhad been known to the planning and constructing companies of the Horten building from the beginning and

additional tests after completion were done, the final certification grade achieved by the building would have been higher.

Main areas for improved performance under the DGBN would include a higher consideration of sustainability aspects mainly concerning cost efficiency. Other sustainability issues which would present significant positive impacts on the result are the consideration of public accessibility of the building, the ease of deconstruction including a recycling concept, and many more. From the tables 1-3 in the annex the relative potential can be obtained.

3.1 Ecological Quality

The ecological quality has an overall result of 71 % with the following strengths and weaknesses:

+ The large amount of timber used especially for the flooring of the building is all certified and therefore positively rewarded. The construction site was an industrial area before and therefore the area is effectively “recycled”.

o The water consumption is at average for office buildings. Water saving installations were chosen but no water reutilization concept or infiltration of rainwater was incorporated into the design of the building. Due to lower average energy demand compared to the reference building the Horten building performs slightly above average in the life cycle assessment criteria (LCA).

- The information about materials used that can cause environmental risks is quite limited and therefore only a low score could be granted for the criterion “risk to the regional environment”.

3.2 Economical Quality

The result on the economical performance is very low with 43 %. The construction of this office building was expensive and although multiple usage of the spaces within the building is possible, this was not specifically planned and therefore the scoring is low.

3.3 Socio-cultural and Functional Quality

In this topic the result of 62% is a little above the average.

+ The appealing exterior design of the building fits in well with the novelty of the surrounding buildings. The high amount of natural light and the good acoustic comfort are considered above average for this building. The thermal comfort during summer and winter time is good as well. Influence on HVAC-system is designed on a room level due to the small office sizes, therefore making it a good workplace.

- The area efficiency is relatively low because of the wide open areas in the middle of the building which are in principle not part of the usable space. Indoor air quality measurements and subjective safety are not specifically followed and there is no access to the building for the public which gives rise to a low score. The low score in the quality of design and art within architecture are due to not having an architectural competition as part of the biding procedure. This is slightly contradictory to the outstanding exterior design of the building but it is difficult to measure these criteria in any different way.

3.4 Technical Quality

The technical quality has a high performance with 72%: Strenghts and weaknesess are identified in the text which follows;

+ Noise protection in particular is above average creating a good working environment. Fire protection exceeds legal requirements and the quality of the buldingshell is good as well.

- The low score in the ‘Ease of deconstruction, recycling and dismantling’ is because no recycling concept was generated within the planning stage and it is difficult to dismantle certain building elements that consist of various layers.

3.5 Quality of Process

The quality of the planning process gives in a performance of 56%, having a performance similar to the Company House. This is largely due to a lack of partly German specific data such as proof of qualification of companies as well as architectural competition but also evidence of sustainability considerations during bid invitation. Strenghts and weaknesses under this quality include:

+ The tenant was part of the planning process. Outside noise measurements were made during the construction process to ensure minimum harm to the surroundings. All plans were updated “as built” and a systematic commissioning was applied. Establishment of preconditions for optimized operation was considered in the form of an extensive hand book.

- No water-use savingconcept was developed during the planning and no specific dust or soil protection measures were undertaken during the construction process. During bid awarding and tendering no special considerations regarding sustainability issues were stated.

3.6 Quality of Location

The quality of location is separately evaluated and results with 77% at a good silver level. The well maintained neighbourhood and the location close to the sea buttresses the high score:

+ Within the area there is a good chance for synergy effects with potential clients. There is a media, energy and telecommunication infrastructure and a high density of shops providing goods for everyday needs. The economic stability of the area is one of the highest in Denmark and open space in the back of the building is an additional contributor to the positive aspects.

- Conditions at the micro location are rather low because the outside air quality and the noise level is negatively affected by the location within the city even thought the proximity to the sea offsets this to a minor extent.

4 Overall Conclusions

Both buildings could receive a certification by the DGNB even though the criteria have not been known before the buildings were constructed. This shows that the applicability of the German system is possible and that the design teams of both office buildings did indeed consider many aspects of sustainable construction.

4.1 Assessment of Rating Results and Potential

The ecological quality is fulfilled to a high degree for both buildings. While the Company House receives 72 %, the Horten building gets 71 %. Both buildings have a high ranking degree of fulfillment in the seven life cycle assessment criteria, whereas the results of the water consumption, surface area usage, the risks to the regional and other impacts on the global environment receive moderate rankings from the evaluation.

The economical performance differs greatly with 88 % for the Company House and 43 % for the Horten building. The reason lies in the different construction costs of both buildings.

The socio-cultural and functional quality of both buildings is 54 % for Company House and 62 % for the Horten building, making them comparable. While both constructions have high results in the thermal evaluation, barrier-free accessability and bicycle-user comfort, the following criterion receive low values: indoor hygiene, safety and risks of failure, assurance of the quality of the design and in art within construction.

In the technical sector the Company House has a fulfillment of 68 % whereas Horten achieves 72 %. High values for fire and noise protection counteract the weaknesses in the 'ease of cleaning and maintenance of the structure' as well as 'ease of deconstruction, recycling and dismantling' criteria.

The results for the planning quality are similar with 52 % and 56 % and show the highest potential for improvement because many topics here have not been considered by the design teams. Both buildings receive high results in the criteria 'establishment of preconditions for optimized use and operation' and 'systematic commissioning'. A low degree of fulfilment was obtained from the 'quality of the projects preparation', 'evidence of the sustainability considerations during bid invitation and awarding' and from 'construction on site'.

For the quality of location the Company House receives 64 % and the Horton building 77 %. Both locations have strong values in the 'vicinity to usage-specified facilities' and in 'adjoining media, infrastructure development'. Low results for Company House are achieved in the criterion 'circumstances at the micro-location'.

If the DGNB certification criteria had been known from the beginning of the planning process, several easily obtainable points in different qualities could have been realized. For example, the design team could have defined a recycling and water concept or integrated sustainable aspects during the selection of companies and products. Through the integration of these topics both buildings would receive at least a 5 % better overall performance.

The overall potential of the Company House is a target achievement of over 80% or a certification in **gold**. However, this requires additional costs and documentation effort. For example measurements and simulations have not been conducted (e.g. VOC and acoustical measurements). Similarly higher technical requirements lead to higher costs (e.g. the consideration of personalized user influence on HVAC in the Company House).

The Horten building could only ever receive a certificate in **bronze** because the construction costs are very high and therefore the result of the economical quality low. To receive an overall certificate in silver, each of the five qualities has to have at least the bronze level. To receive a gold certificate, each quality has to have at least the silver level. Since the results of the economical quality are below 50 %, only the bronze certificate can be reached unless cost reductions would have been considered.

4.2 Adaptation of DGNB System to Danish Standards and Effort

In general the difference of the building standard in Germany and Denmark is not very high. This can be confirmed from the results of both evaluated buildings. Many of the considered norms are based on European regulations and thus the effort for adaptation is low. In the tables 1-3 in the annex the estimated effort for adaptation can be found.

The design teams of both buildings did not consider the DGNB evaluation in the planning and construction phase. Therefore the lack of awareness of the DGNB requirements is the first reason for point deductions. Additionally methodological, geographical, and cultural differences between Germany and Denmark caused a lower overall result.

Differences in standardization were identified. The German norm for energy calculations for example is very complex and includes many different values which were hard to compare with the Danish energy standard. Within the noise protection there is no regulation on subsonic noise whereas there are regulations for that in Germany. Water reutilization methods might also not be as common as in Germany as the evaluated buildings do not consider any such appliances. These different states of standardization made it hard to compare some of the criteria.

In the quality of location criterion, the risk of winter storms is high in the whole of Denmark which leads to lower results in the ‘risks of the micro-location’. Therefore adaption of this criterion would have needed to take place. On the other hand, risks like avalanches simply are non-existing in Denmark therefore it could be omitted from the criteria.

Besides the adaptations on criterion level and target values according to Danish standards, the most important adaptation would be the adjustment of weighting factors to political and cultural values. The relevance of the different criteria groups as well as the specific weighting factors of each criterion within its group need to be discussed and decided upon on a consensus level.

5 Annex

5.1 Results for each Criterion

The following tables show the results of the two evaluated buildings per criterion. The criteria are listed up to the number 61. Certain numbers are only “placeholders” so far for criteria that have been defined but a way has not yet been found for how to quantitatively measure them.

For each criterion the depth of evaluation applied in this study is mentioned as the weighting factor of the criterion. The effort of adaptation is structured into criterion that can be considered without adaptation (none) to the stages low, medium and high effort of adaptation. The efforts of the design team and the auditor reflect the manpower needed to fulfill each criterion. Currently the total effort for the design team is not representative because the effort for documentation is not considered.

Table 1: Information and Results of the Evaluation for Criteria 1-17

									Results Vallensbæk			Results Horten		
		No.	Criterion	Depth of Evaluation	Weighting 1-3	Effort for Adaptation	Effort Des. Team	Effort Auditor	Points	Potential	Comment on Potential	Points	Potential	Comment on Potential
Ecological Quality	Impacts on global and local environment	1	Global warming potential	screening	3	med	1/2 d	10-13 d	8,7	10,0		5,0	10,0	
		2	Ozone depletion potential	screening	1	med			10,0	10,0		6,3	10,0	
		3	Photochemical ozone creation potential	screening	1	med			10,0	10,0		10,0	10,0	
		4	Acidification potential	screening	1	med			10,0	10,0		10,0	10,0	
		5	Eutrophication potential	screening	1	med			9,7	10,0		7,9	10,0	
		6	Risks to the regional environment	screening	3	high	<1 h	3 d	5,0	10,0	Datasheets missing	5,0	10,0	Datasheets missing
	Utilization of resources and waste arising	8	Other impacts on the global environment	complete	1	low	<1h	<1h	1,0	10,0	No certified timber used	10,0	10,0	
		10	Non-renewable primary energy demands	screening	3	med	part of #1-5	part of #1-5	9,1	10,0		7,9	10,0	
		11	Total primary energy demands and proportion of renewable primary energy	screening	2	med			9,6	10,0		9,7	10,0	
		14	Potable water consumption and sewage generation	complete	2	med	<1 h	1/2 - 1 d	5,6	10,0	No concept of water reutilization	5,2	10,0	No concept of water reutilization
		15	Surface area usage	complete	2	none	<1h	< 1/2 day	2,5	5,0	No compensation actions	7,5	10,0	
Economical Quality	Life cycle costs	16	Building-related life cycle costs	screening	3	high	2 d	4 d	9,8	10,0		2,7	10,0	Expensive construction
		17	Value stability	complete	2	none	1/2 - 1 d	1/2 - 1 d	7,3	10,0	Height office rooms, flexibility of interior walls	6,8	10,0	

Table 2: Information and Results of the Evaluation for Criteria 18-42

									Results Vallensbæk			Results Horten		
		No.	Criterion	Depth of Evaluation	Weighting 1-3	Effort for Adaptation	Effort Des. Team	Effort Auditor	Points	Potential	Comment on Potential	Points	Potential	Comment on Potential
Socio-cultural and Functional Quality	Performance Health, comfort and user satisfaction	18	Thermal comfort in the winter	screening	2	high	1 d	1 d	9,0	10,0		9,0	10,0	
		19	Thermal comfort in the summer	screening	3	high			9,0	10,0		10,0	10,0	
		20	Indoor hygiene	screening	3	low	1/2 - 1 d	<1h	5,0	10,0	No test of fugitive organic substances	5,0	10,0	No test of fugitive organic substances
		21	Acoustical comfort	complete	1	low	1/2 d	<1 h	0,0	10,0	Calculation of reverbation times not performed	10,0	10,0	
		22	Visual comfort	screening	3	low	1/2 d	1/2 d	7,4	10,0	Glazing protection, documentation and calculation daylight factors missing	7,6	10,0	
		23	Influences by users	complete	2	none	<1 h	1h - 1/2 d	1,8	10,0	No workplace specific control of HVAC	9,6	10,0	
Socio-cultural and Functional Quality	Performance Health, comfort and user satisfaction	24	Outside design	complete	1	none	<1h	1h - 1/2 d	5,0	10,0	Design and usability of roof, facade and outside area neglected	10,0	10,0	
		25	Safety and risks of failure	complete	1	none	<1 h	1h - 1/2 d	4,4	10,0	Video surveillance, alarm system and contact persons in case of emergency	4,4	10,0	Technical safety devices missing
	Functionality	26	Barrier free accessibility	complete	2	med	<1 h	1h - 1/2 d	7,5	10,0		7,0	10,0	
		27	Area efficiency	complete	1	none	part of #17	part of #17	9,0	10,0		5,0	10,0	
		28	Feasibility of conversion	complete	2	none	part of #17	part of #17	5,5	10,0	More modularity neccessary	6,5	10,0	
		29	Accessibility	complete	2	none	<1 h	<1 h	6,2	10,0		1,0	10,0	Building was designed as "not public"
		30	Bicycle comfort	complete	1	none	<1 h	1h - 1/2 d	8,0	10,0		10,0	10,0	
		31	Assurance of the quality of the design and for urban development for competition	screening	3	med	<1 h	<1 h	0,0	10,0	No competition applied	0,0	10,0	No competition applied
		32	Art within architecture	complete	1	med	<1 h	<1 h	1,0	10,0	No art by constructor	1,0	10,0	Costs of art within building too low
Technical Quality	Quality of the technical implementation	33	Fire protection	complete	2	med	1h - 1/2 d	1h - 1/2 d	8,0	10,0		6,5	10,0	
		34	Noise protection	screening	2	high	<1 h	<1 h	8,0	10,0	Calculation on noise protection missing	9,5	10,0	
		35	Energetic and moisture proofing quality of the building's shell	screening	2	med	>1 d	>1 d	6,9	10,0	No separate sun value and thermal bridge calculation	7,5	10,0	No separate sun value calculation
		40	Ease of cleaning and maintenance of the structure	screening	2	none	<1 h	<1 h	5,8	10,0	More cleaning friendly planning (e.g. windows)	7,1	10,0	
		42	Ease of deconstruction, recycling and dismantling	screening	2	none	<1 h	1/2 d	5,3	10,0	No recycling concept planned	5,3	10,0	No recycling concept planned

