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Strategic spatial planning – a missed opportunity to facilitate district heating systems based on excess heat

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ABSTRACT
Strategic spatial planning is important for developing long-term visions and strategies towards regional and local sustainability. This paper explores if and how strategic spatial planning could be useful for overcoming some barriers related to new sustainable ways of heating residential areas, using district heating systems based on industrial excess heat. This longitudinal study builds on interviews with municipal and private actors in six Swedish municipalities. It highlights that important barriers can be overcome by influencing the design and location of residential districts and industrial activities. Further, it identifies missed opportunities in local spatial planning practice as stakeholders are involved late in the planning when much is set, leaving little space for stakeholders to have an impact. Consequently, there might be a lack of knowledge and expertise in how such issues could enhance planning. Strategic spatial planning could facilitate conditions for excess heat-based systems of district heating as it implies a broader systems perspective which could enhance a broader planning scope. Plan programs could bring about more strategic spatial planning processes as these require early stakeholder involvement. If taking stakeholder involvement one step further to stakeholder collaboration or co-production, an even broader planning scope would be achieved.

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Introduction
Strategic spatial planning is highlighted as an important contributing factor when developing realistic, long-term visions and strategies towards sustainability on the local and regional levels (e.g. Council of Europe, 2006a, 2006b; European Council, 2011; UNECE, 2008). It can serve as an effective tool for sustainable development of residential areas and large technical systems, such as transportation, waste management and energy systems (Poister & Streib, 1999).

One critical issue in striving for a more sustainable development is energy use. A large amount of energy use in Europe is for space heating in buildings and production of hot tap

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water. Individual burners or electrical heaters dominate the heat market in Europe, but, especially in countries with cold climates such as Sweden, Finland and Russia, district heating systems are widespread for such purposes (Werner, 2016). In Sweden, which is the focus of this paper, district heating accounts for more than half of the heating of residential buildings and premises (Päivärinne, 2017). District heating systems consist of a boiler and a distribution grid. Depending on local conditions, fuels used in the boiler can vary, e.g. coal, oil, biofuels and household waste. To improve the environmental performance of district heating systems, one strategy has been to replace fossil fuels such as coal and oil with renewables. Another way leading to the same result is to increase the use of excess heat as a heat source (Fredriksen & Werner, 2014).

Sweden has a tradition of big energy-intensive manufacturing and process industries, generating large amounts of excess heat. Together with well-established systems of district heating, this has set a good foundation for the emergence of excess heat-based systems of district heating (Cronholm, Grönkvist, & Saxe, 2009). Excess heat utilization in district heating grids is currently one of the most cost-effective ways of using excess heat as a source for heating (Fahlen, Trygg, & Ahlgren, 2012). Still, the utilization is low compared to the availability (Swedish Energy Agency, 2010). An increased recovery of excess heat from industrial processes and thermal power generation has potential to reduce primary energy demands (Persson & Werner, 2012). Recovery of industrial excess heat could also lead to the development of new district heating systems.

Systems of district heating in Sweden currently constitute a natural monopoly. This is because the owners of the district heating grids, which are the district heating companies, own the legal rights for production as well as exclusive access to the distribution systems. This implies that actors with an excess of heat do not have the ability to directly sell and distribute heat through the existing grid infrastructure. The sales and distribution of excess heat must, therefore, be made via the district heating companies. Thus, development of excess heat-based systems of district heating requires collaboration between industries generating excess heat and district heating companies wanting to use it in their grid. One problem for emergence of such systems is that supply of excess heat does not always match demand, and vice versa (Päivärinne & Lindahl, 2016; Päivärinne, Hjelm, & Gustafsson, 2015). Yet another factor highlighted as a barrier is that these systems require rather expensive infrastructure (mainly heat exchanger and distribution grid) related to distribution (Päivärinne & Lindahl, 2015, 2016). In addition, the district heating sector as such is a mature industry in its established markets with declining market growth (Sahlin, 2013). Further, renovation of old buildings and construction of new energy-efficient buildings lead to decreasing heating demands, making traditional district heating systems based on fossil or biofuels less profitable. Despite the barriers mentioned above, Doménech and Davies (2011) argue that it is possible to achieve profitability for district heating systems based on excess heat, since excess heat is less expensive than primary energy. Of interest is also an upcoming EU directive on zero-energy buildings (Directive, 2010/31/EU), which states that the energy used should be measured as primary energy, that is, the total amount of energy needed to provide energy to the end users. Since excess heat is not classified as primary energy, heating solutions using excess heat will be favoured.

