Research Centre on
ZERO EMISSION
NEIGHBOURHOODS
IN SMART CITIES

NTNU SINTEF

BREEAM COMMUNITIES & ZEN DEFINITION AT A GLANCE

A Qualitative comparison and what we can learn

ZEN MEMO No. 56 – 2024

Giulia Vergerio, David Collins | NTNU

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BREEAM Communities and ZEN Definition at a glance. A qualitative comparison and what we can learn.

Keywords: ZEN Definitions, BREEAM Communities, Performance assessment scheme, Sustainability assessment scheme, Key Performance Indicators, toolkit, quatification and measurement, operational phase.

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https://fmezen.no

Preface

Acknowledgements

This memo has been written within the Research Centre on Zero Emission Neighbourhoods in Smart Cities (FME ZEN). The authors gratefully acknowledge the support from the Research Council of Norway, the Norwegian University of Science and Technology (NTNU), SINTEF, the municipalities of Oslo, Bergen, Trondheim, Bodø, Bærum, Elverum and Steinkjer, Trøndelag county, Norwegian Directorate for Public Construction and Property Management, Norwegian Water Resources and Energy Directorate, Norwegian Building Authority, ByBo, Elverum Tomteselskap, TOBB, Snøhetta, AFRY, Asplan Viak, Multiconsult, Civitas, FutureBuilt, Heidelberg Materials, Skanska, GK, NTE, Smart Grid Services Cluster, Statkraft Varme, Fornybar Norge and Norsk Fjernvarme.

The Research Centre on Zero Emission Neighbourhoods (ZEN) in Smart Cities

The ZEN Research Centre develops solutions for future buildings and neighbourhoods with no greenhouse gas emissions and thereby contributes to a low-carbon society.

Researchers, municipalities, industry and governmental organizations work together in the ZEN Research Centre to plan, develop and run neighbourhoods with net zero greenhouse gas emissions over their lifetime. The ZEN Centre has nine pilot projects spread over all of Norway that encompass an area of more than 1 million m2 and more than 30,000 inhabitants in total.

To achieve its high ambitions, the Centre will, together with its partners:

- Develop neighbourhood design and planning instruments while integrating science-based knowledge on greenhouse gas emissions;
- Create new business models, roles, and services that address the lack of flexibility towards markets and catalyze the development of innovations for broader public use; This includes studies of political instruments and market design;
- Create cost-effective and resource and energy-efficient buildings by developing low-carbon technologies and construction systems based on lifecycle design strategies;
- Develop technologies and solutions for the design and operation of energy-flexible neighbourhoods;
- Develop a decision-support tool for optimizing local energy systems and their interaction with the larger system;
- Create and manage a series of neighbourhood-scale living labs, which will act as innovation hubs and a testing ground for the solutions developed in the ZEN Research Centre. The pilot projects are Furuset in Oslo, Fornebu in Bærum, Sluppen and Campus NTNU in Trondheim, Ydalir in Elverum, Campus Evenstad, Campus Mære, Ny by- Ny flypass Bodø, and Zero Village Bergen.

The ZEN Research Centre will last eight years (2017-2024), and the budget is approximately NOK 380 million, funded by the Research Council of Norway, the research partners NTNU and SINTEF, and the user partners from the private and public sectors. The Norwegian University of Science and Technology (NTNU) is the host and leads the Centre together with SINTEF.


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Summary

Learning across BREEAM Communities and ZEN definition

A significant effort in ZEN has been put into defining what to measure to define a neighbourhood as 'zero emission' through the identification of assessment criteria and Key Performance Indicators (KPIs), whose final version will be published in 2024 in the ZEN Definition and guideline reports. Less was said, beyond the pilot projects, in terms of how to achieve the goals that the ZEN criteria and KPIs represent. Thus, it is now important to define some process recommendations in this sense. This is a reason why, in this memo, we investigate the similarities and differences between BREEAM (i.e., BREEAM Communities, named BREEAM-C) and ZEN (i.e., ZEN Definition) to understand how the BREEAM thinking can help us in doing so and what would it take for the industry, which is very familiar with BREEAM, to align with ZEN Definition vision.

ZEN is more concerned about quantification, measurement and LCA methodology, while BREEAM-C is largely bonded to the definition of strategies and commitment actions.

Through this memo, after presenting the two schemes in their most recent publicly available forms, we learn that the BREEAM-C and ZEN Definition show both similarities and differences. They are both structured as several issues (in BREEAM-C) or criteria and KPIs (in ZEN) grouped into 6 categories, which are areas of performance to be addressed. They both have a system of credits/points to rate communities/neighbourhoods. However, unlike BREEAM-C, ZEN will not have one score, but rather a rate per each category (i.e., 'Emissions', 'Energy', 'Power', 'Mobility', 'Urban form and Land use', 'Economy'). While BREEAM-C specifies when the issues should be addressed (among 3 steps, namely principle's establishment, layout's definition, and detailed design), ZEN defines the scale of application of the KPIs (building, district or both) and KPIs are not finally and systematically allocated to specific project steps, but most of them are defined as valid for both strategic planning, implementation, and operational phase, which can be targeted for performance assessments. However, as the ZEN Definition is still in progress, there is no final indication of by whom and in which project steps the KPIs must be addressed.