Table 3: Information and Results of the Evaluation for Criteria 43-61

									Results Vallensbæk			Results Horten		
		No.	Criterion	Depth of Evaluation	Weighting 1-3	Effort for Adaptation	Effort Des. Team	Effort Auditor	Points	Potential	Comment on Potential	Points	Potential	Comment on Potential
Quality of Process	Quality of the planning	43	Quality of the project's preparation	screening	3	med	<1 h	1/2 d	3,3	10,0	No arch. competition and sustainable goal definition	3,4	10,0	No arch. competition and sustainable goal definition
		44	Integrated planning	complete	3	none	<1 h	1 h - 1/2 d	5,0	10,0	participation of public, consideration of sustainable subcontractors	5,7	10,0	participation of public, consideration of sustainable subcontractors
		45	Optimization and complexity of the approach of planning	screening	3	med	<1 h	1/2 d	5,3	10,0	No recycling and water concept planned	6,6	10,0	
	Quality of the planning	46	Evidence of the sustainability considerations during bid invitation and awarding	complete	2	none	<1 h	<1 h	1,8	10,0	Selection of sustainable companies	0,0	10,0	Not part of current planning process
		47	Establishment of preconditions for optimized use and operation	screening	2	med	<1 h	<1 h	8,3	10,0		8,0	10,0	
		48	Construction on site, construction phase	screening	2	med	<1 h	1h - 1/2 d	0,0	10,0	No efforts on noise/dust reduction and soil protection	5,0	10,0	No soil protection during construction phase
		49	Quality of executing companies, prequalifications	screening	2	med	<1 h	<1 h	10,0	10,0		5,0	10,0	
	Quality of the construction activities	50	Quality assurance of the construction activities	screening	3	med	1/2 d	<1/2 d	5,0	10,0		7,5	10,0	
		51	Systematic commissioning	screening	3	none	>1 d	>1 d	7,5	10,0		7,5	10,0	
Quality of Location	Quality of Location	56	Risks at the micro-location	complete	2	med	<1 h	1 - 1.5 d	7,0	8,5		6,7	8,5	
		57	Circumstances at the micro-location	complete	2	med			1,8	8,0	location is close to highway (high noise level and low air quality)	3,3	8,0	building is in the city and thus can never reach the maximum
		58	Image and condition of the location and the neighborhood	complete	2	low			5,1	10,0	high crime rate; green easy to maintain surrounding	9,7	10,0	
		59	Connection to transportation	complete	3	none			6,4	10,0	long distance to main station of Copenhagen	7,7	10,0	
		60	Vicinity to usage-specified facilities	complete	2	none			8,0	10,0		9,0	10,0	
		61	Adjoining media, infrastructure development	complete	2	none			10,0	10,0		10,0	10,0	

5.2 Short Description of all Criteria

On the following pages each criterion is described briefly to give a better understanding of the outlined content.

Table 4: Short description of each DGNB Criterion

No	Short description	
1	Life Cycle Assessment including production, operation, maintenance and end of life.	The evaluation is done by assessing the global warming potential which is the contribution of a substance to warm the near-surface air for the so called greenhouse effect.
2		The evaluation is done by assessing the ozone depletion potential which is the destruction of the ozone layer by a group of pollutant emissions.
3		The evaluation is done by assessing the photochemical ozone creation potential which is the formation of near-surface ozone caused by destructive trace gases (e.g., nitric oxide and hydrocarbons)in combination with UV-radiation.
4		The evaluation is done by assessing acidification potential which is the rising of the concentration of H-ions in the air, water and soil.
5		The evaluation is done by assessing the acidification potential which is the transition of water bodies and soil from a nutrient-poor to a nutrient-rich (a.k.a. eutrophic) state.
6	Assessment of materials and substance types that can cause environmental risks, such as large building components like surface coatings (paints, varnishes), foam insulation, wood preservatives, and adhesives.	
8	Assessment of the impacts of a building on the global environment. A central aspect is the proof of the use of certificated wood which defines the percentage of certified timber that has been sustainably harvested.	
10	Life Cycle Assessment	The evaluation is done by the identification of the non-renewable primary energy demands, the energy-efficiency of the construction and use, as well as the energy demands of the upstream chain.
11		The evaluation is done by the identification of the total primary energy demand, as well as the relative percentage of renewable energy demands.
14	The evaluation is done by calculating the reference value for "specific" water use, by adding the ascertained potable water consumption and the sewage emergence.	
15	The usage-change of the area is evaluated in this criterion: to which degree and in which sense the type of area used is changed by the construction project.	
16	Life cycle costs of a building are all costs that arise during the entire useful life of a building. The life cycle costs are divided into three cost categories: production costs, follow-up costs, and deconstruction and disposal costs.	
17	A building designed for sustainability can be easily adapted to changing requirements. A high level of adaptability of buildings under the criterion of sustainability is present, if the alteration can be realized with a small amount of resources. This is evaluated by a check-list.	
18	The thermal comfort of a person is closely linked to satisfaction at the work place. A person can feel thermal comfort but can be adversely affected by local draught on a body part. For this a documentation of the operating temperature, drafts, humidity should be done. A high score can be reached through a thermal building simulation.	
19	To assure thermal comfort all criteria from criterion 18 have to be fulfilled in the summer also. So a thermal building simulation should also be done for the summer. For this a calculation / documentation of the operating temperature, drafts, and humidity should be done for the expected high temperatures in the summer.	
20	The goal is to assure the indoor hygiene and to avoid negative impacts on the user's state of health. Indoor air measurements should be done 4 weeks after the completion of the building and a compliance with limits should be reached.	
21	The aim is to achieve a low level interference and background noise with speech intelligibility in all rooms to avoid affecting use, health and capability of the users. High speech intelligibility in communication rooms and high absorbability of sound propagation to restrict the mutual interfering potential is of advantage. A calculation of the reverberation times must be done to achieve a high score.	
22	Visual comfort shall be achieved by balanced illumination without appreciable interferences such as direct and reflected glare, a sufficient illumination level and the possibility to adjust illumination individually to the particular needs. Criteria are the visual connections to the outside, light distribution and spectral color in the room.	

No	Short description
23	The maximization of the user influence capabilities in the sectors ventilation, sun protection, visor, temperature as well as regulation of daylight and artificial light at the workplace is been assessed.
24	The entire roof area should be designed. The integration of the roof in the design of the building and its surroundings shall enhance the development of a three-dimensional urban surrounding. Areas such as greened roofs, solar-active areas, socio-cultural utilizations are being looked at.
25	Insecurity and anxiety can constrain the movement of humans. The subjective sensation of safety contributes basically to the comfort of humans. Things looked at as part of this issue would be illuminated paths, parking spaces for women, clear arrangement of structure, evacuation plans, halogen content in components that could burn and further more.
26	Buildings shall be constructed barrier-free. Barrier-free accessibility augments value and attractiveness for all population groups and concerns for all people with motor and sensory restrictions. Handicapped accessible sanitary rooms are one of the things looked at.
27	Areas should be handled as economical as possible. Area efficiency is an index for the utilization of floor space inside buildings. The specific value area efficiency corresponds to the proportion between usable floor space to gross floor area (in m^2/m^2).
28	The better a building can be converted with as little time and effort as possible, the better the attribute “Feasibility of Conversion” is evaluated. The ceiling height, conversion costs, flexibility of electrical and media channels, as well as water and heating pipes are being assessed.
29	Acceptance and integration of a building inside a district, city and region shall be enhanced by increased accessibility. The usage of the outdoor facilities, the canteen and other facilities by the public are seen as positive values.
30	The percentage of cyclists shall be raised. Missing building-specific infrastructure for bicycles in praxis often leads to “wild” parking in the public space. The number, location and kind of bicycle parking spots and shower facilities for cyclists are part of this criterion.
31	Planning competitions shall take place to attain the best solution for the architectonical and constructive tasks. With this, the architectural diversity is assured and an expert jury can judge best architectonical solutions and integration into the urban context. Competitions forward creativeness and are efficient methods to optimize quality and profitability.
32	Art within architecture shall be enhanced. It is an element of architecture that forms quality and expressiveness of the building and is therefore an integral part of the construction job and the responsibility of the owner.
33	The quality of fire protection measures shall be increased. Measures that exceed the fire protection regulations can be rated positively. Proof of official requirements, proof of compliance with the official requirements and documentation of the additional measures taken are necessary. 75% of the points can be reached by demonstrating the compliance with the regulatory requirements.
34	Noise protection shall be improved. Measures that exceed the minimum noise protection requirements lead to a better score. Protection against footfall sound, external, work area and building services noise are being considered.
35	The energy demand for the space conditioning shall be minimized, high thermal comfort shall be assured, and structural damages shall be avoided. The building’s shell is evaluated by looking at several criteria incl. the average heat transmission coefficient, the consideration for thermal bridges, the permeability of joints, the formation of condensate and the air change rate.
40	With targeted cleaning and maintenance, the used materials can be operated for the maximum useful lifetime. The ease of cleaning and maintenance of the structure has a high impact on the costs and the environment of a building during the operating phase. The checklist includes things such as the ease of cleaning the glass surfaces, the size of dirt traps and others.
42	Goal of increasing the ease of deconstruction, recycling, and dismantling is the avoidance of waste, in particular by reducing its amount and hazard. Deconstruction materials can serve as important resources for future construction materials. The ability to recapture homogenous deconstruction materials and extract high-grade recycling materials is very important for the ease of deconstruction and recycling.

No	Short description
43	The tasks that should be achieved prior of any architectural work should optimally prepare the project. To be considered are: planning of the needs, discussion to identify the objective, agreement on an objective, preparation of the architectural contest, and exerting influence over the energy input caused by the user and the usage.
44	The principles of integral planning are to be put into practice. This necessitates enhanced coordination between all participants. An interdisciplinary design team develops an integral concept with a comprehensive strategy that is oriented toward sustainability, in order to reduce energy consumption and environmental pollution, and at the same time to improve the level of comfort and be economical.
45	The availability, extent, and quality of concepts and documentation will be verified and evaluated. The type and scope of the implemented alternative comparisons will be judged. The concepts include a health and safety plan and an energy, water, waste and measurement concept. A concept for supporting the abilities of alteration, verification by an independent third party and others should also be done.
46	During the bid invitation and awarding phases specific, manageable and verifiable requirements for products and technologies for reaching the sustainability targets shall be formulated. Besides this the integration of sustainability aspects during the selection of companies will also be assessed.
47	Creating and documenting comprehensive instructions for maintenance, inspection, operation, and care can make an important contribution to an efficient operation of the building, and thus reduce its life-cycle costs. In this criterion the presence and quality of different documents will be verified.
48	The evaluation of the construction site and construction process should minimize the effects on the environment and simultaneously the health of all participants should be protected. The topics low- waste, low-noise, low-dust and environmental protection on the construction site should therefore be of considered and documented.
49	Competence and quality of the executing contractors shall be described. By being registered in the pre-qualification list, the contractors document their reliability, technical qualification, and capability with a kind of quality certificate to the awarding authority. The pre-qualification covers the complete performance chain.
50	The quality reached in the process of the construction execution shall be described, verified, and certified. Used materials, additives, and safety data sheets should be documented and measurements for quality control are to be taken. Quality assurance methods of a building include among many others the energy quality (e.g. Blower Door or thermal imaging) and the acoustical qualities of a building.
51	A systematic commissioning is a major contributing factor for a long-lasting and efficiently operating building automation. After the final inspection, the individual components of the building's technical equipment will be calibrated. After an initial operating phase of about 10 to 14 months, the buildings systems can be re-adjusted.
56	It should be analyzed if and to what extent the technical solutions of the building structure will react to the available risks at the site. Man-Made-Hazards which are described as human induced catastrophes and risks caused by weather and nature are part of this criterion. The risks caused by nature are earthquakes, avalanches, storm, flood and they depend on the geographical circumstances of the sites.
57	The circumstances at the micro locations will be characterized in order that they can be applied in a location study. Included are: ambient air quality, ambient noise level, building ground circumstances, ground pollution, electromagnetic fields, appearance of radon, city and landscape / visual context.
58	The goal is to characterize image and condition of the neighborhood / site in order to make this information available for a location study. The criteria are the evaluation in respect of compliance of image and type of use, the regional crime rate and the condition of the local building development.
59	Traffic flow caused by building use is to be reduced by adequate site selection. These will be influenced by the user behavior as well by the quality of the transport connections. Necessary distances and transportation schedules as well as availability via various means of transportation shall be evaluated.
60	The choice of the site shall contribute to the users and their visitor's quality of life. The rating of the relevant user specific facilities follows in two classes: Class I for an office complementary requirement: catering, local supply and free spaces. Class II for an office complementary desirable: culture, medical care, sport and recreation.
61	Alternatives for supply and sanitation shall serve as ecological goals, and financially release the cities and communities. Therefore four aspects are described and evaluated in this criterion. They include the connect ability of pipeline-bound energy, solar radiance supply, provision of broadband connection and water seepage on site.

Faneblad 6

DGNB: Kriterieoversigt

Dette er en oversættelse lavet af SBI, idet der ikke er en officiel oversættelse til engelsk af listen af kriterier med underkategorier (indikatorer).