Strategic spatial planning could help overcoming some of the barriers mentioned above by influencing the design and location of both built areas (which set the demand for heat)
as well as industrial activities (generating excess heat) (c.f. Ranhagen, 2008). As strategic planning implies having a broad perspective to planning, such an approach could also enhance for having a broader perspective to stakeholder involvement and stakeholder collaboration, meaning that actors with excess heat could be identified as relevant for the planning process.

Spatial planning in Sweden is the responsibility of local authorities through a municipal plan monopoly¹ (National Board of Housing, Building and Planning, 2016) and is built on a tradition of including participatory mechanisms (Busck, Hidding, Kristensen, Persson, & Prestholm, 2008; Maier, 2001). However, there are several studies highlighting the need for building stronger stakeholder commitment to planning processes and to better involve a multitude of stakeholder groups when developing strategic visions for spatial planning (Albrechts, 2006; Poister & Streib, 1999). The importance of this is also stressed in multiple EU and international policies (Aarhus Convention, 1998; Council of Europe, 2000, 2006a, 2006b; Food and Agriculture Organization of the United Nations European Commission, 2004; FAO, 2003; Forest Europe, 2011).

Given the discussion above, this paper aims to explore if and how strategic spatial planning could facilitate the conditions for excess heat-based systems of district heating. To do this, the aim is broken down into two research questions. The first question is: ‘How do Swedish local authorities take district heating and excess heat issues into account within spatial planning?’

Answers to this question help in understanding how spatial planning is done in practice and how issues regarding district heating and specifically excess heat-based district heating are managed. By knowing this it is possible to take a more forward-looking perspective and answering the second research question: ‘How could Swedish planning practice be developed in order to improve the conditions of excess heat-based systems of district heating?’

After this introduction follows a brief introduction to how the concept of strategic spatial planning is used in this paper. Thereafter, the paper gives a background to local spatial planning in a Swedish context. This is followed by a presentation of the study’s methodological approach. The results’ section presents the empirical evidence, elucidating the two research questions. The paper wraps up through a discussion leading into the conclusions including some suggestions and implications.

**Strategic spatial planning**

Spatial planning is traditionally mainly associated with regulatory land-use planning (e.g. Albrechts, 2010; Purkarthofer, 2016). Due to current trends such as rapid urbanization, a need for more flexible and dynamic planning modes has emerged, demanding stronger focus on processes, actors and change, rather than focusing only the plan document (Albrechts & Balducci, 2013). Even though plan documents could be seen as one of the tools to achieve a desired change, there is a general shift away from planning by rules to planning by goals, from land-use oriented planning towards more strategic forms of planning (Albrechts, 2004), also referred to as strategic spatial planning or non-regulatory planning (Healey, 2004). One reason for this shift is that city development needs to go beyond traditional planning tools in order to enhance for societal transformation in a complex urban context (Albrechts, 2010). Compared to regulatory land-use planning,
strategic spatial planning has a broader planning perspective including a stronger emphasis on, e.g. transformative social processes and actor collaboration (Albrechts & Balducci, 2013). Moreover, it also implies a shift from comprehensiveness towards selectivity, inspired by a broad long-term vision (Albrechts & Balducci, 2013). Strategic spatial planning does by no means replace regulatory land-use planning but should rather be regarded as a complement (Albrechts & Balducci, 2013). However, as these two modes of planning have different origin and rationale, there is also a risk of conflict or tension between them, since traditional regulatory land-use planning has a more transparent, democratic approach, while strategic planning is more focused on efficiency and goal-oriented management (Mäntysalo, Saglie, & Cars, 2011).

This paper reflects on how/whether elements from strategic planning could contribute to land-use planning processes with a broader systems perspective, also including energy planning. Strategic planning is a debated concept with a wide range of different definitions and meanings and there is no universal definition. There are different approaches to strategic spatial planning in different continents and different authors define the concept in different ways (as discussed by e.g. Albrechts & Balducci, 2013; Albrechts, 2004). Albrechts and Balducci (2013) mean that strategic planning is action- or project-oriented. It could be seen as a framework used in different ways in forwarding sustainability (Gustafsson, Hermelin, & Smas, 2018). Strategic planning could enhance for multi-level governance, broad actor involvement, throughout the process – from initiation to decision-making and implementation (Albrechts & Balducci, 2013). Strategic spatial planning could be characterized by a process of collaborative learning amongst different actors and stakeholders within a municipality (Albrechts, 2004; Faludi, 2000; Granados Cabezas, 1995). Some stress that strategic spatial planning needs a multidimensional approach because of the subsystems of expertise where politics and economy are linked (Albrechts, 2006; Mäntysalo, 2000; Poister & Streib, 1999). In this paper, we focus specifically on those elements of strategic spatial planning that are related to having a broad systems perspective in order to elucidate different perspectives and actors. This, among other things, means focusing on, broad actor involvement of relevant societal stakeholders throughout the planning process in terms of participation, collaboration and co-production.