When comparing the schemes at the individual issues and KPIs level, we observed that half of the BREEAM-C issues show similarities with ZEN KPIs in terms of their motivation or scope/focus. The similarity is rarely one to one. This is both because BREEAM-C issues have broad scope and because ZEN KPIs are specific in saying what to measure, and the actions that a BREEAM-C issue suggests are directly reflected in more than one quantitative metric. Indeed, ZEN generally focuses more on saying what to measure and how, while BREEAM-C tends to describe subsequent actions to take and document to ensure that the aims are secured. This approach is also reflected in the way the credits/points are awarded.

More BREEAM thinking in ZEN would translate into the definition of practical actions to ensure that the objective that ZEN criteria and KPIs advocate can be operationalized. For instance, actions that BREEAM-C issues similar to ZEN KPIs entail can be grouped into 3 areas: 'Anticipate', 'Plan and Manage', and 'Secure' actions.

More ZEN thinking would require the industry players to be more focused and specific about environmental impacts. Indeed, in ZEN, a huge focus is on quantifiable environmental impacts. Methodological guidance is important, and in ZEN the LCA methodology is the backbone. A great ambition that makes ZEN, as a district-level assessment scheme, special is the possibility to target the operational phase as one of the stages where ZEN criteria and KPIs are assessable, which is not currently within the scope of BREEAM-C.

In essence, the creation of Zero Emission Neighbourhoods is a collaborative effort that requires both precise definitions and flexible toolkits. The ZEN definition, with its focus on specific KPIs, and the BREEAM-C certification, with its broad scope and systematic allocation of issues, together build a synergy that will be instrumental in driving progress towards more sustainable communities.

Contents

1. Introduction

The Research Centre on Zero Emission Neighbourhoods in Smart Cities (ZEN Research Centre) has the goal to enable the transition to a low-carbon society by developing sustainable neighbourhoods with net zero greenhouse gas (GHG) emissions. Clear definitions - including assessment criteria and Key Performance Indicators (KPIs) - , implementation guidelines, KPIs assessment tools, and pilot projects are of key importance to achieve this goal [1]. Accordingly, the Research Centre defines several criteria that should characterize a ZEN, and the related KPIs to assess them. Criteria and KPIs are organized into a 'ZEN KPI tool framework' that gives guidance in operationalizing ZEN Definition within the ZEN pilot projects. Within this framework, an ambition is developing guidelines to support a ZEN process in current and future urban developments that wish to become ZEN. Indeed, it was observed that in ambitious projects there is often a discrepancy between goals and actual delivery [2]. Thus, if the ZEN criteria and KPIs represent the goals of a ZEN development, their actual achievement can be at risk, and recommendations for following up on them are needed.

BREEAM schemes were initially developed to set more ambitious environmental goals for the industry than what is recommended by regulations. Besides environmental ambitions, the BREEAM schemes are still chosen by owners for increasing the market value of the final product, and the construction industry appreciates the measurability of the goals that they provide and the guidance that is given on how to achieve them. Indeed, BREEAM can be considered not only as a collection of subgoals, but also as a method to achieve them, and BREEAM is rebranding itself as such, especially given that the regulations are themselves getting more and more demanding in terms of environmental requirements, especially in Norway, making BREEAM not particularly useful if it were exploited only as a tool to raise ambitions. Accordingly, BREEAM-NOR and BREEAM-Communities (BREEAM-C) are acknowledged as tools in the ZEN toolkit that can help address process-related aspects of the ZEN Definition [1], and, as a sustainability scheme, BREEAM-NOR (among others) has already been compared to FME ZEN in terms of scope, similarities, limitations, and advantages [3].

So far, a significant effort in ZEN Research Centre has been put into defining what to measure (ZEN criteria and KPIs) to define a neighbourhood as 'zero emission', but less was said, beyond the pilot projects, in terms of how to achieve the goals that the ZEN criteria and KPIs represent. Thus, it is now important to define some process recommendations in this sense. This is a reason why, in this report, we investigate the similarities and differences between BREEAM (specifically BREEAM-C, for its focus on communities) and ZEN (i.e., ZEN Definition and related metrics) to understand how the BREEAM thinking can help us in doing so and what would it take for the industry, which is very familiar with BREEAM, to align with ZEN Definition vision.

The reader should note that the analysis reported here is based on the latest publicly available ZEN Definition and guideline reports [1, 4], but the final version of those will be published in 2024. Furthermore, we acknowledge the difference in the mission of FME ZEN Research Centre and BREEAM. However, we respect the relevance of BREEAM as an organization to have a debate with, since it is well-recognized, long-lived, rich in resources and expertise, and enriched by a long learning process in their work of developing sustainability schemes.

In the rest of the report, we introduce BREEAM-C and ZEN Definition in brief (chapter 2) and we present the results from a qualitative comparison between the two in terms of structure and by 'issues', in BREEAM-C, versus ZEN KPIs, focusing on their purpose as part of an assessment scheme as defined by BREEAM and ZEN (chapter 3). Differences and similarities are discussed (chapter 4) to extract lessons, which are summarized in the end (chapter 5).

2. BREEAM-C and ZEN Definition

In this chapter, both BREEAM-C and ZEN Definition are summarized, in their latest publicly available forms, in terms of what they are, what purpose they pursue, what is their target and how they work. Their structure as assessment schemes is also illustrated in figures.