Kategori/Kriterie	Tjekliste Point	Point	Vægtning af kriterie	Vægtning af kategori
Ecological Quality				
01 Global Warming Potential		10	3	22,5 %
02 Ozone Depletion Potential		10	1	
03 Photochemical Ozone Creation Potential		10	1	
04 Acidification Potential		10	1	
05 Eutrophication Potential		10	1	
06 Risks to the Regional Environment		10	3	
08 Other Impacts on the Global Environment		10	1	
10 Non-renewable Primary Energy Demands		10	3	
11 Total Primary Energy Demands and Proportion of Renewable Primary Energy		10	2	
11.1 Total Primary energy	10			
11.1 Total renewable energy	5			
14 Potable Water Consumption and Sewage Generation		10	2	
15 Surface Area Usage		10	2	
Economical Quality				
16 Building-related Life Cycle Costs		10	3	22,5 %
17 Value Stability		10	2	
17.1 Area efficiency	30			
17.2 Adaptability	50			
17.3 Conversion to different use	20			
Socio-cultural and Functional Quality				
18 Thermal Comfort in the Winter		10	2	22,5 %
18.1 Operative temperature	70			
18.2 Draught	10			
18.3 Radiation temperature etc.	10			
18.4 Relative humidity	10			
19 Thermal Comfort in the Summer		10	3	
19.1 Operative temperature	70			
19.2 Draught	10			
19.3 Radiation temperature etc.	10			
19.4 Relative humidity	10			
20 Indoor Hygiene		10	3	
20.1 VOC	50			
20.2 Personal ventilation rate	50			
21 Acoustical Comfort		10	1	
21.1 Offices up to 40 m2	35			
21.2 Large offices	35			
21.3 Meeting rooms	35			
21.4 Cantina larger than 50 m2	20			
22 Visual Comfort		10	3	
22.1 Day light, whole building	16			
22.2 Day light, work stations	14			

Kategori/Kriterie	Tjekliste Point	Point	Vægtning af kriterie	Vægtning af kategori
22.3 Visual connections, outside	14			
22.4 Blending free day light	14			
´ 22.5 Blending free artificial light	14			
22.6 Light distribution artificial light	14			
22.7 Colour reproduction	14			
23 Influences by Users		10	2	
23.1 Ventilation	14			
23.2 Sun protection	14			
23.3 Blending protection	14			
23.4 Temperature during heating season	14			
23.5 Temperature outside heating season	14			
23.6 Regulation of day light and artificial light	14			
23.7 User friendliness	16			
24 Building related outdoor quality		10	1	
24.1.1 Roof	20			
24.1.2 Balconies etc.	10			
24.1.3 Outdoor area	10			
24.1.4 Special areas	10			
24.2.1 Design concept	10			
24.2.2 Local conditions and planting	5			
24.2.3 Maintenance contract for the planting	5			
24.2.4 Vision to at least two sky directions	5			
24.2.5 Socio-cultural use of outdoor areas	5			
24.2.6 Positive contribution to outdoor micro-climate	5			
24.2.7 Features	15			
25 Safety and Risks of Failure		10	1	
25.1 Security	50			
25.2 Reduction of damage extend	50			
26 Barrier free Accessibility		10	2	
27 Area Efficiency		10	1	
28 Feasibility of conversion		10	2	
28.1 Modularity of building	10			
28.2.1 Feasible spatial structure	15			
28.2.2 Spatial organisation	15			
28.3.1 Double floor	10			
28.3.2 Capacity of electricity and IT	10			
28.3.3 CTS	10			
28.4.1 Flexible heating system	10			
28.4.2 Flexible water system	10			
28.4.3 Flexible ventilation and climate system	10			
29 Accessibility		10	2	
29.1 Basic accessibility to the building	16			
29.2 Opening of the external areas for public	16			
29.3 Opening of building facilities for public	16			
29.4 Possibility of a third party renting building space	16			
29.5 Information for the public	26			
30 Bicycle Comfort		10	1	
30.1 Qualitative criteria	50			
30.2 Quantitative …	50			

Kategori/Kriterie	Tjekliste Point	Point	Vægtning af kriterie	Vægtning af kategori
31 Assurance of the Quality of the Design and for Urban Development for Competition		10	3	
31.1.1 Design competition	20			
31.1.2 Competitive procedures	40			
31.1.3 Award-winning draft	30			
31.1.4 Commissioning of planning team	10			
31.2 OR: Architectural price	100			
32 Art within Architecture		10	1	
32.1 Requirements	10			
32.2.1 OR: Provisioning of resources within the building task	20			
32.2.2 Implement recommendations	40			
32.2.3 Guidance of the public	40			
Technical Quality				
33 Fire Protection		10	2	22,5 %
33.1 Fire regulations	50			
33.2 Materials	10			
33.3 High fire protection class	10			
33.4 Enlarge openings for ventilation of smoke	10			
33.5 Fire gas detector	5			
33.6 Smoke or heat detector	5			
33.7 Automatic fire extinguishing system	5			
33.8 Reduced fire sections	5			
34 Noise Protection		10	2	
34.1 Airborne noise protection against exterior noise	20			
34.2 Airborne noise protection against adjacent working rooms	30			
34.3 Footfall sound protection	30			
34.4 Noise protection against technical installations	20			
35 Energetic and Moisture Proofing Quality of the Building's Shell		10	2	
35.1 U-values	30			
35.2 Thermal bridges	15			
35.3 Air permeability	15			
35.4 Condensation	15			
35.5 Air tightness	15			
35.6 Solar …	15			
40 Ease of Cleaning and Maintenance of the Structure		10	2	
40.1 Building structure	20			
40.2 Non-bearing structure exterior	20			
40.3.1 Floors	20			
40.3.2 Dirt trap zone	20			
40.3.3 Skirting boards	10			
40.3.4 Room layout	10			
42 Ease of Deconstruction, Recycling and Dismantling Process Quality		10	2	
42.1 Effort to demolish	38			
42.2 Effort to separate	38			
42.3 Recycling concept	24			
Quality of the process				
43 Quality of the Project's Preparation		10	3	10 %
43.1 Planning of demand	25			
43.2 Goal finding discussion	25			
43.3 Contest	25			

Kategori/Kriterie	Tjekliste Point	Point	Vægtning af kriterie	Vægtning af kategori
43.4 Influencing energy effort	25			
44 Integral Planning		10	3	
44.1 Interdisciplinary design team	20			
44.2 Qualification of design team	20			
44.3 Integrated design process	20			
44.4 Integration of user	20			
44.5 Integration of the public	20			
45 Optimization and Complexity of the Approach to Planning		10	3	
45.1 Health and safety plan	10			
45.2 Energy concept	10			
45.3 Water concept	10			
45.4 Day light optimization	10			
45.5 Waste concept	10			
45.6 Monitoring concept	10			
45.7 Concept on flexibility and recycling	10			
45.8 Concept on cleaning and maintenance	10			
45.9 Inspection of building documents by third party	10			
45.10 Comparison of alternatives and variants	10			
46 Evidence of Sustainability Considerations during Bid Invitation and Awarding		10	2	
46.1 Integration of sustainability issues in tender	50			
46.2 Consideration of sustainability issues in bidding procedure	50			
47 Establishment of Preconditions for Optimized Use and Operation		10	2	
47.1 Documentation	25			
47.2 Instructions for operation and maintenance	25			
47.3 Update of documents and calculations after construction	25			
47.4 User handbook	25			
48 Construction Site, Construction Phase		10	2	
48.1 Waste reduction	25			
48.2 Noise reduction	25			
48.3 Dust reduction	25			
48.4 Environmental reduction	25			
49 Quality of Executing Companies, Pre-qualifications		10	2	
50 Quality Assurance of the Construction Activities		10	3	
50.1 Documentation of materials and security	50			
50.2 Quality control	50			
51 Systematic Commissioning		10	3	
Quality of the Location				
Is presented separately, and is not included in the overall grade of the object.				
56 Risks at the micro location		10	2	100 %
56.1 Earthquake	25			
56.2 Avalanches	25			
56.3 Storms	25			
56.5 Floods	25			
57 Circumstances at micro location		10	2	
57.1 Air quality	16			
57.2 Noise	20			
57.3 Soil	16			
57.4 Electromagnetic fields	16			

Kategori/Kriterie	Tjekliste Point	Point	Vægtning af kriterie	Vægtning af kategori
57.5 Urban and landscape scenery	16			
57.6 Radon	16			
58 Image and Condition of the Location and Neighbourhood		10	2	
58.1 Image	25			
58.2 Synergy potential	25			
58.3 Crime	25			
58.4 Maintenance and conservation status	25			
59 Connection to Transportation		10	3	
59.1 Main station railway	30			
59.2 Local public transport	30			
59.3 Cycling track	40			
60 Vicinity to Usage-specific Facilities		10	2	
60.1 Gastronomy	10			
60.2 Local supply and services	10			
60.3 Parks and public spaces	20			
60.4 Educational institutions	10			
60.5 Institutions and public administration	10			
60.6 Medical care	10			
60.7 Sport and recreation facilities	10			
60.8 Facilities for leisure and recreation	10			
60.9 Service providers	10			
61 Adjoining Media, Infrastructure Development		10	2	
61.1 Wire tired energy	25			
61.2 Solar energy	25			
61.3 Broadband internet access	25			
61.4 Rainwater drainage	25			

Faneblad 7

HQE® process apply to existing Building in Denmark

Report made by: Arnaud BILLARD
Date: 12th of April 2010

1. Introduction

HQE® certification called “NF – Bâtiment tertiaire – Démarche HQE”, from CERTIVEA – CSTB, is based on two main points which are:
A management system of the operation,
14 sustainable goals.

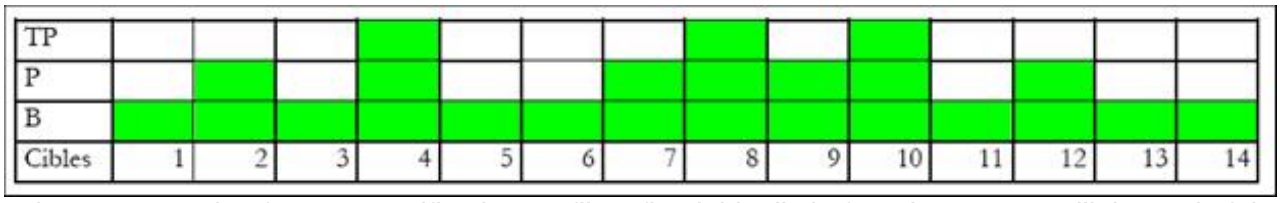
Sustainable management of the project, is the way for the client to identify and answer following questions: Who is doing what and why, at which moment of the project, with which teams/tools under which contract. The sustainable management of the project fix as well the documentary process which has to be respected during all project phase (program, sustainability report, etc.).

The management system of the project is a tool used by CSTB / CERTIVEA to allow the client to established his sustainable profile, but as well to be able to follow sustainability criteria during all project long (from the competition phase till delivery of the building).

14 HQE® goals are describe below. HQE® goals can be treated at 3 differents levels, BASE which correspond to the application and respect of codes and regulations. PERFORMANT which is an increase in performance of the project on this specifics goals. TRES PERFORMANT (high performance) which is a strong sustainable point of the project.

Goal n°01: Impact of the building to it’s environment
Goal n°02: Materials and way of construction
Goal n°03: Building construction management
Goal n°04: Energy management
Goal n°05: Water management
Goal n°06: Waste management
Goal n°07: Maintenance and sustainability criteria’s maintenance
Goal n°08: Thermal comfort
Goal n°09: Acoustic comfort
Goal n°10: Visual comfort
Goal n°11: Smell comfort
Goal n°12: Healthy quality of spaces
Goal n°13: Healthy quality of air
Goal n°14: Water quality

Example of a HQE® profile:



Picture: Example of HQE® certification profile – fixed, ideally before the program till the end of the building construction – 3 goals minimum in TP (HIGH PERFORMANCE) / 4 goals minimum in P (PERFORMANT) / 7 goals maximum in B (BASE):

To be able to get the certification, a minimum HQE® profile with 3 goals treated in TRES PERFORMANT, 4 goals in PERFORMANT and 7 in BASE are a must. We note that the target energy, n°04, do not exist in BASE, minimum treated in PERFORMANT or TRES PERFORMANT.

Philosophy of the HQE® process. Difference with other sustainable certification is mainly founded on the need for the client to establish a HQE® profile on the 14 goals. In others words, the client get the responsibility, before to establish it's program of the project, to understand und identify the sustainable profile which will have to be maintained till the end of the building construction (it's strictly difficult to change the HQE® profile during the conception of the construction of the project).

CSTB / CERTIVEA established a contract with the client. CSTB / CERTIVEA are organisms which are going to follow the sustainability quality of the project, in regard of the goals fixed by the HQE® profile of the client. CSTB / CERTIVEA acts, usually and mainly, three times on the project. After the establishment of the program (AUDIT PROGRAM), after the end of the conception (tenders documents phase) (AUDIT CONCEPTION) and finally at the end of the construction of the project (AUDIT BUILDING CONSTRUCTION). At each of theses three meetings, CSTB / CERTIVEA use a intermediate called "HQE® assessor" which is coming at all three meetings (it's usually the same assessor for all 3 meetings) to check the evaluation of the sustainability quality of the project. In others words, the team (client / architect / constructions companies) have to established all document to allow to present the evaluation of the sustainability of the project. An HQE® assessor is not coming on the project to optimise the project, to participate to the conception or to modify the project. During theses 3 sessions, the HQE® assessor is checking as well the way that the sustainable management of the project is made. The HQE® assessor notifies all gaps between goals fixed by the HQE® profile and the evaluation of the sustainability quality of the project. The team (client and/or conception team and/or constructions companies) have a fix time to answer points which could be out of the range of the HQE® profile goals. At this end of the process, the HQE® assessor mention all results out of theses 3 sessions to a jury, made of professional of the building sector, to deliver or not the HQE® certification.

***Nota**: to help the reader to identify goal classification a colour code is used in this report:*

- ***Goal with TRES PERFORMANT level in GREEN***
- ***Goal with PERFORMANT level in ORANGE***
- ***Goal with BASE level in BLUE***
- ***Goal NOT reaching certification in RED***

First building

This building is seen as an office building, located at the adjacent exist of Copenhagen (15 min till 20 min by car from Copenhagen centre). The team facing is made of the project leader of the client, the specialist for HVAC and the specialist for sustainability.

Interview was made of an introduction to the building by it's visit (some representative rooms of the buildings) by the project leader. Interview took one day and half. Interview started by a brief introduction to the HQE® certification process, immediately followed by the beginning of the interview.

