

Challenges and Best Practices for the planning of Zero Emission Neighborhoods and Smart Energy Communities – the case of seven Norwegian cities

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Abstract

Designing more sustainable neighborhoods as implemented in the concept of Zero Emission Neighborhoods (ZENs) and Smart Energy Communities (SECs) is a complex challenge and requires a leap from segmented planning approaches to holistic planning. Seven neighborhoods in Norway are currently under planning and development into a ZEN/SEC and used as cases in this paper to extract the significant barriers to the design and implementation process of sustainable development. After presenting the main challenges on a general level, we will focus on stakeholder collaboration as this is pointed out as one of the key challenges in our research. We will show how Norwegian cities cope with challenges within stakeholder collaboration and present best practice solutions from the case cities.

However, the findings show, that the sustainability of the neighborhood requires tools that can encourage also the integration of spatial qualities and sequencing to ensure sustainable behavior as well as an early and ongoing collaboration with stakeholders. A participatory approach with municipalities, utilities and private developers was taken to suggest a solution to this. The paper will end with the presentation of a planning tool, the SEC Planning Wheel with a Core of Community (CofC) Fund mechanism, which aims to be a guideline for city planners to induce stakeholder collaboration and thereby aiming to maximize the emission reduction while ensuring social and economically livable cities.

Key Words

Urban planning, Urban governance, Sustainable Urban Neighborhood, Integrated Planning, Low Carbon Society, Smart Cities, Integrated Project Delivery

1. INTRODUCTION

To develop cities with a lower carbon footprint is a development goal all over the world. The building stock is thereby counting for one third of climate gas emission and 50% of energy consumption. In the last decades in Norway, a strong research evidence and building examples were achieved on the way to reach the ambition of Zero Emission Buildings (ZEB). ZEBs are compensating CO₂ emissions with energy generation over their lifetime. Today, the

ZEN¹ concept moves this way of thinking beyond buildings. Successful planning for ZEN needs to consider not only energy and emissions, but also needs to incorporate the interests and ideas of a broad number of "new" stakeholders like e.g. utility companies from the early planning stage. Based on observation and interviews, this paper will present the main challenges identified when planning for Zero Emission Neighborhoods in the seven Norwegian cities and towns Oslo, Bergen, Trondheim, Bodø, Steinkjer, Evenstad and Elverum. Each of these cities is planning for or already developing a ZEN and all of them are partners within the Research Center for ZEN at the Norwegian University of Science and Technology (NTNU)ⁱ.

2. BACKGROUND ABOUT ZEN AND SECS

Historically, ambitious neighborhoods were the art of the architects, building Functional Cities in line with the Athens Charter. Today, the planning of urban neighborhoods depend upon the facilitation of multi-stakeholder processes (Maggioni et al., 2012, Ouhajjou et al., 2017) and negotiation (Monstadt, 2007). Situations of give and take, where researchers, private developers, utility companies, transport administration, municipal planners and citizens have to contribute to make environmentally, socially and economically sustainable living areas.

The Smart Energy Community (SEC) concept was developed as a response to Bergen and Oslo wanting to become pilot cities for the purpose of developing and accessing better tools for the design of emission reducing communities. Two building projects, Zero Village Bergen and Furuset in Oslo, were starting points for this research and the following definition of a SEC was created within the PI-SEC project²: While Zero Emission Neighborhoods are still in the development of a concluding definition from NTNU,

'A Smart Energy Community (SEC) is an area of buildings; infrastructure and citizens sharing planned societal services, where environmental targets are reached through the integration of energy aspects into planning and implementation. The Smart Energy Community aims to lower dependency on fossil fuels by becoming highly energy efficient and increasingly powered by renewable and local energy sources. Its spatial planning and localization considers reduction of carbon emissions also through its relationship with the larger region, both through the design of energy systems and by including sustainable mobility aspects of the larger region. It further encourages sustainable behavior through its overall design from building and citizen scale to community scale. The application of open information flow, a large degree of communication between different stakeholders and smart technology are central means to meet these objectives' (Nielsen et al.). The concept of ZEN is widening the definition of SEC by taking not only emissions into consideration which are produced within the operation of the neighborhood, but as well emissions which are produced while planning and constructing the area, as well as embodied emissions (Wiik et al., 2018).