2.1. BREEAM-C

What is it?

BREEAM-C can be defined as "(…) environmental, social and economic performance standard against which large scale developments in the UK and internationally (...) can be assessed, rated and certified." [5]. It is based on a scheme of issues (and related credits and weighting) that large-scale implementations should target. The application of the scheme is performed by a certified assessor with the support of a dedicated manual and tool. The methodology is in continuous development. In this report, we refer to the version presented in "Manual 2012" [5], dated August 2017.

Which mission does it pursue?

It aims to support the design and assessment of big developments, including master planning, across different life cycle stages to increase their sustainability level in a holistic sense. Indeed, it is the result of a commitment of BREEAM to widen the group of stakeholders involved in the development of well-established BREEAM environmental certification schemes.

What is the target?

As specified in the manual, BREEAM-C scheme is not suitable for all type of developments, but if the latter has opportunities for shared solutions and have a strong impact on existing communities and demand for services and infrastructure, then the deployment of the scheme would most likely bring additional value. In line with the BREEAM philosophy, the scheme is in a form that is very easy to receive by the industry. However, as mentioned above, the Communities release of BREEAM aims at widening the group of stakeholders involved in the BREEAM environment.

How does it work?

The balanced scorecard approach of tradable credits typical of BREEAM schemes is expanded to a broader concept of sustainability, including social and economic impacts. The scheme must be deployed by an accredited assessor with the support of the manual and tool.

In its latest form, the scheme is based on 40 assessment issues (with related credits and weights) grouped into 5+1 categories (reflecting the aims of the scheme):

- Governance
- Social and economic well-being
- Resources and Energy
- Land use and ecology
- Transport and movement
- (Innovation)

considered across three development steps. 27 out of the 40 issuers require some form of consultation with community representatives and other stakeholders.

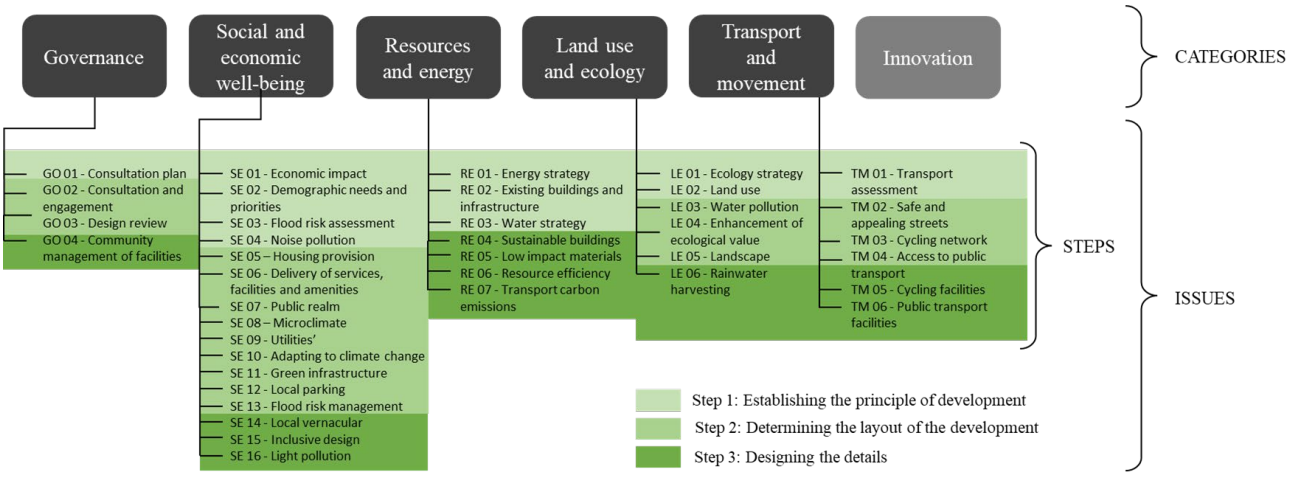

Figure 1 – Structure of BREEAM-C.

The three development steps considered as part of the assessment of sustainability at the master planning level are:

- Step 1: Establishing the principle of the development.
- Step 2: Determining the layout of the development.
- Step 3: Designing the details.

Site selection is not included because it is to a large extent decided by local planning authorities, developers, and landowners. Post-construction certification is also not included at present.

The assessment process consists of awarding the available credits per issue depending on whether the requirements, as described in the manual, are met. The number of obtained credits in each issue is divided by the total credits available and multiplied by the percentage weighting of the issue to obtain a score. Percentage weightings are pre-defined in the scheme in such a way that the total for all issues equals 100%. The total score for the project corresponds to the sum of all the scores obtained in all 40 issues across the 5+1 categories. The total score is finally compared to benchmark values to rate the community as outstanding (score ≥ 85%), excellent (≥ 70%), very good (≥ 55%), good (≥ 45%), pass (≥ 30%), or unclassified for certification (< 30%).

The certification process to get to the final rating is divided into two stages: interim and final. The commitment to the scheme and the appointment of an expert should happen as early as possible. For phased projects (masterplans divided into plots that are developed at separate times), the assessor can choose to pursue BREEAM-C certification per each phase separately, or to have an interim assessment for the entire site and a final assessment per each separate phase.

2.2. ZEN Definition

What is it?