Sustainable Management Process of the project:

From our point of view, criteria which are established by CSTB / CERTIVEA are reached by the team. This is coming from:

- the fact that the client get a very clear vision of the task split of companies working on the project (explanation made are extremely clear, without any doubt of the choice made)
- An internal client organisation has been made to be able to reach clear goals develop before the beginning of conception.
- A clear limitation of responsibilities inside the team according to field of work
- A clear view of document establish before / during / after the completion of the project
- An analysis of the site (transport, local requirement, acoustic, green spaces, etc.).

Some specific and very important points are helping this project to fulfil requirements of management as the clear vision of sustainability definitions mainly based on:

- energy performance with a fix value (extremely important for the HQE® process) of a minus 25% compare to Danish code (result is a minus 28%)
- insertion of the project in a local environment and to integrate this project in association with local authorities
- the will of flexibility of uses of the project
- the will of possibility of extension of the project

Out of interview, the sustainable management of the project was really well described and all answers were extremely clear. Out of the interview, we could feel this client defined its targets and organised itself to join all knowledge necessary to reach its goals.

This kind of management will be at 100% fitting to the French HQE® management system (obviously, additional documents / studies would have to be done / made, but following principles of HQE® the results is very good).

GOAL n°01: Insertion of the building in its environment

This goal will be TRES PERFORMANT: Out of the interview, it's obvious that this team will easily get the best score for this goal. This is coming from:

- Choice of the location of the project according to specific criteria's as transport nodes, future economics development of this area, to propose an alternative for office building location in Copenhagen area, etc. In others words, the client thought previously about the fact if the project would make sense at this location and under theses conditions.
- Choice of a complete integration of the project with local authorities. It has been said many times that link and exchange with local authorities took place to be able to ensure a success of the project (common transport link, water management, sharing of green spaces management, respect of view for neighbours, rain water integration in park, acoustic, etc.). Important common works have been done with local authorities to be able to reach an exemplarity of insertion (as the work made with responsible of the highway to find compromise on parking place, or insertion of waste room according to local habits, etc.).
- Identification of specific problems on this location as the acoustic problems coming from the adjacent highway, and decisions made that the project could be useful as acoustic protection for neighbours / choice of triple glazing.

Insertion strategy of the project in the site is very simple but highly efficient, focusing on main problems for futures users. Client tried to understand its environment (physics, codes/laws and social) before to start the project, integrating all good decisions (as far as possible) to optimise its integration according to mutual exchange with local authorities and neighbours.

This kind of treatments of target n°01 will be at 80% fitting (missing shading study, to the score TRES PERFORMANT of the French HQE® (very good)

Goal n°02: Materials and way of construction

This goal is in BASE, coming from the fact that client decisions on materials and way of constructions were absolutely not leaded by requirements announced in the HQE® rules. Nevertheless, this goal can stay in the HQE® BASE level according to the fact that codes and regulations have been applied and that the client declare that this goal is not a necessity in its sustainability philosophy.

Except flexibility of uses, all answers to HQE® requirement are codes / laws application. As example the access to external façade for maintenance, or choice of materials (as painting, coating, etc.).

This kind of treatments of target n°02 will be at 100% fitting to the score BASE of the French HQE® (application of codes and laws). An HQE® assessor could accept this goal as one of the 7 goals which can be treated in BASE.

Nota: *to be able to reach the level PERRFORMANT, the client would have to make an effort on identification of materials (as making sustainable comparison of painting, grey energy calculation, developing more a limitation of waste during construction by specific mode of construction, etc.). This point is locking the goal at BASE level, even if the extreme good flexibility of internal use and possibility of horizontal extension of the project are very good points.*

Goal n°03: Building construction management

It's extremely impressive to see that the strict application by the client of the Danish codes and laws for the treatment of this goal is in the range of the highest level of the French HQE® certification. This is thanks to:

- A strict supervision of the building construction site for waste management:
- Identification of waste during construction site (22 kg waste by square meter of building).
- Energy consummation identification during construction site
- Water consummation identification during construction site
- Cleaning of building construction as soon as necessary
- Extreme high level of recycling (50%) on main materials as concrete, wood, steel. Taking into account that the rest of waste used for co-generation system we could estimate that 100% of waste (for this specific products) are recycled or use of energy (French HQE® reach a limit at 70%).
- Site plan for truck circulation
- Use of water for dust propagation limitation
- Specific recycling process for dangerous product
- Meeting with all companies on a 2 weeks base
- Specific parking for people working on building construction (independent of existing parking)

Moreover, many points above were proved by documents presented during the interview.

This kind of treatments of target n°03 will be at 90% fitting (missing acoustic studies, communication with neighbours, limitation of visual pollution, limitation of energy during building construction), to the score TRES PERFORMANT of the French HQE® (very good)

Goal n°04: Energy management

This goal gets a good score thanks to a mix of client will (goal of -25% compare to code for energy) and Danish habits:

- Codes: the project reach its goal of -25% and better with a -28%. Without any knowledge of the Danish code, we trust discussion with client to believe that this reduction is a success taking into account the old code (which was apply to this project). Thus, we consider that all HQE® goals are reached for energy consummation following French code
- Thermal envelop is extremely good as well, we can note the use of triple glazing. Client compare different product and choice one coming from foreign country (Germany) to be able to respect its engagement on energy.
- Infiltration are very low with 1 L/m² floor compare to the 1.5 L/m² of the code (Nota: the client decided to realise this infiltration rate on a voluntary base, fitting perfectly with the application of its philosophy to treat energy as primary target of sustainability)
- Atrium mainly situated on North orientation to avoid any over heating effect
- Different g value of the glazing according to orientation
- Solar protection made by an overhang all along the building (Nota: this argument is critical as it has been done for solar protection, but we are deeply question its efficiency – in a "real" HQE® certification, HQE® assessor will ask additional energy modelling to prove efficiency of solar protection)
- 9 W/m² artificial lighting and 200 Lux on open space (working level) are normal for Danish code. Which is higher than the best score for French HQE® code (Nota: usually very good project in France are based on 8 W/m² to 8 W/m² and 300 Lux to 350 Lux on working desk).
- Studies have been done for renewable energies insertion in the project as photovoltaic panels. Studies shows that no renewable energies would have to be installed to reach the -25% goals fixed at the beginning of the project.

- Project connected to the heating network (Nota: it's a must due to the regulation, for info based on 60% burned waste - 132.8gCO2/kWheating. In Paris, the CPCU, heating Network Company of Paris is distributing hot water and water vapour burning in a range of 30% to 40% of waste. CPCU took the engagement to reach 60% of waste burn for 2012. CPCU network in Paris still one of the most efficient for sustainability in the entire France. It's not a must to be connected to existing heating/cooling network in France, but highly recommended by politics, as town council).

This kind of treatments of target n°04 will be at 100% fitting to the score PERFORMANT of the French HQE® (good).

Nota: It will be a very few effort (almost negligible) for the client to reach the highest score for energy (VERY PERFORMANT), taking into account that we are only missing pollution emission of the project (as CO2, SO2, etc.).

Goal n°05: Water management

This goal was clearly not a goal for the client in its sustainability strategy. Due to this position, this target respect codes application, with some specific actions made on the rain water treatment. Client worked with local authorities to be able to reduce rain water on network, optimisation of rain water infiltration, etc.

Except theses few actions made with local authorities, no actions have been notified during the interview.

This kind of treatments of target n°05 will be at 100% fitting to the score BASE of the French HQE® (code level).

Nota: It will be an important effort for the client to reach the next level of PERFORMANT, taking into account that there is no culture of water management in its company.

Goal n°06: Waste management

This goal was not a goal for the client in its sustainability strategy. But the client is sensitive to this theme. Due to this position, this target respect codes application, with some specific actions made as:

- Common work with local authorities to located the waste room on the other side of the street of the project.
- Recycling glass
- Each users of the building (the building is divided for different users) get their own garbage room.
- common work with local authorities for delivery

Except theses actions made, no actions have been notified during the interview (as recycling

This kind of treatments of target n°06 will be at 100% fitting to the score BASE of the French HQE® (code level).

Nota: It will not be a huge effort for the client to reach the next level of PERFORMANT, taking into account its sensitivity to this theme and the easy way to apply HQE® code for waste management.

Goal n°07: Maintenance and sustainability criteria's maintenance

This goal get a good score thanks to the will of the client to split its project for different users and the will of optimisation for flexibility of its building, we can note:

- A very good way (and very innovative for French people) to communicate between the project operation and house keeper base on internet platform able to send sms (short message on a cell phone) to the house keeper.
- Limitation of artificial light type to 5 to 10 (for such project size it's a quite low numerous of types)
- BMS controlling heating / ventilation / cooling

Unfortunately, some crucial points are missing in the project reach a full PERFORMANT statement, as:

- A crane has to be used for almost all technical intervention on air handling unit on the roof
- No elevator going till the roof level
- No water consumption control
- All problem have to be noticed by human action – no action from BMS
- All consumption (as energy) have to be taken manually – no action from BMS
- Façade maintenance from outside
- No specific studies targeting a simplification of maintenance during building operation

This kind of treatments of target n°07 will be at 20% fitting to the score PERFORMANT of the French HQE® (good). A lot of actions are missing to reach a full PERFORMANT score, but project presents too much good points to be treated in BASE.

Goal n°08: Thermal comfort

This goal get medium score, due to the fact that many studies requested by the HQE® certification process are missing. Nevertheless, we can score a PERFORMANT for this goal thanks to:

- Thermal simulation made for 3 representatives zones (it's a code requirement and not a will of the client)
- Natural ventilation in the lobby (but no simulation to explain air rate, air velocity, etc. it's hard to judge if this solution make sense, only positive user feedback lead to a positive results)
- Solar protection made by overhang out of the building (which is a good point, as architecture try to answer to thermal comfort, but we are questioning if this solar protection is enough to insure thermal comfort all year long)
- BMS is efficient to regulate thermal comfort inside (we note that regulation is only made on air temperature)
- CO2 detector to regulate thermal comfort in meeting rooms
- Triple glazing, protection the people from over heating phenomena

This kind of treatments of target n°08 will be at 40% fitting to the score PERFORMANT of the French HQE® (good). A lot of actions / studies are missing to reach a full PERFORMANT score as:

- Thermal simulation statistics according to different variants of the façade
- In the conception suspended ceiling create a disconnection with the thermal mass – link to the conception of the bulding which is made of a "cocoon" totally air tied with the outside (no possibility of natural ventilation during summer or night passive cooling strategy of the thermal mass during summer night, etc.)
- Impossibility to open windows by users
- No studies / research on ratio window/opaque to optimise thermal comfort

- No prove that overhang is efficient for thermal comfort (by simulation by example). We are deeply questioning the same type of fix solar protection all around the building on the entire year.
- No studies on air velocity (HQE® allow to judge thanks to air speed in building, thus impossible to judge without studies, but the visit of the building lead to mix ventilation which is usually not favourable for low air velocity).
- No different thermal treatment according to uses (as set temperature could be different for restaurant to office, to meeting room, etc.). We are talking about one set temperature for the entire building.

Goal n°09: Acoustic comfort

This goal get good score, due to the fact that acoustic has been a strong point of the project:
Conception team took into account the problem of acoustic coming from the highway – which lead to the triple glazing choice.
Excellent acoustic protection of the façade made by opaque / triple glazing (which can not be opened).
Suspended ceiling used as acoustic absorber (direct action on reverberation time).

This kind of treatments of target n°09 will be at 60% fitting to the score PERFORMANT of the French HQE® (good). This is coming from:

- Triple glazing for the façade
- Strict application of the Danish code for the rest (as suspended ceiling inside, reververation time, etc.).

***Nota**: to reach 100% PERFORMANT goal, it will be some effort for the client, as it do not seem to be the culture of the country to make internal acoustic studies (studies are not only done to prove the acoustic quality but more to compare different acoustic solution during the conception phase).*

Goal n°10: Visual comfort

This goal would be scored at a low PERFORMANT level. This is coming from:

- Strict application of the code with 100% of work desk with view to outside
- Recommendation at 200 Lux for artificial lighting system (which is extremely low for the French habits)
- Colour temperature of 4000°, which is good following French code
- Very good (for the French code) artificial lighting uniformity (from 0.79 to 0.8, 0.8 is the max given by the HQE® classification)
- Artificial lighting driven by movement detector and lux meters, good and efficient.

This kind of treatments of target n°10 will be at 40% fitting to the score PERFORMANT of the French HQE® (good). We can note a good work on artificial light, but many points are missing as:

- Triple glazing reducing daylight penetration
- No external solar protection, avoiding any possibility to deal with glare effect, which is strictly crucial for office building
- No daylight factor studies made to be able to judge and compare different solution for the project during conception phase (it's hard to estimate daylight autonomy of the project, especially for open space office as for corridor, etc.)
- No studies on percentage glazing / opaque by orientation to optimize daylight

Goal n°11: Smell comfort and Goal n°13: Healthy quality of air

Nota: theses 2 goals can be treated together, taking into account the similarities of requirements

Theses 2 goals will be scoring a BASE level, taking into account that the client fix the strict application of the code, without special actions. We can note:

- 2 ACH (Air Change per Hour) for office room and till 6 Ach for meeting rooms
- Ventilation is driven by a general system via BMS

This kind of treatments of targets n°11 and N°13 will be at 100% fitting to the score BASE of the French HQE® (code level). It will be quite an effort for the client to reach PERFOMANT level, taking into account that we are missing studies / research which are part of process of n°11 and n°13 (as identification of specific ventilation for rooms, ventilation rate flexibility according to room uses, increase in filtration performance, etc.).

Goal n°12: Healthy quality of spaces

As the client was absolutely not aware of French HQE® certification requirements, the client didn't answer requirements of this goal. Strict application of Danish code is not enough to get the BASE level on this goal. It would be necessary that the client do, at least, some research on specific points. Due to this lack of process, we can not score this goal as BASE, but we exclude it.

This kind of treatments of targets n°12 is absolutely not fitting to the French requirement. The application of the Danish code can not allow reaching the BASE level. It will be quite an effort for the client to get the PERFORMANT level, but an acceptable effort to reach the BASE level.