There are different levels of actor interaction in planning processes. Having a broad stakeholder participation is by many seen as a benefit as it brings legitimacy to the planning process and the decisions made within the process (Palm & Thoresson, 2014; Thomas, 1995). It could contribute to including important (technical) expertise which improves the quality of the process (Beierle, 1999; Pateman, 1970; Päivärinne, 2017; Sabatier, 1988; Thomas, 1995). However, participation is also complex as different actors have their own reasons for participating, different expertise and perhaps their own (perhaps sometimes hidden) agenda. It is therefore important to have a strategy for the participation in the planning process and reflect on who should be involved when, how and why (Fenton, Gustafsson, Ivner, & Palm, 2016). Stakeholder participation also comes with a responsibility for the planning body (which, in the context of this paper is the local authority) to analyse and handle the ideas, suggestions and opinions and take them into account in the planning process, otherwise it would decrease the planning body’s legitimacy. Having a broad participation means that there are many ideas and suggestions that need to be weighed against each other and there may be several conflicting ideas. However, in the end of the day, it is the planning body that makes the final decision.
on what to include from the stakeholder participation. One risk with stakeholder participation is the issue of ‘window dressing’, meaning that stakeholders are invited just because the municipality is expected to invite them, however, in reality, their participation has little impact on the actual planning process. Therefore, collaboration, networking and co-production have been acknowledged as important tools for strategic spatial planning. In the context of this paper, collaboration is defined as collaboration between different societal actors at different societal levels and in different sectors (both public and private), also including the civic society. Albrechts and Balducci (2013) put forward four factors they consider important for strategic spatial planning, out of which one explicitly stresses the ‘relational nature of strategic planning’, where co-production is key. Co-production in spatial planning is about inclusion and joint responsibility for the planning process. It also means that different actors not only have their say in the planning process, but they also need to interact, jointly discuss visions, challenges, possibilities, etc. To sum up, solely stakeholder participation is not enough for effective strategic spatial planning processes, there is also a need for collaboration, networking and co-production.

**Spatial planning in Swedish municipalities**

As this study is based on Swedish cases, it is important to get a basic understanding of the local spatial planning context in Sweden. Therefore, this section briefly describes how Swedish legislation regulates local spatial planning processes. Municipalities have different preconditions in terms of e.g. geography, population, businesses, large technical systems and other factors affecting the planning. This leads to legislation having varied impact in different municipalities (Elbakidze et al., 2015). Local traditions and practices largely define which spatial planning policies are pursued and how they are carried out (Evers & Tennekes, 2016). Terryn, Boelens, and Pisman (2016) therefore argue that spatial planning needs to integrate a high level of flexibility. A high degree of autonomy and self-governance, along with local plan monopoly give Swedish municipalities this flexibility as well as a broad action space when it comes to local spatial planning. There are, however, several regulations related to spatial planning, such as the Planning and Building Act (PBA; SFS, 2010:900) and the Environmental Code (SFS, 1998:808). Another regulation which is relevant in the context of this paper is the Act on Municipal Energy Planning (SFS, 1977:439).

Spatial planning on a municipal level in Sweden consists of ‘comprehensive planning, area regulations and detailed development planning’ (SFS, 2010:900). The area regulations and detailed development plans are legally binding documents, while the comprehensive plans are more general plans, providing overall directions for land and water use in the local territory. According to PBA (SFS, 2010:900), various societal interests should be weighed against each other in an open and democratic process, while considering the rights of individuals. All policies related to sustainability should, according to the Swedish legalization, be taken into consideration in spatial planning (Elbakidze et al., 2015). According to the current PBA (SFS, 2010:900), municipalities must consult with external relevant stakeholders when considering changes to the comprehensive plan, when developing plan programs and detailed development plans. Examples of such stakeholders are the County Administrative Board, the cadastral authority, energy companies and other interested parties, which can be individuals and businesses who own land or
other real estate in and around the plan territory. The consultation processes constitute open fora, to which stakeholders are invited to give their feedback on draft plans (SFS, 2010:900).

