**Holistic planning approaches – starting with common ground**

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**Abstract:**

The sustainability of urban development is a central concern in climate change mitigation, as the built environment is responsible for a significant portion of greenhouse gas emissions. However, the landscape of planning for urban sustainability is fragmented, due to varying views on how it can be achieved and which aspects to prioritise. Considering the broad variety of urban stakeholders and their diverse needs in energy-conscious projects, it can be difficult to balance technical and non-technical parameters in processes where both aspects themselves are already complex and challenging. However, conflicts between stakeholder needs, technical and non-technical aspects of sustainability can be challenging to resolve at advanced stages of the project, when significant amounts of time and money have already been invested.

Re-occurring themes have emerged within our work conducted in PI-SEC, FP7 ZenN, and other projects (i.e. FP7 RAMSES) and international research networks (i.e. SHC-IEA Task 51 "Solar Energy in Urban Planning"). Our research shows that several aspects of sustainable development, such as transport and mobility, quality of life and user experience, may have disruptive effects both on the implementation and on the performance of neighbourhood-scale projects. Nevertheless, these parameters are often considered with low priority. Our findings imply that utilising a holistic approach from the early stages of energy conscious project development and planning will help to take into account the currently unaccounted non-technical parameters.

## Introduction and background

Sustainability of cities has been one of the key concepts and goals in urban planning theory and practice, and it is increasingly important as a field of research and innovation today. Reducing energy use and greenhouse gas emissions is central in this aspect, and, in line with the priorities of the European Union (SET Plan, 2014), interventions on a neighbourhood level should be put into focus. The implementation of nearly Zero Energy Buildings (nZEB) is in line with the European Commission's 202020 goal, aiming to reduce carbon emissions by 20%, increase renewable energy production by 20%, increase renewable energy production by 20% by 2020 (European Commission, 2011, European Commission 2012). This aim has been underpinned by the European Energy Performance of Buildings Directive (EPBD) which specifies that all new buildings in Europe shall be nearly zero energy by 2020 (Article 2 of the EPBD, 2010). nZEB combines traditional project constraints with increased energy efficiency performance targets, and ideally but not necessarily entails positive environmental and social consequences (Article 2 of the EPBD, 2010, EuropeanCommission, 2012). Traditional assessment tools such as BREEAM and LEED emphasize some of the ambitious EU targets, focusing primarily on energy efficiency gains in compliance with current rules and regulations. However, a comparison with the focus areas expressed in planning documents highlights a clear mismatch. Planning focuses on a variety of technical and non-technical topics such as transportation, energy use and supply, indoor climate, reduction of pollution, noise and emissions, common waste treatment, as well as quality of outdoor and green areas (Narvestad, 2010). There is extensive literature on a variety of non-technical barriers to the realisation of energy efficiency in the built environment (e.g. Langlois-Bertrand et al., 2015). Still, experiences within our research show that non-technical parameters are often considered with low priority in construction projects, while zero-energy targets do not play a central role in the

physical planning of neighbourhoods, even when they are both nominally present in the planning documents.

The emergence of digital tools based on sensors, big data, etc., as data sources for planning has yet to be effectively implemented by municipalities. The aspiration of using such tools is to contribute to closing the gap between energy planning and land-use planning. Additionally, most existing digital tools in urban planning neglect the complexity and the conflicts between different aspects at the urban scale. Indeed, it is common practice to optimize only one specific parameter without taking into account that municipal decision makers have to face a multitude of criteria (Harrison et al., 2001). In addition, municipal decision-makers do not have technical background and they are usually not able to use the tools necessary to conduct complex analyses (Patt et al., 2013, Addison et al., 2013). Therefore, they usually edit urban regulations with minimal utilization of technical data. Furthermore, they often express the view that researchers do not work effectively with them. On the other side, researchers use city data to perform their own research and when they provide the results to the municipality, the outcomes often cannot be effectively used to face the actual needs in practice (Cook et al., 2013, Sussman et al. 2014). An effective cooperation between science and practice in urban planning requires the information to be relevant and timely, credible and legitimate in the eyes of both researchers and decision makers (Addison et al. 2013, Cook et al., 2013). To overcome these barriers, researchers and decisions-makers should cooperate more closely by establishing win-win dialogues (Montavon, 2010, Van Stigt et al., 2013, Verdon-Kidd et al., 2014). Tools should support decision-making by (i) synthesizing available knowledge in a systematic, rational and transparent way and (ii) provide a platform for exploring and solving uncertainty about the consequences of urban planning decisions.

This work proposes to address the above outlined issue by looking at energy efficient building and neighbourhood development projects in light of a holistic view on city planning.

We discuss the observed necessity for tools to account for the aforementioned aspects neglected in current practice. We aim to examine the possibility of creating a common ground for a holistic approach to planning and implementation of energy efficiency measures and open up discussion on what types of tools are required to make this common ground a reality.

**Research questions and methods**

The aim of the work presented in this paper is to highlight specific areas of energy where a holistic approach can positively contribute to the planning and implementation of smart energy communities. We identify common problems in such processes, in order to pinpoint gaps that can and need to be addressed. This paper addresses the following research questions:

- What are the common challenges experienced in the planning of neighbourhoods that are highly ambitious regarding energy use and generation?
- How do these challenges relate to a more holistic/integrated view on neighbourhood planning and how can such a view improve these projects?

Research approach

We refer to ongoing research in order to understand how holistic approaches can be useful in planning and construction on neighbourhood scale. The projects focus on different underlying concepts – smart energy communities and nearly zero energy neighbourhoods – but have in common an objective to reduce energy consumption and create a sustainable living environment. The projects started at different dates after 2013 and are still ongoing. Individual semi-structured interviews as well as focus group interviews were utilised for data gathering. The information presented here are based on findings from project reports:

- Planning Instruments for Smart Energy Communities (PI-SEC) Report 2.1 on municipal planning instruments on two neighbourhood developments in Norway.