Goal n°14: Water quality

Theses 2 goals will be scoring a BASE level, taking into account that the client fixes the strict application of the code, without special actions. We can note:

- Partial identification of water need for the project
- Mineral wood insulation of water net

This kind of treatments of targets n°14 will be at 100% fitting to the score BASE of the French HQE® (code level). It will be quite an effort for the client to reach PERFOMANT level, taking into account that we are missing studies / research / actions which are part of process of n°14.

Conclusion Building n°01:

>>> Management system of the project: **ACHIEVED**

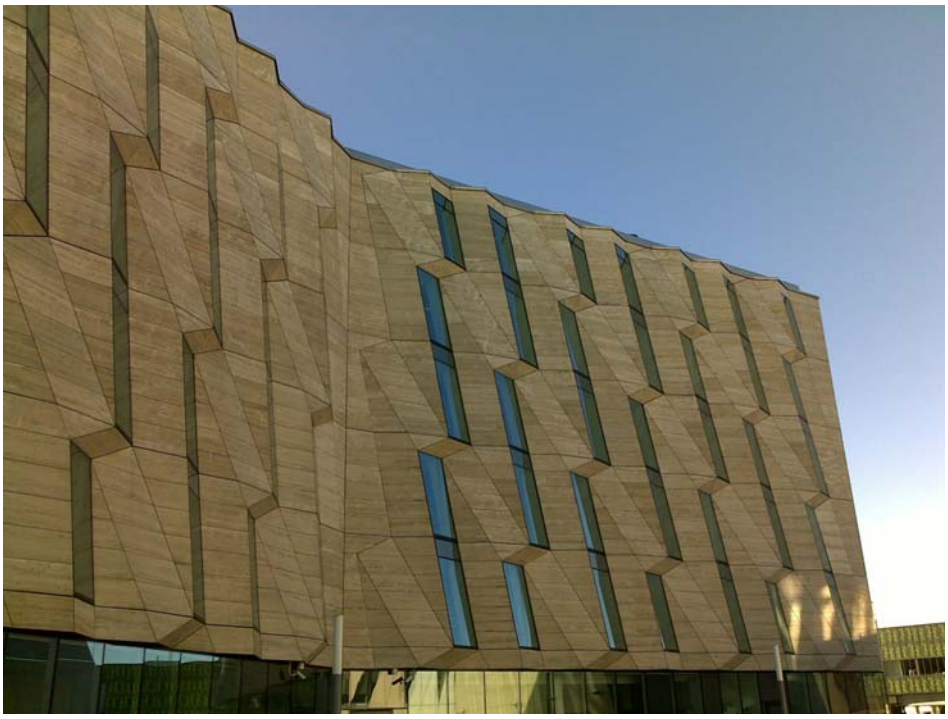
>>> Profile on the 14 HQE® goals:

Target	n°01	n°02	n°03	n°04	n°05	n°06	n°07	n°08	n°09	n°10	n°11	n°12	n°13	n°14
TRES PERFORMANT														
PERFORMANT														
BASE														

Building n°01 could be certified “NF – Bâtiment tertiaire – Démarche HQE” for quite few efforts which are:

- Some effort (almost negligible) on goal n°04 (energy) to reach the TRES PERFORMANT level, and thus to get at least 3 goals in TRES PERFORMANT
- Quite an effort to bring the goal n°12 at BASE level (specific requirement not take into account in the Danish code), to avoid a goal out of the certification process.

Second building



This building is seen as an office building, located in Copenhagen, very close from historic centre of the town. The team facing is made of a representative of the architect office, and a representative of the Engineer office (HVAC, structure, etc.). This building got a high budget, today use by only one client (Layer Company).

Nota: team facing us was clearly too light to be able to go through all questions for this mission. Nevertheless, we have tried to get out all possible answers, but we kindly state at the beginning of the report, that this lack of responsible person are strongly and negatively impacting on the score for the HQE® process.

Sustainable Management Process of the project:

Facing the lack of capability of the client team to answer our questions on management, we can only guess that management for this project has been correctly done. We will score this management of the project by a strict application of the code.

Nevertheless, we can note that no sustainable points / goals have been notified by the client team. In other worlds, the project was absolutely not targeting any sustainable quality.

This kind of management will not be fitting to a sustainable certification, as no sustainable goals have been defined.

Nota: In a real certification process, we will refuse to go ahead in the audit process under theses conditions (person in charge missing), as an HQE® assessor is coming to judge and evaluate the "sustainable evaluation of the project", and not to do it by its own – we guess that CSTB / CERTIVEA will not accept to jump in this project without real motivation signs from the client.

GOAL n°01: Insertion of the building in its environment
This goal will be BASE, this is coming mainly from:

- The project location is 100% fitting to an urban development of the town (with shopping mall, accommodations, offices, etc.). The master plan is coming from Municipality.
- Project allow to reduce travel time for people coming to work (nota: it is not proven that this new building reduce working time travel time – no study)
- Specific parking places for the project, with special attention for women parking places
- Shadow studies have been done, taking into account that the architect was as well responsible for the adjacent building
- "Site analysis" prove there are no acoustics problems on site
- Link to common transport

Insertion strategy of the project in the site seems to be a simple adaptation of the project of local authorities requirement. We are facing a lack of documents described in the HQE® process. But behind theses lacks, some points are strictly against HQE® philosophy as:

- any development of green areas,
- any link with the adjacent water (rain water strategy)
- any studies / work on external areas (as comfort of people, etc.)

This kind of treatments of target n°01 will be at 30% fitting in BASE level of the French HQE® (code application)

Goal n°02: Materials and way of construction
The only positive specific positive point of this goal is the innovative system of construction of the façade. Behind this specific point, it has been quite challenging to find some positive point, taking into account that:

- Materials choice have been driven by aesthetic criteria compare to sustainability (we can note the stone coming from foreign country, which is always quite difficult to justify from sustainable point of view – wood used by parquet have been chosen according to aesthetic / resistance / cost, without indicating if it's a label wood, etc.).
- Mode of construction seems to be fine, taking into account that the team tried to use pre-fabricated elements as far as possible.
- Access to external façade can be made by cherry pickers (no maintenance by windows openings)

This kind of treatments of target n°02 will be at 40% fitting to the score BASE of the French HQE® (application of codes and laws). An HQE® assessor judgement will be at the limit to score this goal out of the certification.

Nota: *to be able to reach the level BASE, the client would have to make an effort on almost 100% of the French certification for this specific goal.*

Goal n°03: Building construction management

Without any information from the team client, we estimate that this goal has been well treated. We base our judgement on:

- A comment from direct competitor (neighbour of the site), making compliment on building site management
- The knowledge of building n°01 and Danish practice.

We can note that, comparatively to building n°01, no documents are provided by the client team. One more time we guess that the building site has been done correctly.

This kind of treatments of target n°03 will be at 70% fitting to the score TRES PERFORMANT of the French HQE® (very good) (We will need at least same documents presented by building n°01 team to give the same score).

Goal n°04: Energy management

This goals treatment will not be accepted by an HQE® assessor. This is coming from:

- The huge difficulties from the team client to explain clearly the way the building is managed (from energy point of view)
- A -10% compare to the Danish code, presented as a "achieved challenge" by the client team. Which do not seems to be fitting as a challenge but more as a "good practice" without real specific low energy consumption.
- No study at all on renewable energies potentials (we can avoid renewable energies in a HQE® project, but at least, a study has to be shown proving that the client took into account this option).
- No CO2 emission studies at all
- A full air conditioning system for the lobby (100% glazed façade without solar protection), open to all storeys (used as well as office area). Which is a strict non-sense for any project trying to save energy (the HVAC has to condition at 19°C in SUMMER the ground floor to insure a 24°C at last floor! So much energy spend for a south façade lobby). Just this will be a "killing certification" point, we guess that CSTB / CERTIVEA will not certified such conception building, as representative of their sustainable approach.
- No solar protection
- Etc.

In conclusion, the project for the goal energy will be scored BASE, which can not be accepted by the HQE® process, taking into account that PERFORMANT is the minimum reachable by the certification. By this process, CSTB / CERTIVEA want to show that energy is one of the most important goals in the certification process, in regard to energy impact of building on the environment.

Goal n°05: Water management

This goal was clearly not a goal for the client in its sustainability strategy. Due to this position, this target respect codes application. Nevertheless, we can note some gap in the conception as the lack of connection with sea water, adjacent to the project. This specific point would be hardly understood by an HQE® assessor taking into account that the project modify by it's own the sea water penetration on site. It would be almost negligible effort to link rain water to sea water, and highly appreciate by the HQE® certification.

This kind of treatments of target n°05 will be at 20% fitting to the score BASE of the French HQE® (code level).

Goal n°06: Waste management

This goal was not a goal for the client in its sustainability strategy. We didn't feel the client sensitive to this specific point. We can note some positive points as:

- recycling paper and glass out of local authorities requirements
- the access to garbage area in basement level, where truck get a direct access.
- The important garbage areas at basemen level

Except theses actions made, no actions have been notified during the interview. Moreover, we are questioning the way of working for garbage for the restaurant area, and vertical circulation with garbage area at basement level (it's seems that it's quite a long way to access to garbage area at the basement level, whereas another conception could have been done without changing the project).

This kind of treatments of target n°06 will be at 10% fitting to the score BASE of the French HQE® (code level).

Nota: It will be quite an effort for the client to reach a better level than BASE.

Goal n°07: Maintenance and sustainability criteria's maintenance

It's extremely hard to score this goal better than BASE, due to the lack of information given by the client team. We guess that the project, taking into account it's cost, has to get an efficient BMS. But one more time, without any information, it's hard to judge. We simply do not know how the BMS is working and how we can maintain condition in the building.

We can note that access to mechanical equipment are not separated to offices areas, that specific mechanicals rooms are separated from office rooms.

This kind of treatments of target n°07 will be at 5% fitting to the score PERFORMANT of the French HQE® (good).

***Nota**: we score PERFORMANT, guessing that with a such cost, the BMS has to be efficient, in other words, better than the code requirement. But additional information could show that the project is just in BASE.*

Goal n°08: Thermal comfort

This specific goal will be out of the certification, this is coming from:

- The lack of solar protection for the project, especially for the South orientated glazed façade (moreover taking into account that the lobby is used as office areas)
- No passive / natural strategy as nigh ventilation during summer night (the project is made as an air tied "cocoon" out of any interaction with the outside conditions).
- No thermal simulation
- No opportunity to open windows, which are not justify by the team client by another sustainable goal (as acoustic level from outside for example)
- CFD (Computational Fluid Dynamics) simulations provided by the client team are feeding us to justify that the conception of the lobby is against any sustainable responsible project. In summer time, to insure a 24/27°C at the last floor, the ground floor is fully air conditioned at 18°C/19°C. It means that **it's colder in summer at the ground floor than in winter**. This is just a non-sense according to any sustainable process.

This kind of treatments of target n°08 will strictly be out of the certification process.

Goal n°09: Acoustic comfort

Absolutely no studies have been shown during interview, but during the visit, we could estimate the huge work done on internal façade to reach an extreme comfortable acoustic level in the lobby (use as working area as well). This is extremely well done in the project taking into account the

numerous of people working (secretaries are as well including in theses areas) and the numerous of floor link in the lobby.

For the rest of acoustic requirements in the HQE® certification, we trust the client team that a good to very good job has been done.

This kind of treatments of target n°09 will be at 80% fitting to the score TRES PERFORMANT of the French HQE® (very good) (additional document will have to be obviously given to justify the 100% of the TRES PERFORMANT scored level, but with negligible effort, this project could be a reference to treat acoustic in big open spaces).

Goal n°10: Visual comfort

This goal is out of the certification, mainly due to the conception of the glazed lobby, used as offices areas. It was obvious to see that a brand new building get conception problem for glare effect, as users added internal (and totally out of architectural conception) on specific areas to be able to work on their working stations.

We can note the positive points:

- windows conception, which are not facing direct sun
- daylight factor simulation have been done (we are questioning the “low” daylight factor results presented in lobby area, the client team think that this study was old and not the last one).
- Choice of light colours for indoor surfaces.
- Strict application of the code with 100% of work desk with view to outside

Behind theses “positives” points, it’s extremely hard to justify a daylight strategy in the project.

This kind of treatments of target n°10 will be out of the certification, due to lack of strategy to avoid glare and actions of the users to change the project (internal sun screen) to be able to optimise their daylight condition in a brand new project. We hardly guess that such actions by users can not be sustainable representative project certify by CSTB / CERTIVEA. Moreover, client team presented a daylight movie where daylight penetrations are clearly seen as coming deep in the lobby, and no actions have been done by the conception team. Behind the fact that glare effect were identified by this movie and Daylight factor simulation, it’s directly questioning the sustainable management of the project (out of movie and daylight simulations, actions should had modified the project, but no actions have been made).

Goal n°11: Smell comfort and Goal n°13: Healthy quality of air

Nota: theses 2 goals can be treated together, taking into account the similarities of requirements

It was extremely hard to understand filtration system quality and ventilation specification. We guess that out of interview and cost of the project that this goal can be scored in BASE

This kind of treatments of targets n°11 and N°13 will be at 100% fitting to the score BASE of the French HQE® (code level). Maybe with more information, the project could be reaching a PERFORMANT level.

Goal n°12: Healthy quality of spaces

As the client was absolutely not aware of French HQE® certification requirements, the client didn’t answer requirements of this goal. Strict application of Danish code is not enough to get the BASE level on this goal. It would be necessary that the client do, at least, some research on specific points. Due to this lack of process, we can not score this goal as BASE, but we exclude it.

This kind of treatments of targets n°12 is absolutely not fitting to the French requirement. The application of the Danish code can not allow reaching the BASE level. It will be quite an effort for the client to get the PERFORMANT level, but an acceptable effort to reach the BASE level.

Goal n°14: Water quality

It was extremely hard to understand how the project is working for this goal. For example, it took us some time to be sure that the 60°C are reached for the water to fight against legionel bacteria's.