All Swedish municipalities must have up-to-date comprehensive plans for their geographical territories. The comprehensive plans provide guidance for decisions regarding the municipality’s use of land and water as well as the built environment, for a 20–30 years’ period (SFS, 2010:900). As mentioned, the comprehensive plan is not legally binding, which gives municipalities the flexibility to develop the planning process, its scope as well as the level of detail of the plan according to the local context and needs. Keeping the comprehensive plans up-to-date is an ongoing process (and has to be evaluated at least every four years) that allows for the plans to evolve over time, according to changing conditions.

The comprehensive plans are concretized into detailed development plans (that are more site specific for smaller geographical areas of the municipalities). However, before initiating the detailed development plans, the local authorities have to decide whether plan programs are needed (SFS, 2010:900). The objective of plan programs is to enhance the detailed development plans to get a broader planning base, in order for them to include external relevant stakeholders’ experiences and opinions at an early planning phase. This could provide with ideas and knowledge that is valuable for the further planning process. A plan program is a document in which describes the point of departure for the detailed development plan as well as its objectives (SFS, 2010:900). This program is developed by the municipality and communicated with stakeholders. If a plan program is considered necessary, external relevant stakeholders are invited for consultations before the detailed development plan process is initiated (SFS, 2010:900).

Detailed development plans take their point of departure in the comprehensive plan (and the plan program, if there is one). These plans regulate the use of land and water areas as well as the urban design covering specific geographic areas in the municipalities (SFS, 2010:900). Detailed development plans often follow the guiding principles agreed on in the comprehensive plans, but since comprehensive plans are not legally binding, the detailed development plans can sometimes conflict with the comprehensive plans (Lundström, 2018).

As mentioned before, there is also the Act on Municipal Energy Planning (SFS, 1977:439), which is relevant in the context of this paper. Among other things, it states that all municipalities must have an up-to-date energy plan which is mainly a guiding plan for the distribution and use of energy. Municipal energy planning should consider environmental effects of energy use from a local, regional and global perspective (Ivner, 2009). Wretling, Gunnarsson-Östling, Hörnberg, and Balfors (2018) have studied the interface between spatial planning and energy planning and identified a potential for planning process with a stronger sustainability focus by having an integrated approach between these types of planning. However, this integration is currently not very common in Swedish municipalities.

The context of this paper is spatial planning and its relation to planning for excess heat-based district heating systems. The municipalities have limited possibilities to directly control the energy use of buildings through the detailed development plan. They can, however, influence the energy performance of buildings in other ways. By regulating position and orientation of buildings, local authorities may indirectly control how and where
certain types of energy facilities are constructed. For example, a local authority may require densification of a planned area; this requirement will result in high heat density, which is a prerequisite for district heating (Lundström, 2018). Municipalities can also plan new areas close to existing sources of excess heat in order to facilitate the conditions for excess heat-based district heating.

This paper builds on a longitudinal study, and the planning legislation has been revised over the time the research was carried out. When the first part of this study was performed, the planning was regulated by the PBA from 1987 (SFS, 1987:10). In 2016, when the second part of the study was performed, there was a new, revised PBA (SFS, 2010:900). Seen from this study's scope and framing, the main differences between the two PBAs is that the old PBA (SFS, 1987:10), has stronger requirements on stakeholder participation. One example is the demand to publicly expose the draft plan for comments, and another example is the requirement on developing plan programs for detailed development plans. As mentioned earlier, the new PBA says that it is up to each municipality to decide whether a plan program is needed prior to the initiation of the detailed development plan. This could potentially imply that stakeholders are not invited to participate and contribute at an early planning phase, as this might be considered as too time-consuming or expensive.

Methodology

This longitudinal study builds on interviews in six municipalities (case 1–6). The first set of interviews were conducted during the spring of 2009, and they examined the spatial planning process in order to find out whether and/or how district heating issues were addressed within municipal spatial planning of new residential areas. The results of this round of interviews were first presented in Ivner and Persson (2009).

The second set of interviews were conducted in the same six municipalities during the fall of 2016. The purpose of these interviews was to enable an analysis of the development over the seven years that separate the two rounds of interviews. In addition, these interviews also examined whether and how existing sources of excess heat were considered within the framework of municipal spatial planning and explored how the implementation of strategic spatial planning could facilitate the conditions for excess heat-based systems of district heating.