- Nearly Zero Energy Neighbourhoods (ZenN) Report on stakeholder awareness and behaviour aiming to understand the implementation of energy efficiency measures in the renovation processes.

The coding and analysis of the data was different in the two projects, but the similarity in focus allows for a common presentation of the results.

**Findings**

The following sections present the findings of the above projects. The findings are synthesised for ease of understanding.

*What are the common challenges experienced in the planning of neighbourhoods that are highly ambitious regarding energy use and generation?*

- Zero emission buildings as new concepts and associated technologies (e.g. solar) in terms of implementation or use are not widely understood by all stakeholders. Zero emission neighbourhoods share a similar difficulty.
- Municipal planners expect neighbourhood-level projects to consider factors not directly related to the buildings: e.g. citizen behaviour, transportation of people, goods and services. However, in practice this scope is not well-defined, which makes it challenging to tackle neighbourhood-level ambitions regarding emissions or energy consumption.
- There is a variety of misconceptions or prejudices present within the realm of energy efficient neighbourhood development. Stakeholders are sceptical towards some of the technologies being introduced. On the urban level, planners are sceptical about projects promoting energy efficient development as they cannot create legal binds for the energy targets. These concerns need to be addressed to avoid fostering negative opinions against energy efficiency renovation as a whole.

- Due to the novelty of the solutions applied, it is important to ensure that different stakeholders, such as building contractors and residents, are sufficiently knowledgeable about them. Information transfer and training should address the impact of technological solutions on the building performance and maintenance.
- It is not possible to foresee all problems of the installed technological solutions and it is likely that the initial months of operation will require an adjustment period. This adjustment period is to allow users to familiarise themselves with how the technology impacts (or not) their day to day living and to highlight any functionality problems that occur with the technology as it goes into full operation.
- Traditionally, participatory processes focus on social aspects of urban developments, such as liveability, aesthetics and safety. However, energy-efficient neighbourhood development should also address the needs and habits of citizens in terms of energy use.

The above findings indicate that the focus on energy efficiency and generation in neighbourhood projects creates a need for physical planning and energy system planning to be more aligned with each other. This is a shift compared to traditional work methods, where the planning of energy systems is the domain of energy providers. Therefore, planners need to acquire the requisite knowledge and power to act within this realm.

*How can a more holistic/integrated view on neighbourhood planning improve these projects?*

- Defining the concepts of zero emission neighbourhoods can help clarify the relationship between energy efficient and sustainable neighbourhood development. If chosen well, the definition can potentially function as incentives involving specific stakeholders.

- Experiences in the demonstration projects show that ongoing and open communication is required during the renovation process to create a common understanding, and to overcome scepticism and misconceptions.
- It can be beneficial to create tools that can contribute to a more controlled environment where scepticism about reaching energy efficiency targets in urban development plays a smaller role. Tools that enable municipal planners to have control over achieving promised energy targets in planned neighbourhoods could shorten negotiation and planning processes.
- Communication with the installers and users of technological solutions should be seen as an integral part of zero energy developments. Training builds knowledge and understanding of a ZenN renovation which should be considered for both construction contractors and end users.
- Building owners and residents should prepare or have contingencies in place during initial operational phase to reduce impact from initial, unforeseen problems with the different systems installed.
- Participatory processes should be designed in a way that allows local residents to provide input that is directly relevant for energy efficiency and generation as a main focus of neighbourhood planning. This could improve the communication and understanding between the different stakeholders in the process about the aims and importance of the project, and initiate a better integration with sustainable neighbourhood development.

To summarize, there is a need for tools to assist city planners on the integration of alternative energy scenarios into their daily practices in order to address gaps in knowledge and practice in the planning and implementation of the energy efficient neighbourhoods. This would allow

them to be more conscious about the interrelations between physical planning and energy systems and consequences of decision related to both systems.

**Discussion and conclusion**

The findings outlined above support the view that a holistic approach from the planning right through to project development and implementation could start to mitigate challenges associated with non-technical parameters in smart energy communities and zero emission neighbourhoods. Non-technical drivers are often not prioritised in projects even though they persist to impact energy efficiency outcomes. The two studies illustrated, to various degrees, that the quality of integration between local energy production, building-related energy use and other aspects (e.g. transport and mobility, quality of life and user experience), can significantly affect the implementation and performance of energy ambitious projects.

Furthermore, conflicts of interest between stakeholder needs, which may also incorporate technical and non-technical aspects of sustainability, can surface at any point of the project but are particularly challenging to resolve when significant amounts of time and money have been invested. Therefore, the multiple agendas of involved stakeholders need to be considered and should be accounted for in the early stages of the process.

There is no process or tool used for addressing non-technical challenges related to energy performance in the planning and development of the investigated neighbourhoods/communities. This leads to a danger of repetition of non-technical problems occurring in other similar projects. On the other hand, the findings underline that it is equally important to have tools for addressing technical challenges in urban planning departments, which are traditionally more focused on social aspects of development processes. An approach to the development of tools is to identify common lessons learnt, indicators and approaches from innovative projects such as those included here. Such tools will facilitate mediation

between stakeholders and mitigate non-technical challenges throughout the planning, implementation and operation process.

Limitations of study

The projects did not allow for like for like cross case comparisons. However, they all have high environmental and energy reduction ambitions and all are at neighbourhood level, allowing for common conclusions to be drawn.

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