With this lack of information, and in regard of the cost of the project, we reach the score BASE.

Conclusion Building n°01:

>>> Management system of the project: **NOT ACHIEVED**

- Absolutely no definition of sustainability in the project
- By two times, on crucial goals (energy, thermal comfort and daylight comfort) the client was aware of conception problems in the lobby (Energy and thermal comfort: CFD simulation showing the air conditioning problem between winter and summer – Daylight: the movie on daylight penetration in the lobby + daylight factor simulation) and no actions have been done to optimise the project, leading to actions token by the users to optimise their working conditions by their own (internal sun screen to avoid glare effect).

>>> Profile on the 14 HQE® goals:

Target	n°01	n°02	n°03	n°04	n°05	n°06	n°07	n°08	n°09	n°10	n°11	n°12	n°13	n°14
TRES PERFORMANT														
PERFORMANT														
BASE														

From our perspective, the building conception is not fitting to the HQE® process, too much effort would have to be done, from the beginning to be able to make this building suitable for a such certification. In other words, to reach HQE® process, the building conception by its own would be impacted (from architecture and engineering point of view).

Faneblad 8

HQE: Kriterieoversigt

De viste point bruges udelukkende til at afgøre om bygningen opnår ***Meget god*** (High Performance ”HP”). Til den første kategori omkring bygningens nærmiljø findes der også et begreb der hedder ***baggrundspoint***. Disse er ikke medtaget i oversigten.

Kategori/Kriterie	"HP" Point
1 The Relationship of the Building with its immediate Enviroment	20
1.1. Developing the plot for sustainable urban development	13
1.1.1. Ensure consistency between the development of the plot and the community's policy	0
1.1.2. Optimize entrances and manage flows	2
1.1.3 Control travel methods and encourage those which produce the least pollution for optimal functionality	7
1.1.4. Reserving/improving the ecological and landscaping quality of the site	4
1.1.5. Preserve/improve biodiversity	0
1.1.6. Integrating the management of rainwater and/or wastewater into the landscape.	0
1.2. Surrounding quality of outdoor spaces for users	4
1.2.1. Create a satisfactory outdoor climate ambience	2
1.2.2. Create a satisfactory outdoor climate ambience	0
1.2.3. Create a satisfactory visual ambience	0
1.2.4. Outdoor lighting	1
1.2.5. Provide healthy outdoor areas	0
1.2.6. Accessibility, well-being, and hospitality	0
1.2.7. Visual nuisances	1
1.3. The impact of the building on its vicinity	3
1.3.1. Ensure that neighbours have sun and light	0
1.3.2. Ensure that neighbours have views	0
1.3.3. Ensure neighbours' right to health	0
1.3.4. Ensure neighbours' right to calm	2
1.3.5. Limit nightly visual pollution	1
2 Integrated choices in Construction Products, Systems and Processes	55
2.1. Constructive choices for the sustainability and adaptability of the building	14
2.1.1. Consideration given to the building's adaptability over time based on its desired lifespan and usages	8
2.1.2. Adapt the construction choices to the building's lifespans	0
2.1.3. Consideration is given to the removability/separability of the construction products, systems, and processes	6
2.1.4. Choose products, systems, or processes whose characteristics are verified and compatible with the usage.	0
2.2. Construction choices to facilitate the maintenance of the building	6
2.2.1. Ensure that the building is easy to access for maintenance	3
2.2.2. Choosing construction products which are easy to maintain and limit the environmental impact of maintenance.	3
2.3. Choosing construction products in order to limit the environmental impact of the building	15
2.3.1. Be aware of how construction products contribute to the environmental impact of the building	6
2.3.2. Choosing construction products to limit their contribution to the environmental impact of the building	3
2.3.3. Use materials and products derived from the shortest and least-polluting supply lines	3
2.3.4. Use a minimal volume of wood	3
2.4. Choosing construction products in order to limit health impact	20
2.4.1. Be aware of the health impact of construction products with respect to indoor air quality (*)	15
2.4.2. Choose construction products to limit the health impact of the building	2
2.4.3. Know the emissions of fibres and particles of chemicals in contact with the air	0
2.4.4. Limit pollution through wood treatments	3
3 Low enviromental impact worksite	35

Kategori/Kriterie	"HP" Point
3.1. Optimizing the waste management of the worksite	19
3.1.1. Optimize the collection, sorting, and combination of the worksite's waste	2
3.1.2. Recycle the worksite's waste as well as possible, as appropriate for the existing local collection options, and ascertain the destination of the waste	13
3.1.3. Reduce worksite waste at the source	4
3.2. Limiting nuisances during the worksite	8
3.2.1. Limiting acoustic nuisances	5
3.2.2. Limit visual nuisances	0
3.2.3. Limit nuisances due to traffic	1
3.2.4. Limit nuisances due to dust, mud, and concrete slurry	2
3.3. Limiting pollution and the consumption of resources during construction work	8
3.3.1. Limit water and land pollution	3
3.3.2. Limit air pollution	1
3.3.3. Limit the consumption of resources	4
4 Energy Management	40
4.1. Reduce energy use through architectural design	2
4.1.1. Improve the ability of the outer surface to limit leaks	0
4.1.2. Improve the ability of the building to reduce its energy needs, in both summer and winter	0
4.1.3. Improve the air-permeability of the outer surface	2
4.2. Reduce primary energy consumption	32
4.2.1. Reduce primary energy consumption due to heating, cooling, lighting, DHW, ventilation, and support systems (depending on the type of building)	25
4.2.2. Use products or systems which are innovative or not accounted for by thermal regulation, which enable significant energy savings	2
4.2.3. Limit non-regulatory artificial lighting	0
4.2.4. Limit consumption by electromechanical equipment	1
4.2.5. Use of local renewable energy	4
4.3. Reduce the emission of pollutants into the atmosphere	6
4.3.1. CO2 equivalent quantities generated by the use of energy	2
4.3.2. SO2 equivalent quantities generated by the use of energy	1
4.3.3. Quantity of radioactive waste generated by the use of public electricity	1
4.3.4. Impact on the ozone layer	2
5 Water Management	50
5.1. Reduce drinking water consumption	20
5.1.1. Guarantee decreases in drinking water use in bathrooms	12
5.1.2. Guarantee drinking water savings for watering green spaces and cleaning the premises.	5
5.1.3. Limit water consumption in energy systems or systems characteristic of the uses of the building	3
5.2. Rainwater management on the plot	20
5.2.1. Seepage management: Watertightness coefficient	5
5.2.2. Retention management: Leakage flow after construction	10
5.2.3. Treatment of runoff	5
5.3. Wastewater management	10
5.3.1. Identify and pretreat the wastewater	0
5.3.2. Treat wastewater on-site	5
5.3.3. Recycle wastewater	5
6 Management of Activity-generated Waste	10
6.1. Optimize and recycle activity waste	7
6.1.1. Identify and classify the production of activity waste in order to optimally recycle them	0
6.1.2. Choose waste removal options with preference given to recycling them	4
6.1.3. Encourage waste sorting at the source	0
6.1.4. Encourage the recycling of activity waste at the source	3
6.2. Quality of the activity waste management system	3
6.2.1. Encourage waste management through appropriate design of waste areas/premises	0

Kategori/Kriterie	"HP" Point
6.2.2. Guarantee the health and safety of the waste areas/premises	0
6.2.3. Optimized activity waste flows	0
6.2.4. Guarantee the durability of the activity waste management system	3
7 Maintenance – Permanence of environmental performance	40
7.1. Maintaining the performance of the heating and cooling systems	12
7.1.1. Design the building so as to encourage maintenance/upkeep servicing during its operating phase.	3
7.1.2. Ensure that the equipment and systems are simple in design so as to facilitate maintenance and limit inconvenience caused to occupants during	0
7.1.3. Provide the resources needed to track and test the performance of heating/cooling systems while the building is its operating phase	9
7.2. Maintaining the performance of the ventilation systems	11
7.2.1. Design the building so as to encourage maintenance/upkeep servicing during its operating phase.	3
7.2.2. Ensure that the equipment and systems are simple in design so as to facilitate maintenance and limit inconvenience caused to occupants during maintenance tasks.	0
7.2.3. Provide the resources needed to track and test the performance of ventilation systems while the building is its operating phase	8
7.3. Maintaining the performance of the lighting systems	9
7.3.1. Design the building so as to encourage maintenance/upkeep servicing during its operating phase.	2
7.3.2. Ensure that the equipment and systems are simple in design so as to facilitate maintenance and limit inconvenience caused to occupants during maintenance tasks	0
7.3.3. Provide the resources needed to track and test the performance of lighting systems while the building is its operating phase	7
7.4. Maintaining the performance of the water management systems	8
7.4.1. Design the building so as to encourage maintenance/upkeep servicing during its operating phase.	2
7.4.2. Ensure that the equipment and systems are simple in design so as to facilitate maintenance and limit inconvenience caused to occupants during maintenance tasks.	0
7.4.3. Provide the resources needed to track and test the performance of water management systems while the building is its operating phase	6
8 Hygrothermic comfort	11
8.1. Architectural measures intended to optimize hygrothermic comfort in summer and in winter	3
8.1.1. Take the characteristics of the site into account (mainly summer)	0
8.1.2. Improve the building's ability to encourage good hygrothermic comfort conditions in both summer and winter	0
8.1.3. Combine together rooms with the same hygrothermic needs (summer or winter)	0
8.1.4. Handle midseason discomfort	3
8.2. Creating hygrothermic comfort conditions in winter	8
8.2.1. Set/achieve an appropriate (resulting) temperature level in the spaces	0
8.2.2. Ensure the stability of temperatures during occupancy periods (for intermittently used spaces)	3
8.2.3. Ensure air speed that does not harm comfort	4
8.2.4. Room temperature controlled by users during cold periods	1
9 Acoustic comfort	15
9.1. Optimize architectural measures taken to protect users from acoustic nuisances	0
9.1.1. Optimize the positioning of sensitive and highly sensitive spaces with respect to indoor nuisances	0
9.1.2. Optimize the positioning of sensitive and highly sensitive spaces with respect to outdoor nuisances	0
9.1.3. Optimize the shape and volume of the spaces in which internal acoustics are a challenge	0
9.2. Create an acoustic environment quality appropriate for the different rooms	15
9.2.1. Insulating group offices from the outside	3
9.2.2. Impact noise levels transmitted into group offices	0
9.2.3. Noise level of equipment in group offices	3
9.2.4. Internal acoustics of group offices	4
9.2.5. Insulate (receiving) group offices from aboveground noise coming from other (emitting) group offices and open spaces.	3
9.2.6. Walking noise in group offices	2

Kategori/Kriterie	"HP" Point
10 Visual comfort	30
10.1. Optimizing natural lighting	20
10.1.1. Have access to daylight in sensitive areas	5
10.1.2. Have access to outdoor views in sensitive areas	3
10.1.3. Have minimum natural lighting	10
10.1.4. Quality of natural light treatment	2
10.2. Comfortable artificial lightning	10
10.2.1. Have optimal light levels	0
10.2.2. Ensure the uniformity of the lightning	2
10.2.3. Avoid glare due to artificial lighting and seek out a balance between light sources from the surrounding light environment	0
10.2.4. Provide a comfortable quality of light emitted	8
10.2.5. Control of visual ambience by users	0
11 Olfactory comfort	15
11.1. Guarantee effective ventilation	10
11.1.1. Provide air flows suitable to the activity of the rooms	4
11.1.2 Prevent air leaks	2
11.1.3 Ensure the control of ducted air quality	0
11.1.4 Provide a healthy atmosphere in the spaces	1
11.1.5 Ensure optimal indoor air scavenging in the spaces	3
11.2. Control the sources of unpleasant odours and create a pleasant olfactory environment	5
11.2.1. Identify and reduce the effects of sources of odours	1
11.2.2. Treat foul-smelling waste in order to prevent odours from spreading	3
11.2.3. Provide a pleasant olfactory environment in the spaces	1
12 Health quality of spaces	10
12.1. Limiting electromagnetic exposure	3
12.1.1. Identify sources of electromagnetic emissions	0
12.1.2 Limit the impact of sources of electromagnetic emissions	3
12.2. Creating special health conditions	7
12.2.1. Create special health conditions	0
12.2.2. Optimize the health conditions of maintenance rooms	1
12.2.3. Encourage design that improves ergonomics in order to facilitate cleaning	1
12.2.4. Cheese materials that limit the growth of fungi and bacteria	5
13 Health quality of air	35
13.1. Guarantee effective ventilation	10
13.1.1. Provide air flows suitable to the activity of the rooms	4
13.1.2. Prevent air leaks	2
13.1.3. Ensure the control of ducted air quality	0
13.1.4. Provide a healthy atmosphere in the spaces	1
13.1.5. Ensure optimal indoor air scavenging in the spaces	3
13.2. Control sources of indoor pollution	23
13.2.1. Identify and reduce the effects of internal sources of pollution	0
13.2.2. Know the emissions of fibres and particles of products in contact with the air	0
13.2.3. Limit pollution through wood treatments	3
13.2.4. Prevent the development of bacteria in the air	3
13.2.5. Be aware of the health impact of construction products with respect to indoor air quality	15
13.2.6. Choose construction products to limit the health impact of the building	2
13.3. Control sources of outdoor pollution	2
13.3.1. Identify sources of outdoor pollution	0
13.3.2. Limit the entry of identified outdoor pollutants	0
13.3.3. Ensure pollution control	2
14 Health quality of water	15

Kategori/Kriterie	"HP" Point
14.1. Quality and sustainability of materials used in the indoor network	0
14.1.1. Choose materials that comply with regulations	0
14.1.2. Choose materials compatible with the nature of the water being distributed	0
14.1.3. Comply with pipeline implementation rules	0
14.2. Organization and protection of the indoor network	0
14.2.1. Provide structure and signs to the indoor network based on water usages	0
14.2.2. Separate the drinking water network and any non-drinking water networks (if non-drinking water is being used).	0
14.2.3. Protect the indoor network	0
14.3. Controlling the temperature inside the indoor network	9
14.3.1. Keep the DHW and DCW networks at an optimal temperature	1
14.3.2. Design the DHW network(s) so as to limit the risk of legionellosis	5
14.3.3. Check that the networks' temperatures are maintained	3
14.3.4. Handle burning hazards	0
14.4. Controlling treatments	4
14.4.1. Do not treat cold water intended for human consumption	0
14.4.2. Optimize the maintenance treatments of the indoor network	3
14.4.3. Manage the performance of treatments	1
14.5. Managing the health risk related to the recovery and reuse of non-drinking water on-site (if non-drinking water is being reused on-site).	2
14.5.1. Treating reused non-drinking water	2
14.5.2. Optimize the design of reused non-drinking water storage tanks	0

Faneblad 9

NCC oplevelse af LEED, BREEAM, DGNB og HQE

GENERELT

For alle systemerne gælder at der er behov for tilpasning til danske forhold. I den forbindelse er det hensigtsmæssigt at fastlægge en strategi for hvilke kriterier der tilpasses nationalt og hvilke der bevares som internationale kriterier. Nuværende praksis hvor landene i EU udformer energikrav efter nationale metoder, bør efter NCC opfattelse bevares i miljøcertificeringer, fordi den betyder at der ikke skal gennemføre supplerende, og dermed fordyrende, energiberegninger. For byggevarer anbefaler NCC derimod at tage udgangspunkt i miljø- og afgasningskriterier der anvendes internationalt, ex miljømærkning og Emicode.