In earlier research, we have identified 10 challenges on the way to ZEN within the seven case areas in Norway (Andresen et al. 2017):

1. Stakeholder collaboration and project management
2. Lack of knowledge
3. Legislation
4. Goal conflicts

¹ The ZEN Research Centre is a research centre for environmentally friendly energy [forskningssenter for miljøvennlig energy]. It was established in 2017 by the Research Council of Norway. The ZEN Research Centre is hosted by the Norwegian University of Science and Technology and organized as a joint NTNU/SINTEF unit. More information in english available on <https://fmezen.no/>.

² The Planning Instruments for Smart Energy Communities (PI-SEC) is a research project funded by the Norwegian Research Council, spanning from 2016 to 2019. See <https://www.ntnu.edu/smartcities/pi-sec>

5. Time and cost pressure
6. New energy technologies
7. System boundaries
8. Risks and uncertainties
9. Flexibility
10. Transferability

There is a strong believe among stakeholders in the case areas that technological solutions will enable the development of ZEN. But the collaboration of multiple stakeholders within the development process is highlighted as the one of the main challenges as well as enablers for a successful development. Planning for energy and emission reduction and developing ZEN is a multi-stakeholder challenge with new stakeholders on the agenda and the need for new planning and design approaches.

2.3 Challenges related to stakeholder Collaboration

Stakeholders are defined as any individuals, groups or organizations from different disciplines and with different needs, responsibilities, and resources who affect the project, or are affected by it, or exhibit an interest in it.

Designing energy ambitious areas depend upon stakeholder collaboration where all stakeholders need to commit and contribute more than 'business as usual'. While the ambition level is increased by the high environmental commitments following the Paris agreement, (Agreement, 2015, Hulme, 2016), stakeholder collaboration and the relationship between private and public actors are old topics in urban planning(Huxham, 1996, Abdulgader and Aina, 1970). The liberalization of utilities revitalized the need to better governing of private and public stakeholders(Monstadt, 2007), and the emission reduction agenda increased the need for better practices and policies even further. The climate emission reduction depend on the success of integrating energy into urban planning, meaning that collaboration may be the 'win or lose' aspect of the entire vision. (McCormick et al., 2013) The initial reason for the frustration [about stakeholder collaboration] seems to be the separated design and construction, or disintegration of the construction project process in general(Lahdenperä, 2012)" Further, the "low bid syndrome can be recognized as a major determinant behind the customary adversarial behaviour [of stakeholders](Lahdenperä, 2012).

An important aspect is that governance and planning are identified as the key leverage points for transformative change(McCormick et al., 2013), yet neither are simple key points to address and change quickly in the right direction.

In this paper, we contribute to this discussion by looking for cross-sectoral stakeholder-collaboration related challenges in seven real neighborhood cases; finding the most pressing issues that need to be adressed in order to achieve the transformative change in governance and urban planning.

3. CASES

Seven Norwegian neighborhood developments are dedicated to be developed as a ZEN and are participating as pilot projects within the ZEN center at Norwegian University of Science and Technology (NTNU). The cities of Bergen and Oslo are similarly participating within the PI-SEC project. The pilot projects are innovation hubs for co-creation between researchers and building professionals, property developers, municipalities, energy companies, building owners, and users. As urban living labs they shall help to verify, document and optimize the

real-life performance of the solutions developed. They will also be lighthouse projects to learn, inspire, and disseminate ZEN-related knowledge.