The criteria for selecting cases were based on the size of the municipalities and on ownership structures for the local district heating distributors. All municipalities represent medium-sized Swedish municipalities, considering number of inhabitants (population 18,000–57,000) (Table 1). In two of these municipalities (case 1 and 2), the district heating companies were wholly owned by the municipality; in two other municipalities (case 3 and 4), the district heating companies were partially privately and partially publicly owned; and in two municipalities (case 5 and 6), the district heating companies were privately owned (Table 1). The reason to select municipalities with different ownership structures of district heating companies was to be able to capture a potential difference between the planning processes within the different municipalities. An example of such a difference could be the requirement of financial returns and pay-off times of investments, that is, the private and partially private companies are to some extent more concerned with a return on investment than the solely publicly owned companies.
In the interviews done in 2009, at least three respondents from each case were interviewed in order to provide a deeper understanding of the planning processes. A total of 20 semi-structured interviews were performed to grasp the processes that led to the district heating companies’ decisions on whether to provide district heating or not in planned areas. In each of the six cases, one spatial planner, the municipality’s energy and climate advisor and one representative from the district heating company were interviewed. In two of the six cases, a fourth interview was conducted; in case 3, the data collection was supplemented with an additional interview from a second spatial planner and in case 6, a representative for the municipal housing company was interviewed since the company had a central role in the planning process for that case.

For the follow-up study in 2016, one spatial planner from each municipality was contacted for a semi-structured interview. Apart from following up on the 2009 questions, extra questions related to excess heat were added. It should be noted that it was not possible to interview the same individuals for both studies since the persons interviewed in 2009 had moved to other workplaces. Instead, the same function (spatial planner) was sought. Conducting follow-up interviews with respondents that differ between studies could have an impact on the results since different persons could have different ways to express themselves and different perceptions of the same situation. On the other hand, interviews with the same respondents would most probably also differ because of the long time between the interview occasions.

All interviews focused on the development of detailed development plans. A semi-structured interview format was used with open-ended interview questions. This allowed the respondents to speak freely on specific themes and the interviewer to ask...
follow-up questions to encourage the interviewees to expand on their responses (cf. Bari-ball & While, 1994). The interviews followed an interview guide with a number of themes and with slightly different content depending on the role of the interviewee. One important theme was the spatial planning process, step by step. Further, questions were asked to learn at what stage of the planning process the district heating company was or was not invited to participate. A final theme was whether and how existing sources of excess heat were taken into account within the spatial planning. The interviews were recorded and transcribed word-for-word. Thereafter, the transcripts were sent to the respondents for validation and clarification.

The analysis of the respondents’ answers was based on Swedish spatial planning processes as specified in PBA (SFS, 1987:10; SFS, 2010:900) as well as on previous research on strategic spatial as reflected on in an earlier chapter of this paper. The interviews conducted in 2009 were structured and analysed using the PBA prevailing before the revision in 2010 (SFS, 1987:10) and the ones conducted in 2016 were analysed using the current PBA (SFS, 2010:900).

The follow-up in 2016 of the result from the interviews in 2009 enabled an analysis of whether the local authorities adopt spatial plans differently regarding the more saturated heating market, and the revised PBA (SFS, 2010:900), which specifies the strategic role of comprehensive plans.

Results

The results are presented using themes found in the joint analysis of the interviews in this study. The first theme deals with how planning was done and if and how the perspective of district heating was included or not. The second theme deals with how heat sources for district heating systems and waste energy utilization were handled. When analyzing the results, it became apparent that the ownership of the district heating companies on the planning processes had no influence on the results.

Inclusion of district heating issues in municipal planning practice

Starting with comprehensive planning, the aggregated results from both studies showed that all comprehensive plans for the six municipalities were designed with capillarity in focus to better use existing infrastructure of surrounding built-up areas. Further external relevant actors, such as district heating companies, were not consulted at this stage in any of the cases, not in 2009, nor in 2016. Furthermore, results from 2016 (despite the revised legislation) showed the same for actors with an excess of heat.

As described in the previous chapter, before initiating the detailed development plan, there is is the voluntary stage of issuing plan programs to bridge between comprehensive planning and developing detailed planning. None of the respondents highlighted the development of such programs, which indicates that this step generally was overlooked in the preparation of detailed development plans.

Moving on to the stage of developing detailed development plans, the interviews showed that when there was an interest in developing new areas, the initiative of exploitation often came either from the local authorities or from developers, meaning that the developers approached the municipality with suggestions on areas for exploitation.
However, respondents from all cases described the consultation with district heating companies and other external relevant stakeholders as sparse. This is since these consultations’ main focus with energy companies was about finding out if there was any interest in connecting planned areas to district heating. According to the respondents, no other themes were discussed.