Afprøvning af LEED og BREEAM har gjort det klart, at der er behov for at bringe kriterier for nærhed til offentlige transportmidler i overensstemmelse med det 600 meter opland der anvendes i dansk planlovgivning. Projektet i Vallensbæk er lokaliseret indenfor den danske 600 meter oplandszone, og fik derfor point i LEED der opererer med en 0,5 mile zone, men ikke i BREEAM der opererer med en 500 meter zone.

Nærhed til offentlige transportmidler er efter NCC opfattelse vigtig og vi anbefaler derfor en opdeling i serviceniveau A, B og C som funktion af afstand og antal afgange, jf. Håndbog om Miljø og Planlægning, s. 63, 2004. Point for nærhed til butikker, spisesteder og posthuse mener vi derimod ikke er relevant, når det handler om dansk kontorbyggeri. Danskere spise generelt ikke frokost uden for arbejdspladsen, regninger betales via e-bank og pakker leveres på hjemadressen om aftenen.

Afprøvningen viste, at nogle kriterier overholdes, fordi de er omfattet af almindelig god dansk praksis eller lovkrav, det gælder fx cykelstativer og affaldssortering. De kan derfor opfattes som ”nemme” point. Det er NCC opfattelse at når systemerne skal virke på tværs af landegrænser kan det ikke undgås at nogle point vil være omfattet af national god praksis og love.

LEED

Overordnet indtryk

LEED anvender amerikanske måleenheder og henviser til amerikanske ASHREA normer for energi og indeklima. Det medfører ekstra arbejde at oversætte disse til danske forhold. Der henvises desuden til amerikanske ordninger for miljøtilpassede byggematerialer, ex. FloorScore, det betyder at man enten skal finde byggematerialer der er omfattet af disse, alternativt skal produkterne igennem særskilte test og/eller ansøgning for at opnå denne godkendelse.

Projektet i Vallensbæk fik mange ”nemme” point for beliggenhed nær offentlig transport og butikker, fordi LEED opererer med en ”oplandsgrænse” der er større en i dansk lokalplanlægning. Der kan også opnås nemme point for p-pladser til biler der er miljøvenlige ifølge amerikanske kriterier og for cykel parkering. En ulempe ved ovennævnte point er at de ikke siger noget om kvaliteten af bygningen. Tiltag som reducerer forbrug af drikkevand belønnes desuden rigeligt med point, fx at man undlader vanding med drikkevand.

Hvad er positivt

- Tydelig sammenhæng mellem et tiltag og point gør det, på flere områder, nemt at kommunikere hvad tiltag, ex. regnvandsopsamling og cykelstativer, betyder for bygningens klassifikation.
- Udbredt og NCC har oplevet efterspørgsel fra både investorer og lejere på LEED.

Hvad er negativt

- Brugen af amerikanske energi- og indeklimanormer indebærer ekstraarbejde og omkostninger.
- Brugen af amerikanske kriterier for miljørigtige byggevarer kan give problemer med at fremskaffe disse, alternativt ekstra omkostninger til tests.
- Giver mange point pga. beliggenhed, cykelstativer, p-pladser til europæiske biler. Noget som ikke omhandler bygningen.
- Der opereres med præcise amerikanske regler for management af byggepladser, behov for dansk tilpasning.
- Certificeringsgebyr til USGBC er bekosteligt.

BREEAM

Overordnet indtryk

BREEAM Europe er tilpasset europæiske standarder på en række områder og der benyttes en offentlig tilgængelig engelsk www database til miljøvurdering af byggematerialer. Det gør det muligt at anvende ordningen allerede i dag.

Hvad er positivt

- Henviser til Europæiske standarder på en række områder.
- Den europæiske version indeholder allerede henvisninger til danske forhold.
- Tydelig sammenhæng mellem tiltag og point gør det, på en række områder, nemt at kommunikere hvad et tiltag, ex. regnvandsopsamling og cykelstativer, betyder for bygningens klassifikation.
- Fleksibel omkring metoder til miljøvurdering af materialer, muligt at anvende LCA værktøjer som alternativ til Green Guide.
- Udbredt og NCC har oplevet efterspørgsel fra både investorer og lejere på BREEAM.
- Certificeringsgebyr til BRE er prisbilligt.

Hvad er negativt

- Ved miljøvurdering af byggevarer kan der som alternativ til Green Guide anvendes LCA værtkøjer. Det er dog et problem at der henvises til engelske LCA værktøjer og ikke nogle ½som er gængse i resten af Europa.
- Det engelske krav om nærhed til station afviger fra dansk praksis, så der ikke opnås point for bygning der er lokaliseret godt efter dansk målestok.
- Der opereres med præcise engelske praksis for management af byggepladser, behov for dansk tilpasning.

DGNB

Overordnet indtryk af systemet

Bygningen opnåede ”silver”, hvilket er en relativ høj vurdering i DGNB. Det afspejler at bygningen er bedre end en tysk standardbygning. Det tyske system opleves mere videnskabeligt baseret end de øvrige på området, idet flere kriterier bygger på resultatet af en beregning med et særligt LCA værktøj.

Hvad er positivt

- Præcist og ensartet vurdering på stort set alle områder, blandt andet fordi der er krav om at alle anvender samme LCA og LCC værktøj.

Hvad er negativt

- Kræver rådgivere til udførelse af LCA og LCC vurderinger. Det betyder meromkostning til mindst 14 dages rådgivning.
- I forbindelse med projektudvikling vil LCA vurderinger forsinke beslutningsprocessen, mens man venter på resultatet af næste beregning.
- Svært for leverandører og kunder at koble fra projektændringer til betydningen for resultat, når der skal gennemføres en LCA beregning. LCA vurderingen er en black box for ikke fagfolk.
- DGNB er et nyt system fra 2009 og anvendt på under 100 tyske bygninger
- NCC oplever ikke efterspørgsel fra hverken investorer eller lejere.

HQE

Overordnet indtryk

Der er ikke udleveret en rapport fra afprøvningen af HQE, og under gennemgangen blev der ikke systematisk samlet op på hvilke HQE kriterier bygningen kan overholde. Det gør det vanskeligt for NCC at give en tilbundsgående vurdering af systemet. Men enkelte oplevelse kan fremhæves.

Hvad er positivt

- Har en god procestilgang, hvor auditor involveres tre gange, startende med programfase, over projekteringen, og endelig i en gennemgang af den færdige bygning.
- HQE er det eneste system der stiller krav om at sikre drikkevandkvalitet. Det vides at ukritisk brug af armaturer og fittings kan forringe vandkvaliteten.

Hvad er negativt

Det blev ved afslutningen af gennemgangen oplyst at bygningen ikke kan certificeres efter HQE på grund af for få indsatsområder. Det er for ambitiøst at der skal være tre forbedringsområder, for at blive certificeret. Men det er muligvis et spørgsmål om at det ikke blev klart kommunikeret hvad der forstås ved forbedringsområder.

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NOTAT

Workshop vedr. måling af bæredygtighed

18.05.2010

Projekt: Horten firmadomicil
Bygherre: Carlsberg Ejendomme

Notat: 01
Kunde: Byggeriets Evalueringscenter

Tilstedeværende

Rådgivere
Arkitekt: Sune Mogensen, 3XN
Ingeniør: Birthe Lindegaard, Rambøll
Entreprenør: Pihl – var ikke til stede ved nogle workshops

Derudover var Byggeriets Evalueringscenter og SBI repræsenteret med flere personer samt assessorerne.

Overordnet indtryk samt forudsætninger

Der blev afholdt workshops med de 4 systemer LEED, BREEAM, DGNB og HQE, som forløb over en – to dage. Den første workshop blev afholdt på øvre mødeetage i Horten bygningen, hvilket gav assessoren et godt indtryk af bygningen og underbyggede vores/ rådgivernes data til gavn for indbyrdes forståelse. Det var interessant at høre hvordan bygningen og dansk byggeri i det hele taget blev opfattet af de udenlandske assessorer - med særlig fokus på bæredygtighed.

Som energimæssig målsætning var den fra start tænkt, som en bygning, der skulle holde sig 10 % under BR-krav for standard kontorbyggeri. Der er i designprocessen gjort yderligere tiltag, som bidrager til bæredygtighed i det omfang det var muligt. Fokus har imidlertid været på særligt godt indeklima og gode materialer, som til dels også honoreres i de forskellige systemer. Bygningen har til formål at afspejle dens brugere mest muligt, hvorfor Horten og dennes lejerådgiver, Site Arkitekter, tidligt har været inkluderet i programmeringen. Carlsberg Ejendomme hyrede i 2006, 3XN til at tegne en bygning på deres grund i Hellerup, hvorfor der ikke har fundet en arkitektkonkurrence sted forud for byggeriet, hvilket nogle systemer straffer.

Overordnet fik man det indtryk, at Horten bygningen vil kunne certificeres i de fleste systemer. Det egentlige resultat skal man nok ikke tillægge for meget værdi, da det i højere grad er et udtryk for den pågældende assessors vurdering og vilje til at tilegne danske standarder til det enkelte certificeringssystem.

Jeg synes der bør knyttes en kommentar til den manglende information vedr. forventet udførelse af dette notat. Hvis denne information var givet indledningsvis ville vi, som rådgivere og repræsentanter, have haft bedre forhold for, at lave denne evaluering med fokus på forskelle i de 4 systemer samt anvendelighed i dansk regi.

De fire certificeringssystemer

LEED v. John Boecker fra 7 Group

Det var tydeligt, at John Boecker har været med til at udvikle LEED og er meget engageret i systemet og dets formåen til at flytte byggeriets fokus mod bæredygtighed. Det faktum at workshoppen foregår i selve Horten bygningen, var et godt udgangspunkt, hvor evt. tvivlspørgsmål kunne opklares ved simpelthen at iagttage omgivelserne. Han var god til at slå ned på de steder, hvor bygningen kunne tolkes iht. LEED og hurtigt gå forbi de punkter, hvor det blev for "amerikansk". En spændende og lærerig workshop.

Særligt positive forhold:

- Assessorens viden om LEED certificering og ambitioner hermed
- Overskuelig evaluering ift. opnåelige points, hvis man fra starten gik efter LEED certificering
- Mulighed for bonuspoint for særligt gode tiltag indenfor eksisterende kriterier! (GODT)

Særligt negative forhold/ "Credits" – bør tilpasses danske forhold:

- Ikke tradition for 3. parts firma ("commissioning") i DK, i samme grad som i USA.
- Energirammen er væsentlig lavere i DK end i USA.
- Fjernvarme er udbredt i DK men ikke i USA, hvilket afspejler sig i systemet.
- Afstandsbegrebet ift. at bruge "ressourcebesparende materialer" er et andet i USA end i DK.

BREEAM v. Elaine Harvie og Jeremy Cruickshank fra Arup

Det faktum, at workshoppen foregik i en anden bygning, var udslagsgivende ift. at vurdere konkrete tvivlsspørgsmål, som det var muligt med LEED. Vi som rådgivere og repræsentanter gjorde tydeligt opmærksom herpå. Workshoppen foregik med en meget slavisk gennemgang af systemet, hvilket medførte at det samlede indtryk nærmest druknede i opslag og sammenligninger og man kom ligesom ikke ind under huden på BREEAM systemet. Det efterlod dog en højere grad af sammenlignelighed med danske standarder end det var tilfældet med LEED.

Særligt positive forhold:

- Virker overordnet som om, systemet kan tilpasses danske forhold med mindre justeringer.

Særligt negative forhold/ "Credits" – bør tilpasses danske forhold:

- Ikke tradition for 3. parts firma ("commissioning") i DK, i samme grad som i US (som LEED)
- The Green Guide: et kæmpe opslagsarbejde, som virker meget omstendigt. Konstante opdateringer vil medføre store bureaukratiske følger og omkostninger.

DGNB v. Anna Braune og Maximilian Martin m.fl. fra PE International

Det faktum, at workshoppen foregik i en anden bygning, var udslagsgivende ift. at vurdere konkrete tvivlsspørgsmål, som det var muligt med LEED. Vi som rådgivere og repræsentanter gjorde tydeligt opmærksom herpå. Workshoppen, som foregik over 2 dage, afspejlede i høj grad den forventede tyske grundighed og var præget af en i bund gående analyse af bygningen. Det var tydeligt at PE International

var vant til analysere en bygning efter opførelse og havde 4 delegerede til opgaven. Efterfølgende efterspurgte de mange supplerende oplysninger.