The seven neighborhood developments varies regarding size, functionalities, time frame and some are green- and brownfield development as others are existing neighborhoods. The most common project owner of the neighborhood developments are the municipalities and only the Zero Village Bergen (ZVB) project has a private developer as project owner. The neighborhood projects in Elverum, Bergen, Bodø, Trondheim and Steinkjer are transforming former brown- or greenfields or areas in use for other purpose as an airport or commercial area into a ZEN. The pilots are developed into multifunctional sub centers in Oslo and Trondheim and to a multifunctional area in Bodø. The pilots in Elverum, Bergen and Steinkjer will be developed as residential areas with public services as schools or kindergartens located within the neighborhood. Evenstad is a university campus and the only pilot which is already in the operational phase, meaning that no further construction is planned within the coming years. The focus in this project is the transformation of the energy system. Figure 1 gives a short overview of the seven case study neighborhoods.

	City population (1.1.16)	Project owner	Area size in m ²	Planned/ Current Function	Construction	Status/Phase
Elverum - Ydalir	14 794	Public (Municipality)	430 000	Residential area with school and kindergarten (planned)	New construction, 1 000 dwellings (ca. 100 000 m ²), a school and a kindergarten	Planning
Oslo - Furuset	652 940	Public (Municipality)	870 000	Multi-functional sub centre with 1 400 dwellings and 3 800 inhabitants, 213 100 m ² (existing)	Retro-fitting/upgrading and new construction, 1 700 – 2300 dwellings and 2 000 – 3400 work places (up to 160000 m ²)	Planning and Construction
Bergen - ZVB	252 772	Private (Developer)	378 000	Residential area with a kindergarten and additional services (planned)	New construction, 720 dwellings (92 000 m ²), a kindergarten and additional service functions	Planning
Trondheim-Sluppen	177 617	Public (Municipality)	275 000	Multifunctional Neighbourhood (existing)	Retro-fitting and new construction	Planning and Construction
Steinkjer – NRK	12 466	Public (Municipality)	11 113	Kindergarten and dwellings (planned)	Re-use and new construction of 10-12 dwellings	Planning
Evenstad - Campus	2 623 (Municipality)	Public (University)	61 000	University Campus (existing)	Building stock in use: 10 000 m ² no further construction planned	Operation
Bodø - NyBy	40 209	Public (Municipality)	3 400 000	Multifunctional city centre extension with residential and business areas (planned)	Re-use and new construction, 2 800 dwellings in the first construction stage	Planning

Figure 1: The seven pilot projects within the Zen research center at a glance

4. METHOD

39 interviews were undertaken with stakeholders involved in the neighborhood developments in 7 municipalities during 2016-2018. In addition, we conducted six workshops with a participatory design thinking – approach, with municipalities on certain topics. Participants were from municipal planning offices, climate section, regional governors, national road administration, utility companies, private developers, city architects, energy researchers from the case cities, and also international experts from review groups and two international conferences.

The interviews were transcribed and analyzed while the workshop outcome was photographed and discussed in separate reports and papers (Juhász-Nagy et al., 2017, Nielsen et al., Nielsen et al., 2017). In the analysis for this study we were first looking for stories indicating challenges

related to the stakeholder collaboration aspect of planning and implementation of integrated ZENs, and secondly we looked at the same material for strategies or best practice examples meeting these challenges.

4. FINDINGS

During the analysis, we identified four challenges relating to stakeholder collaboration:

1. Achieving multi-stakeholder concept design and commitment;
2. Private/public relationship and responsibilities;
3. System borders in regional and city planning
4. Balancing social and high environmental goals.

We will present each of the challenge with examples from the various pilot projects in the Norwegian cities. For each of the challenge we will also present Best Practice Examples for attempts to solve these challenges, for other projects to learn from.