ZEN Definition is the description, which the ZEN Research Centre is working to agree upon, of what a Zero Emission Neighbourhood is. The characterization is based on assessment criteria and KPIs with related points that the Centre considers relevant for six performance categories – 'Emissions', 'Energy', 'Power', 'Urban form and Land use', 'Mobility', and 'Economy'. A guideline document helps operationalize the definition, explaining how to assess all the KPIs in ZEN implementations (primarily ZEN pilots) to measure status and progress. The final version of the ZEN Definition and related

guideline reports will be published in 2024. In the present report, we refer to the 2022 versions [1, 4]. Thus, neither the KPIs nor the related point system has achieved the fullest maturity yet.

Which mission does it pursue?

It allows us to measure the status and progress of ZEN implementation (primarily ZEN pilots). More broadly, the goal is to support the vision for Zero Emission Neighbourhoods by defining them.

What is the target?

Primarily, ZEN pilots. Indeed, being a research project, piloting is a key action, and it involves and keeps involving actors both in the industry (e.g., constructors, consultants, owners, energy companies, etc.) and in authorities (e.g., municipalities). More broadly, the ZEN Definition targets national and international bodies that are seemingly involved in the definition of Zero Emissions Neighbourhoods.

How does it work?

Criteria and KPIs (and related points) are used along the process of ZEN implementation (primarily pilots) to measure its adherence to the outlined definition of ZEN. They are deployed with the support of the ZEN Definition guideline and related ZEN KPIs tool for reporting and monitoring, which will be developed further in 2024.

In the latest public version, the ZEN Definition consists of 43 KPIs (and related points) belonging to 15 criteria grouped into the following 6 categories:

- Emissions
- Energy
- Power
- Urban form and Land use
- Mobility
- Economy

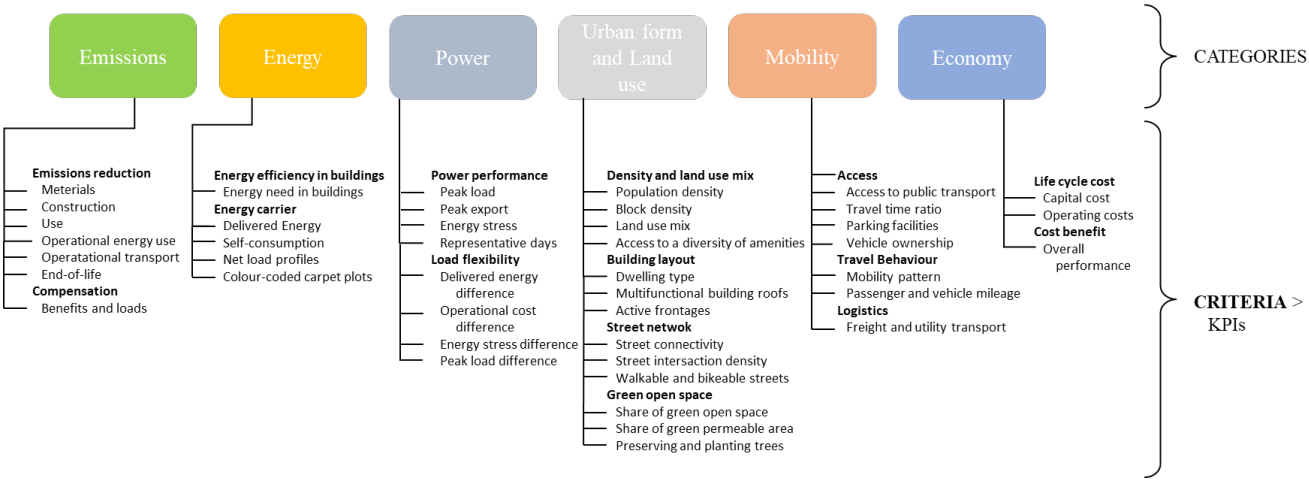

Figure 2 – Structure of ZEN Definition.

4 KPIs are considered valid solely at the building level, 28 at the neighbourhood level, and the remaining 11 are relevant at both levels. As the ZEN Definition are still in progress, KPIs are not finally and systematically allocated to specific project phases, but there is a possibility for most of them to cover both strategic planning, implementation, and operation, since most of them are identified as valid in all the three phases except capital cost (not to be re-assessed in operation), and the whole 'Urban form and Land use category' (defined as valid only in the strategic planning phase).

The assessment process consists of calculating the KPIs to check on the progress of a ZEN implementation. Points are awarded per each KPI depending on whether the KPI is documented or not or depending on the level of performance achieved against a pre-defined benchmark. So far it is expected that in ZEN there will not be a final score, but rather the score will be computed on a category-by-category basis as the percentage of points achieved over the total available. KPIs within the same category are weighted simply because the maximum number of points achievable is not the same per each KPI but is allocated based on the judgement of the level of importance within the category. Seemingly, the 'Emissions' category has a higher weight because it has the highest number of achievable points (50), while the rest (100 points) are equally distributed among the other 5 categories. The rating will also be done on a category-by-category basis to classify the neighbourhood as gold (80-100% points), silver (60-80%), bronze (40-60%), or none (below 40%), for 'Emissions', and dark green (80-100%), green (60-80%), light green (40-60%), or grey (below 40%), for each of the other categories.