All spatial planners interviewed both in 2009 and 2016 described that they contacted external relevant stakeholders, including district heating companies, for consultation during the preparation of their detailed development plans. Thus, the district heating companies became involved in the planning process, enabling them to have an influence and contributing with their knowledge. However, all respondents representing the district heating companies in the interviews from 2009 expressed that, at this stage of the planning, they found it difficult to have an influence in order to facilitate the conditions for district heating. Most respondents from the district heating companies also believed that they had limited influence especially regarding location of planned areas, something that is particularly difficult to change later in the process. The district heating companies and other external relevant stakeholders from the six studied municipalities expressed that they only had the opportunity to voice their concerns when all decisions, in principle, already had been made.

According to all respondents from both years, it is generally most profitable to expand systems of district heating in densely populated residential districts. Some argued that it was up to the district heating companies whether or not a residential district would be connected to the district heating grid. The decision, they claimed, was based on the financial profitability. This meant that even if the local authority wanted the district to be heated by district heating, it was out of their scope of action to ultimately make this decision. In addition, the respondents also noted that the expansion of district heating to planned residential areas outside the city centre and expansion of existing district heating grids were further complicated by the fact that new buildings are becoming more energy efficient.

All respondents from both studies described that it was the individual developer together with the district heating company who, at the building permit stage, determined whether the planned area would be connected to district heating or not. At the same time, they acknowledged that the heating issue did not really come into the planning process until the construction process. As the respondent from case 1 described it: ‘The issue of district heating is solely based on whether the district heating company believes that it is profitable to provide district heating to the planned area’.

The spatial planners interviewed in 2016 expressed that they could only indirectly influence the decision on whether the planned area gets district heating through consultation by providing recommendations and through mutual discussions with the district heating company. The spatial planners interviewed in 2016 from cases 1–5 articulated an awareness of the fact that the current legislation allows local authorities who own the land to decide type of heating. However, most spatial planners interviewed in both 2009 and 2016 thought that the decision on district heating expansion was made regardless of whether the municipality owned the land or not.

The spatial planner from case 5 experienced a general trend of keeping the detailed development plan on a general level with few details. The same respondent described that there was a conflict of interest between demands for sustainable energy systems and expansion of the municipality by exploitation of new areas. The local authority was perceived of, to some
extent, being afraid to set too high energy demands leading to fewer developers willing to exploit. Ultimately, this could result in that the planned area was not exploited.

**Handling of excess heat-based systems of district heating within the spatial planning process**

None of the spatial planners in the interviews from 2016 said that they took existing sources of excess heat into account in the development of neither comprehensive nor detailed development plans. Nor did any of the respondents describe any influence of their municipal energy plans on such planning. The respondents from cases 2 and 5 felt that they probably could have done more to influence the district heating companies’ willingness to provide district heating and to facilitate the conditions for district heating based on excess heat. However, the respondent from case 5 argued that this ultimately was a political issue and that the issue of excess heat would need to be raised on the political agenda in order to get a greater impact on spatial planning. The respondent from case 2 meant that the spatial planning often had a strong focus on public transport solutions and proximity to water, sanitation and other services, and that energy, and heating issues, in particular, had become a lower priority. In case 4, the spatial planner believed that heating was not a key issue within spatial planning as ‘heating can be solved in other ways than district heating’.

The spatial planner from case 6 (interviewed in 2016), described that the municipal spatial planners had developed a document for sustainable construction with directives and guidelines, which among other things stated that buildings should be connected to district heating where district heating is available, unless a more energy-efficient and environmentally better alternative could be presented. Yet the document did not include any directives or guidelines related to utilization of excess heat. However, at the same time, the respondent described that they were experiencing uncertainties regarding what requirements and demands they had the mandate to issue and that it therefore usually ended up in recommendations.

Planning for areas in order to facilitate for excess heat-based system of district heating concerns a matter that none of the respondents had previously reflected on. All spatial planners interviewed in 2016 thought that for some areas they planned for the settlement to get a high heat density which in turn would benefit and improve the conditions for district heating. Yet, the spatial planner from case 6 believed that planners had poor knowledge of existing sources of excess heat that could provide heat to the grid.

To summarize, the aggregated results from the interviews conducted both in 2009 and in 2016 were strikingly similar and showed that the preconditions for district heating as well as excess heat-based systems of district heating in planned areas were only indirectly set through the development of the comprehensive plans. More directly, they were set through the development of the detailed development plans.