(1) Achieving multi-stakeholder concepts and commitment

A significant challenge, seen from the municipal planning side, is to achieve a good process that allow for co-design with all relevant stakeholders. This most commonly includes municipality planners and climate section, private developers, real estate, utility companies, and architects. To aim for a climate gas reduction on a neighborhood level, the commitment and participation of multiple stakeholders – including citizens- within the process is crucial. For the construction industry ZEN requires to go beyond the ambitions of current building act requirements, and requires the collection and provision of data regarding emission in building materials and construction processes. Essential facilitators to gain for energy and climate gas reduction like the building industry or energy utilities are often reluctant to gain for more as asked from regulation and law framework.

The case of ZVB included high influence of one private stakeholder on the project development. After planning and designing the neighborhood the regional governor filed a protest with regard to the location of the planned neighborhood. The project is already on hold for 9 years and still waiting for approval. An integrated co-design or dialogue approach with more stakeholders from public and private sector represented, could have been one of the aspects avoiding this situation.

Best Practice Example 1 The dialogue platform 'Forum Sluppen' in Trondheim

In 2015, a dialogue platform was established between the stakeholders in the Sluppen project in Trondheim, called 'Forum Sluppen'. The Forum Sluppen was established as an experiment in the CityLab approach of Trondheim and has been partly funded by the Norwegian Ministry of Local Development and Modernization within the planning program for Norwegian cities above a certain scale. The goal was to test new forms for collaboration between public and private stakeholders in the area.

Trondheim municipality, Sør-Trøndelag county, the National Road Authority and the biggest private landowner R. Kjeldsberg participated in the Forum Sluppen. The project leader is Trondheim municipality. It was also tried to involve other stakeholders. Siemens as industry stakeholder in Sluppen and Koteng, another private landowner in Sluppen, participated only at an early stage.

In 2017, a feasibility study for Sluppen was conducted as a parallel assignment. The reason for doing this as a parallel assignment was that the participants in the Forum Sluppen wanted an open process with a broad academic discussion. NTNU has assisted the work with the feasibility study. The parallel assignment involved three invited interdisciplinary teams with architects and advisory engineers who were selected by the Forum Sluppen members after an open tender competition with 13 providers.

It was important for the participants of the Forum Sluppen to ensure that the selected teams could share experiences during the process and get input from the Forum Sluppen along the way. In the period from March to June 2017 a start-up seminar, a mid-term seminar and a closing presentation meeting was organized to ensure the possibility for discussion. The final presentation meeting in June was also open to the public and around 55 persons participated. The Forum Sluppen evaluated the three proposals. The results are presented within the evaluation report of the feasibility study (Trondheim Kommune et al., 2017).

Trøndelag County (Trøndelag Fylkeskommune, 2018) evaluates the dialogue within the Forum Sluppen as good and especially useful to find common agreements about the objectives and requirements for the feasibility study. The collaboration is described as an open dialogue, characterized by an understanding for the different positions and agendas of the involved stakeholders. The work with the feasibility study has pointed out the difficulties to find a solution in line with the different demands and requirements. The will for cooperation and compromises is described as crucial for an integrated and long-term solution for land-use in Sluppen, the implementation phase and financing. The cooperation in the Forum Sluppen enabled the participants to understand the demand for compromises and to set the development in Sluppen within a long-term perspective. It also helped to build up a better understanding for each other and the development of common goals.

(2) Private/public relationship and responsibilities

As utilities are privatized, municipalities more often than before play the role as negotiators rather than managers of urban planning. In highly ambitious emission reducing projects, we see a shift from public sector responsibility for social needs at the beginning of a project, and technically advanced dialogues between private stakeholders once the implementation start. This is perhaps nothing new, but the advanced technical innovation taking place is dependent on technical tools such as energy simulations and heat exchange and storage; being both expensive, sector dependent and with little relevance to the citizen involvement taking place at the beginning of the planning process. This makes it seem as if the citizen needs is an accountability issue for private sector, while private sector to a decreasing degree shares this responsibility. Also, public stakeholders see themselves as responsible for “pushing” the environment agenda while project developers in general stick to the minimum standard – which still is perceived as environmentally innovative (TEK 17³) by the industry. The private sector on their side believes public sector locally and nationally do not respond to the need for capacity building, both within the building sector and in the municipality.