As the ZEN Definition are still in progress, there is no final indication of by whom and in which project steps the KPIs must be addressed.

3. Qualitative comparison

In this chapter, we report the results of a qualitative comparison between the two schemes, in their latest publicly available forms, in terms of overall structure (section 3.1) and BREEAM-C issue versus ZEN KPIs (section 3.2).

3.1. Overall structures

As can be noticed from the previous chapter, BREEAM-C and ZEN Definition currently have both similarities and differences.

As the figures 1 and 2 illustrate, both schemes are structured in 6 categories. In BREEAM-C, categories are groups of issues, which in turn are topics to be addressed through a dedicated number of actions. Documenting such actions and, in some cases, complying with a certain quantitative level of performance makes the project eligible to gain the related credits. A large part of the manual deals with the description of subsequent actions to take and to document in order to make sure that such issues are addressed. Also in the ZEN Definition, the categories are groups of elements to address. The ZEN definition guideline gives recommendations on best practices for a project to perform well under each criterion and KPI, but a bigger focus is on giving a precise description of what to measure and how. Points are awarded based on compliance with certain quantitative levels of performance and in some cases based on whether the KPI is documented in the project under assessment. This difference will be further discussed at the level of BREEAM-C issues versus ZEN-KPIs (section 3.2).
Another difference is in the fact that BREEAM-C-certified communities will have a single score, while ZEN will have one rating per category. Indeed, the group developing BREEAM-C decided to assign a percentage weighting to each issue based on its impact on the overall aim of the category it belongs to. Before that, category-level weights were defined based on how their impact the three sustainability pillars. Since issues have a variable number of available credits, this means that not all credits have the same value. On the other hand, in the ZEN Definition, it was so far chosen that all credits have the same value, and the way they are allocated in the different KPIs reflects the level of importance of the KPIs themselves against the category. However, all categories are equally important, and as such have the

same number of available credits (20 points), except for the 'Emissions' category which has more credits than the others (50 points).

Last but not least, in BREEAM-C there is a systematic allocation of issues across three development steps (i.e., principle's establishment, layout's definition, detailed design), excluding site selection and operation. In ZEN definition, KPIs are defined as valid at building scale, district scale or both, and there is a possibility/ambition to have them assessed in the operation phase as well, besides strategic planning and implementation stages. Indeed, all KPIs except for those of 'Urban form and Land use' and, partially, 'Economy' category were so far defined as valid for all those three project phases.

3.2. BREEAM-C issue versus ZEN KPIs

To compare the BREEAM-C and ZEN Definition at the BREEAM-C issues and ZEN-KPIs level, a more in-depth analysis has been conducted.

The analysis involved the reading of the BREEAM-C manual and the ZEN Definition guideline in the latest published versions [4, 5]. Each issue in BREEAM-C has been analysed to see the level of overlap with the ZEN Definition. If some similarities were detected, the next step involved the identification of which ZEN criteria and KPIs were involved in the similarity. Often, there would be more than one per each BREEAM-C issue. Such ZEN criteria and KPIs typically address the same topics as BREEAM-C. The BREEAM-C issue was then classified as aligned or equivalent to the coupled ZEN KPIs if:

- Aligned - they have a similar motivation but a different scope/focus or vice versa.
- Equivalent - they do not only have similar motivation, but also similar scope/focus, or it differs to a lesser extent. This can often be said already from the name of the issue.

In total 20 BREEAM-C were found to have some level of similarity with one or more ZEN KPIs, of which 8 aligned, and 12 equivalent. In total, 27 ZEN KPIs are involved in the similarity, with the ZEN category 'Urban form and Land use' being the most represented, as it is visible in the table below.