DGNB lægger for mig at se, for meget vægt på bygningens livscyklus, som jeg mener ikke har så stor relevans, fordi den teknologiske udvikling med al sandsynlighed, vil medføre at nye ressourcebesparende processer (for både drift og genanvendelse af materialer) vil se dagens lys og at certificeringen dermed forældes hurtigere.

Særligt positive forhold:

- Virker overordnet som om, systemet kan tilpasses danske forhold men der bør indgå en løbende opfølgning fra det auditerende firma, for at opnå det bedste resultat.

Særligt negative forhold/ "Credits" – bør tilpasses danske forhold:

- 3 kategorier (guld, sølv og bronze) er for mig at se, for få!
- Pkt. 3.3 Brugbare arealer/ "Area efficiency" vurderes forkert
- Pkt. 3.3 "Art and design" har ikke nogen relevans ift. dets givne kriterier
- Generelt en uoverskuelig evaluering ift. de øvrige systemer.
- Bygningens livscyklus vægtes for højt.

<u>HQE v. Arnaud Billard fra Transsolar</u>

Det faktum, at workshoppen foregik i en anden bygning, var udslagsgivende ift. at vurdere konkrete tvivlsspørgsmål, som det var muligt med LEED. Vi som rådgivere og repræsentanter gjorde tydeligt opmærksom herpå. Arnaud Billard indledte med en hævet pegefinger og anfægtede at Pihl som totalentreprenør slet ikke var til stede, samt at rådgiverne i øvrigt var underrepræsenteret i forhold til det bemandingsniveau som HQE normalt arbejder med. Det virkede som om han ikke var ordentligt oplyst omkring parametrene for denne fiktive evaluering af bygningerne.
Han fokuserede meget på de tekniske installationer og de efterfølgende energimæssige konsekvenser. Faktisk anfægtede han den energirammeberegning som var udført og efterfølgende kontrolleret og godkendt af en ekstern dansk energikonsulent. (Det bliver spændende at se hvad energiregnskabet lyder på).

Særligt positive forhold:

- En meget objektiv vurdering (energimæssigt) af bygningen, fra én som arbejder med store projekter, hvis klare mål er at bruge ressourcebesparende energimæssige løsninger.

Særligt negative forhold/ "Credits" – bør tilpasses danske forhold:

- Assessoren syntes ikke helt bevidst om sin rolle i denne "fiktive certificering".
- Det syntes ikke muligt for HQE, at vurdere bygningen på linje med de andre systemer.
- Man fik ikke et reelt indblik i HQE systemet og dets egentlige formåen.

Med venlig hilsen

Sune Mogensen
3XN Arkitekter

NOTAT

Projekt	**Workshop vedr. måling af bæredygtighed**
Kunde	**Byggeriets Evalueringscenter**
Notat nr.	**01**
Dato	**2010-04-19**
Til	**Peter Hesdorf, Simon Mortensen**
Fra	**Birthe Lindegaard (BIL)**

Vurdering og synspunkter i forbindelse med deltagelse i workshops vedr. udenlandske certificeringsordninger for bæredygtigt byggeri

Dato 2010-04-19

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1. Generel vurdering

1.1 Forudsætninger

Carlsberg Ejendomme har som bygherre bedt arkitektfirmaet 3XN om at tegne et nyt domicil til Horten advokater. Der er således ikke afholdt arkitektkonkurrence, hvilket flere af systemerne straffer.

Horten advokater har sammen med lejerådgiver Site Arkitekter og Søren Jensen Rådgivende Ingeniører været med under hele projekteringen.

Rambøll har projekteret alle ingeniørydelser - først for Carlsberg Ejendomme - senere for totalentreprenøren Pihl, som har forestået projekteringsledelse og udførelse af byggeriet.

Projekteringen er udført i perioden 2007-2008 og byggeriet er afleveret til indflytning 2009-11-01.

BR08 er gældende og energirammen er 100 kWh/m^2 pr. år.
Det aktuelle energiforbrug er beregnet til 91 kWh/m^2 pr. år svarende til 9 % under energirammen.

Bygningen er energimærket til klasse B.

Det er væsentligt at bemærke, at det ikke i byggeprogrammet har været et krav, at Horten skulle være et bærebæredygtigt byggeri, men fokus er især lagt på arkitektur, funktion og valg af gode materialer.

Rambøll Danmark A/S
CVR-NR 35128417

Medlem af FRI

Udformning af den facetterede facade beklædt med Travertin er unik og meget dyr, og har givet hele projektteamet store udfordringer. Megen energi er brugt på at finde innovative løsninger omkring facadens udformning og funktion, herunder tilslutninger og tæthed.

1.2 Overordnet indtryk af systemerne

Der er afholdt workshops med 4 forskellige systemer LEED, BREEAM, DGNB og HQE.

Fra 3XN deltog Sune Mogensen, fra Rambøll deltog Birthe Lindegaard. Totalentreprenør Pihl deltog ikke.
Endvidere deltog Byggeriets Evalueringscenter og SBI med flere personer.

Alle workshops foregik i en god positiv stemning og det var interessant at høre noget om byggeforholdene i de andre lande. Vi havde nogle gode diskussioner om, hvad der er rådgivningspraksis og god byggeskik i de forskellige lande**.**

Flere punkter kunne dog ikke besvares, fordi entreprenøren Pihl ikke var til stede ved nogen af de fire systemer. Vi var heller ikke i besiddelse af drifts- og vedligeholdelses manual for byggeriet, og derfor måtte spørgsmål omkring driften og brugernes oplevelser af huset besvares med vores antagelser, der ikke kunne dokumenteres.

Vedr. håndtering af affald i byggefasen og recycling af materialer måtte vi også henvise til normal praksis i Danmark, men kunne ikke dokumentere, om Pihl havde opfyldt dette. Bedste udsagn var nok, at NCC som var entreprenør på kælder og Punkthusene havde oplyst, at Pihl havde en meget velordnet byggeplads og havde styr på logistik og sikkerhed på pladsen.

Vedr. materialer kunne vi ikke f.eks. ikke oplyse hvilken maling, der aktuelt er blevet anvendt, men kun fortælle hvad projektet foreskriver. Ved en totalentreprise har entreprenøren mulighed for at optimere på de enkelte materialer.

På hver workshop synes jeg, vi brugte megen tid på at forklare generelt om Horten byggeriet. Personligt krævede det stor koncentration at forstå, bearbejde og besvare de stillede spørgsmål, så der ikke blev for megen spildtid.

Det synes derfor ikke umiddelbart indlysende, hvilke fordele og ulemper de forskellige systemer giver, og et samlet overblik er svært for mig at opnå.
Overordnet synes jeg systemerne ligner hinanden meget, og kan nok alle med en vis tilpasning overføres til danske forhold.

BREEAM eller DGNB synes dog nok at være de bedst tilgængelige til danske forhold. DGNB kræver vældig meget dokumentation omkring de anvendte materialer og der skulle efterfølgende udføres mængdeberegninger af de forbrugte materialer f.eks. beton og stål. Der lægges meget vægt på recycling af materialer og LCA vurderinger.

Det er min opfattelse, at det med en rimelig ekstra omkostning og en målrettet indsats vil være forholdsvis let at opnå en certificering af et byggeri i høj kvalitet som Horten.

Horten byggeriet opnåede således også en pæn score i de 3 systemer - mens det ikke ville kunne certificeres af det franske system.

Det er vigtigt at tænke bæredygtighed ind i projekterne allerede på konkurrencetidspunktet. Med en rimelig ekstra omkostning for bygherren kan bygningen forventes at blive certificeret alt efter hvor højt overliggeren sættes i Danmark.

Det kræver dog ekstra indsats hos rådgivere og entreprenører, hvis alt skal kunne dokumenteres, så bygningen kan certificeres, så det må nødvendigvis øge de samlede byggeomkostninger - herunder også honorarudgiften.

2. Amerikanske system LEED

Workshop 20. januar kl. 8.30-17.00 + 21. januar 2010 kl. 8.30-14.00 i Horten bygningen

Workshoppen blev afholdt af 1 person: assessor John Boecker fra 7 Group fra Pennsylvania USA.

John var en levende fortaler for systemet og lavede en god - men noget show præget og lidt provokerende - introduktion til systemet. John har sit eget firma og er dermed direkte engageret i systemet og sidder også i bestyrelsen for LEED.

Denne workshop blev afholdt i selve Horten bygningen, hvilket gav et godt indtryk af bygningens udformning og funktion og helt klart gjorde workshoppen mere levende og interessant.

Der viste sig store forskelle i de byggetekniske forhold i USA og DK, og der var mange punkter, hvor vi ikke umiddelbart kunne bruge systemet direkte overført til danske forhold. Danmark synes længere fremme ift. energi- og ressourcebesparende foranstaltninger end visse dele af USA.

John Boecker bad ikke om at få tilsendt skriftlig dokumentation på de ting han spurgte om, og derfor virkede selve certificeringsøvelsen måske i dette tilfælde ikke så grundig som f. eks. Det tyske system DGNG.

Ved en aktuel certificering skal projektmateriale fremsendes i flere tempi:

- Byggeriets designfase - foreløbig udgave og endelig udgave
- Byggeriets udførelsesfase – foreløbig udgave og endelig udgave

En reviewer ser på alle designdata i projektforslaget og efter en måneds vurdering modtages kommentarer. Projektteamet har herefter 30 dage til at komme med supplerende oplysninger.
LEED giver mange point for alternativ energi, hvilket ikke er så attraktivt i Danmark, hvor vi i byområder som oftest tilbyder fjernvarme baseret på affaldsforbrænding.

LEED focuserer på høj grad af genbrug i materialer.
Afstand til producent af materialer højst 800 km, hvilket nok for stor afstand i Europa.

Måling af luftkvalitet f.eks. CO_2 og formaldehyd giver point, men det gøres normalt ikke i DK.

Horten bygningen opnåede 52 points ud af 110 mulige - svarende til kategori sølv.

3. Britiske system BREEAM

Workshop 29. januar 2010 kl. 9-17 i REGUS bygningen Tuborg Syd.

Workshoppen blev afholdt af 2 personer: Elaine Harvie og Jeremy Cruickshank fra ARUP, Cardiff, GB.

Denne workshop blev ikke afholdt i selve Horten bygningen, men i et møderum hos REGUS, hvilket generelt gjorde helhedsindtrykket mere kedeligt. Assessorerne var ikke direkte engageret i systemet, men auditerer systemet via deres ansættelse hos ARUP.

Vi besigtigede Horten bygningen udefra og inde fra receptionsområdet.

Der lægges meget vægt på extern commissioning. Det danske rådgiversystem er ikke er så klart adskilt, men tilsyn udføres også typisk af personer fra projektteamet eller andre personer fra samme firma.

BREEAM spurgte til, om det er muligt at måle energiforbrug på lys og ventilation særskilt. Det er ikke normalt at gøre det i DK, det ville have krævet flere bimålere på systemet.

BREEAM arbejder med en green guide, hvor alle materialer er kategoriseret og bliver tildelt point efter bæredygtighed. Det er et stort arbejde at slå alle materialer op i kataloget.

I BREEAM kommer en assessor ud og gør arbejdet mens man i LEED sender projektmaterialet ind til vurdering.

4. Tyske system DGNB

Workshop 3. februar + 25. februar 2010

Workshoppen blev afholdt af 4-6 personer: ledet af Anna Braune, Jan Poulsen, Maximilian Martin og Larisa Maya.

Denne workshop blev ikke afholdt i selve Horten bygningen, men i et møderum hos REGUS, hvilket generelt gjorde helhedsindtrykket mere kedeligt. Assessorerne var ikke direkte tilknyttet systemet, men auditerer systemet via deres ansættelse hos PE International.

Vi besigtigede Horten bygningen udefra og inde fra receptionsområdet.

DGNB deltager så vidt jeg forstod, ikke i selve byggeprocessen men certificerer bygningen efter opførelsen.

Workshoppen var meget grundig og forløb over 2 dage med et par ugers mellemrum. Der blev efterspurgt supplerende oplysninger om materialeforbrug og livscyklus LCA analyser.

Horten bygningen opnåede 62 % ud af 100 % - svarende til kategori bronze.

5. Franske system HQE

Workshop 4. marts. Kl. 13-17 og 5. Marts kl. 8.30–17 REGUS bygningen Tuborg Syd.

Workshoppen blev afholdt af 1 person: Arnaud Billard fra TRANSSOLAR Energietechnik GmbH Tyskland.

Denne workshop blev ikke afholdt i selve Horten bygningen, men i et møderum hos REGUS, hvilket generelt gjorde helhedsindtrykket mere kedeligt.

Assessoren repræsenterede et rådgivende firma TRANSSOLAR, der rådgiver omkring energi og bæredygtighed. Han var således meget focuseret på de energimæssige problemstillinger og de aktuelt valgte tekniske løsninger – måske mere end han var engageret i selve HQE systemet.

Vi besigtigede Horten bygningen udefra og inde fra receptionsområdet.

HQE skriver kontrakt med bygherre/ejer fra projektets start og fungerer som sparringspartner i processen ved valg af løsninger.

Der laves 3 konsultationer i byggeperioden af den samme assessor:

- byggeprogram, der foreskrives og planlægges
- projektmaterialet, der granskes og optimeres på projekterede løsninger
- efter udførelse, der checkes og dokumenteres

Arnaud Billard havde megen kritik af, at entreprenøren Pihl ikke deltog i workshoppen og sagde, at han slet ikke ville have auditeret hvis det havde været tilfældet ved en virkelig audit.

Det er en fordel at systemet indarbejdes så tidligt som muligt i byggeprocessen, men der kan nemt blive sammenfaldende interesser mellem rådgivning og audit.

Arnaud kritiserede bygningen med de store atriefacader uden solafskærming og deraf stort kølebehov, ingen brug af solceller eller lign. For megen fokus på arkitektur på bekostning af bæredygtige tiltag. Det var Arnauds vurdering, at Horten bygningen ikke kunne opnå certificering. Dette er dog ikke dokumenteret med oversigt over resultatet men på Arnauds oplevelse af den udførte HQE audit.

Med venlig hilsen
Rambøll

Birthe Lindegaard