An argument from several municipalities is that there is a need for a better coordination unit, facilitating innovation in the direction of environment, climate and energy, that can work across the municipal organization. In Furuset, the Futurebuilt programme was one such example,

³ Regulations on technical requirements for construction works, for English translation: <https://dibk.no/byggereglene/Building-Regulations-in-English/>

created to develop environmentally ambitious architecture in the Oslo region, has been the coordinating body ensuring stakeholder collaboration particularly within the municipal organization. Despite a thorough citizen-involvement phase and strongly documented citizen needs, the timeline from citizen involvement to implementation has been lengthy. Also, the lack of investment interest in the area has been a significant barrier. The area is seen by public media as 'challenged' with a high immigrant population and low housing prices ((Rosten, 2012, Dyb et al., 2011)). As public sector is spending more than usual on low-emission buildings on municipal land, what the urban planners refer to as "the Core of the Community" (CofC) is difficult to finance. The CofC are in this case the spatial qualities combined with the citizen behavior aspects related to energy use and spatial planning in the Furuset neighborhood. The CofC is to include a public square, the upgrading of a shopping mall and community house, a park, a green axis, all centered around a public transport hub with metro access; also containing charging stations for electric vehicles. This core is seen as key to make sure the inhabitants use the neighborhood in a sustainable way and that they participate in the community; something that again affects the need for safety and security that was identified in the citizen participation at the beginning of the project.

Best Practice Example 2 Masterplan Development in Ydalir, Elverum

One measure approved in the Ydalir project in Elverum to facilitate an early dialogue between stakeholders was the development of a Masterplan for Ydalir in a collaboration between the project owner and the other involved stakeholders. The masterplan of Ydalir provides general goals and requirements for the neighbourhood development regarding design and technical solutions to aim for a ZEN (ETS 2017).

Five workshops over the period of 6 months were held on the key element for stakeholder collaboration in the development of the Masterplan. Each workshop was dedicated to different aspects of the project development. These included different topics such as aims and vision, energy, building and infrastructure, user and quality aspects, and transportation. These workshops were concluded with a summarizing workshop in April 2017 and the results of these workshops influenced the Masterplan for Ydalir, which was completed in 2018. The Masterplan development, including the workshops, were partly funded by Enova – a public owned company providing funding to develop and implement innovative solutions for energy and climate gas reduction in building or neighborhood developments and the energy system - and facilitated by the consultant agency Asplan Viak.

The project owner, the land development agency of Elverum (ETS), stated that they "deliberately invited a bit wide" to the 5 workshops to integrate as many stakeholders as possible in the masterplan development. The interview partners, who participated at the workshops, described the process as fruitful and important to develop a common understanding for the project and the ambitions related to ZEN. The workshops gave the arena to discuss challenges and integrated solutions for the development of ZEN. One challenge discussed at the workshop was e.g. the difficulties to integrate the energy system, the district heating system, into the design of the buildings and install the energy system correctly. As a result of that, a guideline for the implementation of the heating system will be developed under the guidance of the utility company Eidsiva and with the help of researchers from the ZEN center.

Another example of a new collaboration between stakeholders involved in the Ydalir project is the walk- and cycle pathway that will tie Ydalir to the center of Elverum. This will be built in cooperation between the municipality and the utility company Eidsiva, as Eidsiva must nevertheless dig up a channel to offer district heating to the district. The pathway was originally an idea from the local architectural office Plan1, and with the opportunity to gather stakeholders

and their good ideas, the way could be realized. Creating an attractive walking and cycling network is part of the core of community concept within the Ydalir project. In this case parts of it were realized as a public-private partnership.