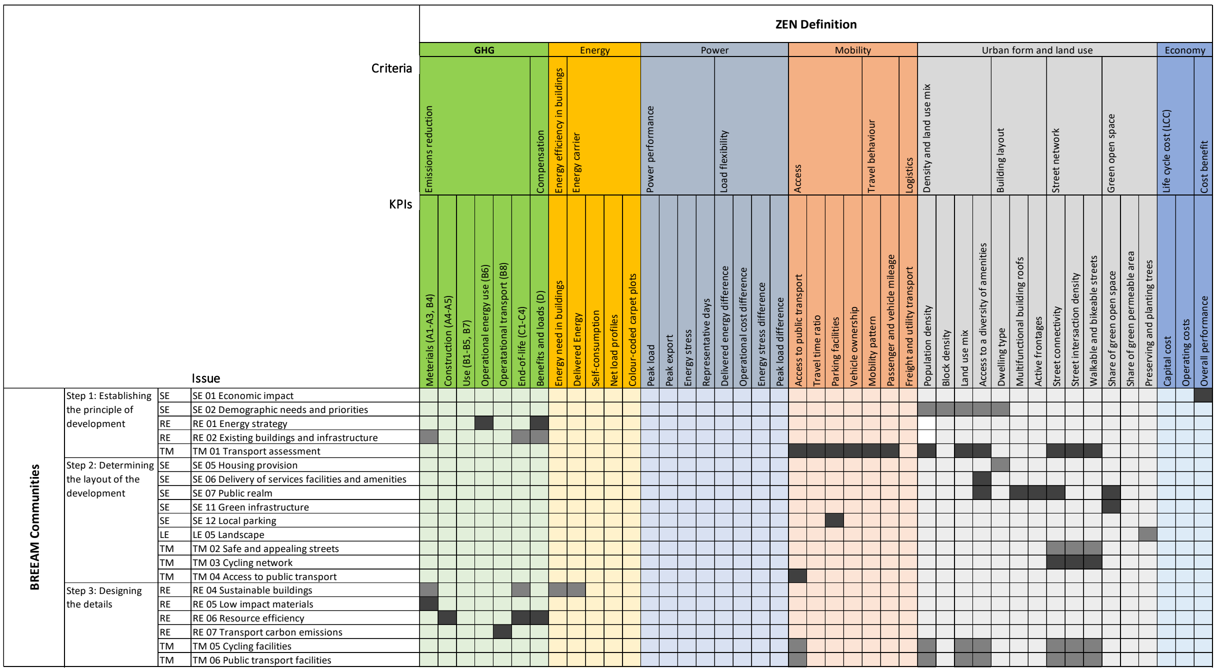

Figure 3 – BREEAM-C issues versus ZEN KPIs. Grey color indicate alignment or equivalence.

In Figure 3, each row represents a BREEAM-C issue that shows similarities with the ZEN Definition. All ZEN KPIs, grouped in categories and criteria, are displayed column by column. At the intersections, light grey or dark grey cells indicate that an alignment or equivalence, respectively, was detected.

Only for 7 out of the 20 BREEAM-C issues the similarity involves 1 ZEN KPI alone. In most cases, it takes more than one ZEN KPI to cover the BREEAM-C issue, and they often belong to different ZEN criteria. This is both because BREEAM-C issues have broad scope and because ZEN KPIs are specific in saying what to measure, and the actions that a BREEAM-C issue suggests are directly reflected in more than one ZEN quantitative metric.

All ZEN categories except 'Power' are involved in the similarity. In the 'Energy' category, ZEN KPIs have a more explicit focus on the energy carrier criteria than BREEAM-C. Unlike BREEAM-C, ZEN KPIs related to 'Emissions' also include the 'Use' of the buildings/district beyond its energy consumptions (i.e., emissions related to use, maintenance, repair, and refurbishment). Transport emissions are covered in both, but, unlike ZEN, BREEAM-C does not envisage an LCA calculation for the operational phase. ZEN 'Mobility' and 'Urban form and Land use' are highly represented in BREEAM-C, except for two ZEN KPIs, namely 'Freight and utility transport' and 'Share of green permeable area'. The economic dimension in BREEAM-C is defined in a holistic sense, which can be similar to the ZEN KPI 'overall performance', depending on how it will be defined in the definitive version of the ZEN Definition and related guideline.

It is interesting to see in which of its three development steps (i.e., principle's establishment, layout's definition, detailed design) BREEAM-C suggests addressing the issues that were found similar to ZEN criteria and KPIs. According to its manual, BREEAM-C issues showing similarities with ZEN 'Emissions' KPIs, should be addressed in Step 1 concerning operational energy, materials, end-of-life, and benefits and loads and in Step 3 when it comes to materials, construction, end-of-life, benefits and loads, and operational transport. BREEAM-C issues aligned with ZEN 'Energy' KPIs are addressed in Step 3, while those aligned/equivalent to ZEN KPIs for 'Mobility' and 'Urban form and Land use' must be assessed across all three steps of the principle's establishment, layout definition, and detailed design.

Another interesting point to compare BREEAM-C issues and ZEN KPIs about is the approach to the awarding of the credits/points. Until the publication on the latest ZEN report on the topic, the system to award points in ZEN was designed only for 28 out of the 43 ZEN KPIs. Of those 28, only 17 are involved in the similarity with BREEAM-C and they belong to 'Emissions' (4 KPIs), 'Mobility' (1 KPI), and 'Urban form and Land use' (12 KPIs) categories. ZEN adopts a quantitative target approach to award the points for all those KPIs, in addition to documentation requirements in the case of 'Emissions'. On the other hand, the BREEAM-C issue requires compliance with certain criteria, which in some cases are quantitative. However, very often the awarding of credits in BREEAM-C is rather bonded to the presence of certain professional figures (e.g., ecologist, travel plan coordinator, landscape designer, etc.), written commitment from the parties, strategies for securing, promoting, or maintaining the qualities that the issues try to pursue.

As an example, the BREEAM-C issue 'energy strategy' is addressed as early as in Step 1 (i.e., principle's establishment) and it aims at reducing the carbon emissions from the future operation of the community

(including energy efficiency, energy carriers, and Renewable Energy Sources) compared to a baseline. Unlike the equivalent ZEN KPI 'operational energy', it does not refer to the Life Cycle Assessment (LCA) methodology as a quantification method, but it is rather interested in stressing, as requirements, that a strategy has been prepared by an energy specialist, and that the developer commits to it. The BREEAM-C 'energy strategy' to target carbon neutrality does not concern embodied carbon, which at the same development step (i.e., Step 1) is addressed thanks to the analysis of the opportunities for refurbishment, reuse, recycling, maintenance of buildings and infrastructures (an issue called 'existing building and infrastructure'), but again no full LCA is requested.