**Discussion**

The current PBA (SFS, 2010:900), aimed at increasing the strategic role of comprehensive planning and to re-establish its central role in local planning practice, does not seem to have had any major impact on planning practice in the six studied municipalities. This
assumption is based on the fact that the results from the interviews from 2016 are similar to the ones from 2009, concerning the respondents’ descriptions of the comprehensive planning. There are strategic elements in Swedish planning legislation that would enhance for more strategic planning with a broad systems perspective including involvement of other actors. However, this type of support is vaguely formulated and therefore opens up for different interpretations. There is, therefore, a risk that municipalities’ own interpretations of legislation result in that important planning steps are omitted. On the other hand, this flexibility could also encourage new innovative and proactive approaches to strategic spatial planning. The lack of adherence is probably due to knowledge gaps, in combination with poor understanding of how different professions and actors could contribute to the process (see, e.g. Uzzi, 1996; 1997). This leads us to the most important missed opportunity that we have observed in this study: the possibility to use stakeholder participation and consulting as a strategic tool for obtaining expert knowledge and to broaden the planning perspective. This has an impact both on the scope of the planning practice as well as on stakeholder involvement. It is not only important for the legitimacy of the planning process (as discussed by, e.g. Palm & Thoresson, 2014) but also important from a quality perspective. Ranhagen (2008) points out that district heating companies have very limited opportunities to influence, not only the design of the area but also the area location. This is an important precondition for enabling district heating based on excess heat. The late actor involvement in current planning practice probably contributes to a lack of interaction and communication among spatial planners, district heating companies, actors with an excess of heat and other external relevant stakeholders. Early stakeholder involvement is necessary in order for municipalities to get access to knowledge concerning important conditions when developing plans for future spatial development. The legislation requires that external relevant stakeholders should be consulted (SFS, 2010:900), yet each municipality has to decide who these are. The district heating companies seemed to be obvious in the context of this study, however, when reflecting on excess heat it is less obvious who the stakeholders would be and how they could be identified.

A way to involve stakeholders at an early stage is to develop plan programs, where the stakeholders can engage, give feedback and contribute with their ideas and expertise before the detailed development plan process begins. Plan programs are described in the PBA, however as it is not mandatory but formulated as an option, this is not always a part of the local planning practice (see SFS, 2010:900, 10§). This is reflected in our study as none of the respondents highlighted plan programs as a step in their process of developing detailed development plans. This indicates that they did not consider plan programs important enough. Instead, the local authorities went straight to drafting detailed development plans. We see this lack of use of plan programs as another missed opportunity for a more strategic spatial planning approach.

Another approach to broaden the scope of planning as well as actor involvement is to integrate the energy planning with the comprehensive planning. Synergies between energy and land-use planning processes have been observed in some Swedish municipalities, as energy planning could contribute with a broader sustainability perspective to comprehensive planning in terms of strategies and targets (Wretling et al., 2018). Wretling et al. (2018) illustrate this with an example from a municipality where the energy planning contributed to the comprehensive planning with analyses of potential densification of districts.
in order to increase the efficiency of the transport system. This could be seen as one step towards strategic spatial planning (as it was discussed earlier in this paper), as this requires a multi-stakeholder approach, a broadened perspective of land-use planning and resources (see, e.g. Albrechts, 2004; Albrechts & Balducci, 2013). However, integrating energy planning into comprehensive planning seems to be a third missed opportunity in the six municipalities in this study as none of the respondents mentioned energy plans as part of the spatial planning.

Strategic spatial planning processes based on stakeholder participation is particularly important given both the weakening of the plan monopoly – entailing decreased municipal power to directly influence the outcome of planning, and the privatization of energy companies – from municipal units to municipally owned energy companies and further to private companies. Wretling et al. (2018) reflected on that the municipal action space had decreased due to privatization of municipal energy companies. In this study, however, we see no differences in practice between municipalities where there are municipally owned energy companies and those where there are privately owned energy companies. As privatization entailed that energy issues went from being controlled and developed by local authorities to instead being controlled and developed by private actors, important knowledge of these systems is no longer within the municipal organization. There could, therefore, be a risk for a missed opportunity in order to achieve a more strategic spatial planning with a broad systems perspective, actor involvement and consultation.