(3) System borders in regional and city planning and infrastructure planning

During planning and implementation of concepts that include an integration of mobility, behavior, energy in buildings and attractiveness, design is challenged by the misalignment of decisions on different system level. In the Bergen case, the regional governor stopped the project entirely due to conflict with urban sprawl regulations that came in place after the project had been politically approved by the previous government. In Furuset, the National Road Administration did not agree with the municipality's plan of adding space and attractiveness through a highway lid. The Regional Governor [Fylkesmann] has overturning authority regarding health and environment while the National Road Administration focuses on cost and safety. Large road infrastructure plans are made by the National Road Administration, working on different time schedule but with more authority than local municipalities. Further, national decision makers can make stricter decisions on things like urban sprawl or traffic limiting policies. While private developers mainly involve collaboration with local municipality, maximizing the emission reduction potential of neighbourhoods depend upon the ability to cross traditional system borders.

Best Practice Example 3: Cooperation contract on transport in Bodø

Regarding transportation planning, a cooperation contract 'smart transport' was signed for Bodø in February 2018 between stakeholders from national level (National Road Authority, Norwegian Railway Directorate, Coastal Administration and the aviation company Avinor AS), regional level (Nordland county) and Bodø municipality. This cooperation shall guarantee that national investments in transportation infrastructure in Bodø is aligned with goals for city development on a local level. This agreement will mostly account for the ZEN development of the "New City – New Airport" project, which is the biggest city development project for the coming 80 years and including the construction of a new airport. The alignment is important as the national investments for the airport and road system are made in an early phase of the neighbourhood development, while the urban development with residential and commercial buildings of the vacant land will follow at a later stage.

(4) Balancing social and high environmental goals

When conducting the interviews in the different pilot projects, stakeholders involved could be divided into two groups. One group, enthusiastic to reach for high environmental goals and seeing this as chance for innovation and better performance of their own organization and the other group being more reluctant and skeptical. Among stakeholders from this group, a ZEN development is often perceived as implementing an additional burden, by making the development more expensive and time consuming as well as being not congruent to social development goals. In this context interview partners often mention that first of all - and before ZEN - they want to develop "a good place to live" Steinkjer. The Steinkjer case has showed how resistant the future users of the ZEN development are against the concept of ZEN. ZEN was perceived as an additional burden to an already delayed and difficult project development. Future user resistance against the re-use of existing buildings – a main concept within ZEN – stopped the further development of the neighborhood as ZEN pilot project.

On the other hand, the "enthusiastic" group also pointed out this problem but emphasized the importance to develop the neighborhood in balance with environmental and social development goals. The idea "You have to give something while you take something" (give an take-concept) was mentioned from several interview partners, meaning to develop an understanding for where to cut down perceived comfort while improving services and usability at another part. The above-mentioned example of the cycle pathway in Ydalir as god example for that. While cutting down parking spaces within the Ydalir neighborhood, the cycle network and connectivity to surrounding areas will be improved.

Best Practice Example 4: Branding strategy in Ydalir

To develop a vision for the neighborhood based on future citizens demands and ideas, a branding strategy was developed at the beginning of the planning phase in Ydalir. A workshop was conducted with participants from ETS, local politicians, members of the administration of the municipality, and participants of the focused inhabitant groups of Ydalir.

The aim was to identify needs and values of the potential inhabitants regarding the neighborhood development. Representatives from different potential user groups participated at the workshop: citizens who have just moved to Elverum, former citizens of Elverum, which are living abroad and considering moving back as well as older residents living in Elverum. Three values are especially important for the potential inhabitants: close, constant and real. Each of these values was filled with a bundle of ideas how the everyday life shall be in Ydalir.

The values and ideas developed at the workshop were used to develop Ydalir as a brand with an own logo and a marketing strategy. The aim is to promote Ydalir as a sustainable neighborhood which incorporates the future way of living. While creating a positive image and pictures of the future, citizens shall have an affirmative attitude to Ydalir and its ZEN ambitions. They shall get an idea "what they get", instead of focusing on what they could lose. Figure 2 shows example pictures from the branding strategy. People displayed at the marketing pictures are residents from Elverum.