On the other hand, the aligned ZEN KPI 'material' envisages controlling for embodied emissions of materials in potentially all stages (i.e., strategic planning, implementation, and operational phases) and per an LCA methodology. Performance of materials in terms of emissions is also addressed in BREEAM-C, but in Step 3 (i.e., detailed design of the masterplan), concerning the public realm (an issue called 'low impact materials'), and sustainable buildings (an issue called 'sustainable buildings'). However, concerning buildings, in BREEAM-C one can decide to address one or more of these areas: energy, water, waste, embodied impacts of materials, and occupant health and wellbeing. The aligned ZEN KPIs ('materials' and 'end-of-life' KPIs in the 'Emissions' category) are so far compulsory and concern all the LCA stages of materials production, replacement, and end-of-life (i.e., deconstruction/demolition, transport, waste processing, disposal).

LCA is explicitly asked in BREEAM-C only concerning construction, which is also now requested in ZEN. ZEN envisages an LCA approach when it comes to operational transport use, whereas the equivalent BREEAM-C issue (named 'transport carbon emissions') is mostly concerned that transport assessments, feasibility studies and travel plans are developed to set out the sustainable transport options (not including public transportation) and that at least one of the options is incorporated into the development. Interestingly, in BREEAM-C, the alternative transport options must be advertised to inform the community of their presence, and a management plan for the related facilities should be in place. Seemingly, in the 'sustainable building' BREEAM-C issue, credits are bonded to the commitment of the developers to implement the strategies and to the fact that such commitment is confirmed through a planning condition (or other binding mechanism, such as a planning obligation) by the local authority.

Finally, it is worth noting that similarity does not imply that, by getting credits through BREEAM-C, one could get points under a ZEN Definition framework. This cannot be said at the moment, since the point system of ZEN is not set in stone yet and because the structures/approaches of the two schemes are different (see also section 3.1).

4. Discussion

In this chapter we elaborate on the main differences between ZEN KPIs and aligned or equivalent BREEAM-C issues to extract lessons for the further development of ZEN guidelines and to say what would it take for the industry, which is very familiar with BREEAM, to align with ZEN Definition vision.

From the thorough comparison between BREEAM-C issues and similar ZEN KPIs (section 3.1), we can notice that ZEN KPIs are generally more concerned about being very specific about what to measure and how, and to bind the awarding of the points to certain quantitative requirements. Less is said about sequential actions that should be taken to make sure that the project can perform well against the identified criteria and KPIs, and there is still a lot of space to tell how to follow up on the goals that the ZEN KPIs represent throughout the process. On the other hand, BREEAM-C has a less quantitative approach to the awarding of credits, and much of the evidence to provide and criteria to comply with refer to having certain actions, strategies, documents, and commitments in place.

Thus, we can argue that more **BREEAM thinking** in ZEN would translate into the definition of practical actions to ensure that the objectives that ZEN criteria and KPIs advocate can be operationalized. For instance, actions that BREEAM-C issues similar to ZEN KPIs entail can be grouped into 3 areas of focus:

- **Anticipate -** actions aimed at preventing ineffective, unacceptable, or sub-optimal solutions, as the analysis and forecast of relevant aspects (e.g., needs, demographics, etc.).
- **Plan and manage -** actions concerning the set-up and maintenance of critical elements in the project (e.g., alternative transport options).
- **Secure -** actions addressed at pinning the decisions and making sure that they can and must be followed up by the interested parties.

Some of such actions are summarized in the following figure.

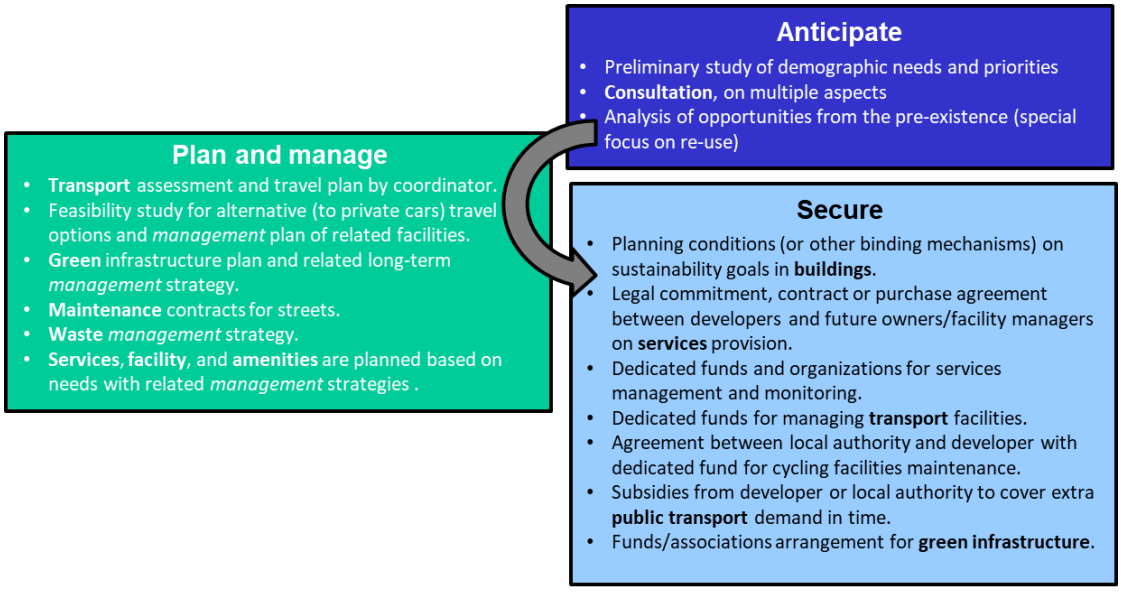

Figure 4 – Some actions suggested in aligned/equivalent BREEAM-C issues.