The consultation needs to develop into discussions on how to frame decisions, actions and implementation. According to Golobic and Marusic (2007), this focus also requires monitoring, feedback, adjustment and revision. More well-developed consultations at this stage could probably also lead to overcoming the unspoken conflict between sustain- able energy performance and the fear of overly high demands on developers, as expressed by one of the spatial planners in 2016. This is because dialogues between spatial planners and relevant stakeholders early on in the planning process could contribute to exchanges of knowledge on important preconditions for the emergence of district heating systems based on excess heat. From a knowledge perspective, the current practice implies missed opportunities for the municipal spatial planners to achieve knowledge from a broader range of external relevant stakeholders (Albrechts, 2004; Albrechts, Healey, & Kunzmann, 2010), knowledge that could facilitate the opportunities for excess heat-based district heating to evolve. In addition, this insufficient consultation likely makes it more difficult for stakeholders to come into the planning process in a natural way even later on. Developing plan programs together with stakeholders when initiating the detailed development planning, could contribute to better knowledge of existing sources of excess heat among the municipal planners before the formulation of the actual detailed development plan begins. It may also create an opportunity for district heating companies to interact with actors with excess heat and to thereby contribute with their knowledge on how to plan in order to facilitate the conditions for excess heat-based district heating further. This could altogether lead to spatial planning evolving in more strategic ways.

Based on the work of Golobic and Marusic (2007), it could be preferable for municipalities (and planning authorities in general) to take a more cyclical approach including feedback loops and continual improvements. This incorporates monitoring, feedback, adjustment and revision in the efforts to accomplish these aims, both in the short term
and the long term (Bryson, 1995; Bryson & Roering, 1988; Faludi & Korthals Altes, 1994; Mintzberg, 1994; Poister & Streib, 1999). Such an approach would encourage learning how to create strategic planning processes with broad participation and actor collaboration throughout the processes. Taken one step further, and as discussed by Albrechts and Balducci (2013), this could ultimately lead to co-creation among actors and to planning processes that engage a wider range of societal stakeholder groups. Such an approach requires institutional capacity and organizational maturity among the participating or co-producing organizations as this could become very complex. It also requires understanding of and respect for different actors’ agendas, missions and ambitions (see, e.g. Eklund & Gustafsson, 2015).

**Conclusions**

This paper suggests that strategic spatial planning could facilitate the conditions for excess heat-based systems of district heating. One argument is that strategic planning implies having a broader systems perspective which could enhance for broadening the scope of the spatial planning. Having a broader approach integrating, for example, energy planning and comprehensive planning could increase the scope as well as range of actors in the planning processes. This would also imply the involvement of municipal planners with different expertise, as well as a broader scope of external actors. Furthermore, strategic spatial planning encourages stakeholder participation throughout the process – not only when the local authority asks for comments on a draft plan – which means that actors such as district heating companies and excess heat providers could be involved when there still is a possibility to have an impact on the development. Current planning practice in the studied municipalities includes communication with stakeholders. However, the district heating companies felt that they were invited too late in the process when there is little space for changes and only to decide the profitability of a potential expansion of the district heating grid to a planned residential district. Furthermore, there was insufficient knowledge in the municipalities of excess heat and of excess heat actors, which means that the use of excess heat was not an issue in most spatial planning processes. Thus, a conclusion of this study is that the potential for district heating and excess heat is little discussed and explored in local spatial planning practice.

Using plan programs could enhance for a more strategic spatial planning as the plan program requires stakeholder involvement at an early planning stage. However, in this study, we see a missed opportunity in not using plan programs. Plan programs could enhance for a more transparent process where actors (such as district heating companies and excess heat actors) are involved and have the possibility to engage and give feedback at an early planning stage. However, this takes time and makes the process more expensive, and the absence of plan programs could be interpreted as if efficiency weighs heavier than stakeholder participation.

Strategic planning could elucidate the importance of not only stakeholder involvement but also the importance of co-production, as no actors alone are in possession of the full picture and all knowledge. However, collaboration and co-production are complex, and it is important that there are joint understanding and respect among the collaborating partners. It would be interesting to further investigate the integration of comprehensive planning and energy planning more in-depth in a future study. Having a more integrated
approach to spatial and energy planning could have a potential to contribute to a closer collaboration and co-production between various energy actors and municipal planners and hence bring actors with excess heat into the spatial planning process.

Note

1. Sweden’s geographical area is divided into 290 municipalities with inhabitants, organisations, and large technical systems. Each municipality has a local authority which through a municipal plan monopoly has a unique position in having a high degree of autonomy in how to manage the local territory of the municipality (SFS, 1991:900).

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