Figure 2. Examples of the logo and marketing visualisations for the Ydalir project, Source: ETS

5. DISCUSSION AND RESULTING TOOL

The previous chapter presented the challenges in the field of stakeholder collaboration within sustainable neighborhood projects. We pointed out- that in the worst case – processes stopped due to objections from individual stakeholder groups as in the Steinkjer and Bergen case. Most of the challenges could be addressed by creating stakeholder collaboration platforms – meeting places - where different stakeholders meet and get the chance to develop a common understanding, goals and solutions for the fulfillment of the high environmental goals of the neighborhood development.

On the other hand, we see that in thematic areas, the integration of social sustainability and spatial planning is the threatened aspects in neighborhoods with high environmental and energy ambitions. This is perceived as a 'goal conflict' among interview partners and thereby not only creates tension between citizens, urban planners, politicians and private developers but most significantly may lead to not intended results as poor living conditions and gentrification. The concept of "give and take" and the 'Core of Community' as a holistic and citizen-centered development concept are responses to this challenge.

But how to deal with these challenges and the good examples we can learn from?

Within several workshops, participants from the Bergen and Oslo case designed a new solution to this imbalance between spatial quality and social sustainability and smart energy communities. They proposed a more stakeholder led version of the planning process, very similar to the integrated project delivery contracts (Lahdenperä, 2012). The Smart Energy Community Planning Wheel (SEC Planning Wheel) was designed through collaborative efforts matched with needs identified in the interviews; and is presented in figure 3.



Figure 3. SEC Planning Wheel, Nielsen et al. 2017

The Smart Energy Community Planning Wheel describes a process in which stakeholder collaboration and citizen inclusion run as parallel priorities from the first step (Step 1 SEC Agreement). This is before a collective agreement is made for the public and private stakeholders to commit to finance the Core of Community as early as possible (Step 2 Core of

Community fund). The idea is that obligation to finance the central elements of the neighborhood development will prevent delays in the implementation. It will lower risk and avoid the situation where "everyone waits for everyone" as happened in Furuset, and overarchingly to increase the sustainability of the neighborhood or community. Ideally, the involved stakeholders suggested that contributing to this fund should lead to a set of incentives (Step 3). Further, participants explained that this would only work when the municipalities would not let other private developers or projects to compete directly with the planned neighborhood development (No Go policy), but prioritize the ones contributing to the CofC. Finally, the learning element particularly needed in the municipal organization, is represented through the need for an evaluation (Step 5).

6. CONCLUSION

Development of neighborhoods with high environmental goals do face a lot of challenges. Some of them are common challenges and could be found in nearly every neighborhood project, as some are distinctive for ZEN and SEC developments. Stakeholder collaboration is one important challenge but meanwhile an enabler for solving challenges in other thematic fields as solving the perceived "goal conflict" by aligning the neighborhood projects with both environmental and social goals.

As these challenges are influential in keeping the silos that we need to think outside to achieve sustainable behavior coupled with technological optimization, we have proposed with the SEC planning wheel a solution in terms of an integrated delivery (Ghassemi and Becerik-Gerber, 2011) orientation. In the planning wheel combining the core of spatial quality and sustainable behavior design with the conceptual development of low-carbon neighborhoods, we place accountability not only for the delivery of buildings, but also for the "Core of Community" – the very aspects that the citizens believe are key to keep the attractiveness of the area.

The SEC wheel is providing an understanding for the planning of neighborhoods with high environmental goals in 5 phases. The presented examples for stakeholder collaboration from the various pilots will be helpful as best practice examples and tools to integrate in the SEC planning wheel. Our future work will therefore focus on the evaluation of the stakeholder collaboration in the pilot projects with special focus on the individual and local context of each pilot project. We do not only need good examples to learn from, but as well an understanding under which circumstances and which context these examples are replicable and a frame to set these best practice cases and tools in a context to each other - the SEC planning wheel.

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