Among the 'Anticipate' actions, consultation occupies a large share, as almost half of BREEAM-C issues demand it. Indeed, we can read multiple aspects where consultation is required, including:

- Services mix and appropriate walking distance.
- Desired uses, design, quantity, and location of accessible and natural greenspace.
- Activities, uses and local identities of the public space.
- Parking spaces, involving not only local authority but also authorities responsible for road networks in the area, developers, community representatives and other stakeholders.
- Refurbishment, reuse, recycle or maintenance of existing buildings and infrastructures, because community and local authority knowledge and opinions is important to collect.
- Requirements for cycling facilities, involving local authorities, developers, community representatives and other stakeholders.
- Requirements for public transport facilities, involving local authorities, developers, community representatives and public transport providers.

In ZEN, the preparation of a consultation plan was advised as part of some preliminary ZEN process recommendations [4], but at present it is not connected to specific ZEN criteria and KPIs.

In addition, even when looking specifically at BREEAM-C issues that are aligned or equivalent to ZEN KPIs, the scope of the former can be much broader, including:

- Equality, affordability, inclusiveness, and match with the real housing needs.
- Ecologist supervision and landscape management plan.
- Masterplan adapted to microclimate studies, consultation outcomes, landscape design, strengthening of local identity, and encouragement of frequent use through a mixture of uses.
- Traffic management plan addressing also the prevention of accidents, the mitigation of noise pollution, etc.

While the focus of ZEN is deliberately on GHG emissions.

On the other hand, the alignment with **ZEN thinking** would require the industry players to be more specific about environmental impacts. Indeed, despite the ZEN category 'Urban form and Land use' also refers to amenities, social segregation, sharing, etc., in ZEN, more stress is given to the quantifiable environmental impacts of the various elements building up an urban development, and they are included in the scheme to the extent to which they impact the environmental performance of the district in terms of life-cycle GHG emissions. ZEN is also more explicit about the power and flexibility of the energy flows.

Proof of the extensive weight given to the environmental concerns is that addressing the 'Emissions' category is, so far, a minimum requirement in ZEN assessment (together with other KPIs that are required for its assessment, i.e., 'delivered energy', 'mobility pattern', 'passenger and vehicle mileage'). Also, methodological guidance is important, and in ZEN the LCA methodology is the backbone of the whole 'Emissions' category. A great ambition that makes ZEN special, as a district-level assessment scheme, is the possibility to target the operational phase as one of the stages where ZEN criteria and KPIs are assessable. So far, the after-delivery is not within the scope of BREEAM-C and, despite the complexity that this kind of assessment brings, its inclusion has the potential to increase the accountability of the actors involved in the development and the chances for the benefits being maintained over time. However, addressing operation should not be a reason not to give recommendations about actions that can be put in place since the planning and design stage to increase the chances of success later in the process.

5. Conclusions

In this short report, we have presented BREEAM-C and ZEN Definition at a glance to qualitatively discuss their differences and similarities.

We have learnt that being both community/district-based performance assessment schemes, they have many similarities when it comes to the topics addressed. However, BREEAM-C has a broader scope and attention to community aspects that, not having a direct impact on GHG emissions (the focus of ZEN), are not reflected in ZEN criteria and KPIs. Nevertheless, BREEAM-C issues show most of the similarities with ZEN criteria and KPIs related to 'Urban form and Land use' and 'Mobility'.

Even where similarities are detected, the differences in approach show how ZEN is more concerned about quantification, measurement and LCA methodology, while BREEAM-C binds most of the issues to the definition of strategies and commitment actions to make sure that the goals that it pursues will live throughout the community development and in operation. Being actions suggested by BREEAM-C focused on 'Anticipate', 'Plan and Manage' and 'Secure', the awareness over them will be further used in ZEN to develop process-related recommendations.

Indeed, the ZEN definition, meticulously crafted with specific criteria and KPIs across six performance categories, provides a detailed framework for measuring the status and progress of ZEN implementations. However, the practical realization of these KPIs necessitates a robust and adaptable toolkit. BREEAM, familiar to the industry, has been already identified as a tool in the ZEN toolkit when it comes to addressing process aspects [1]. Looking at the BREEAM-C certification, we can argue that it provides stakeholders with the flexibility to achieve the ZEN definition KPIs through a variety of methods. On the other hand, ZEN shows some advantages for its attention for pilots. Other industry players who want to align with ZEN Definition vision should increase the focus on the quantitative assessment of emissions and the possibility for operational-phase-performance assessment of future urban developments.

In essence, the creation of Zero Emission Neighbourhoods is a collaborative effort that requires both precise definitions and flexible toolkits. The ZEN definition, with its focus on specific KPIs, and the BREEAM-C certification, with its broad scope and systematic allocation of issues, together build a synergy that will be instrumental in driving progress towards more sustainable communities.

Acknowledgement

This report has been written within the Research Centre on Zero Emission Neighbourhoods in Smart Cities (FME ZEN).

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