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Analysing Conflicting Energy and Climate Targets between Municipalities, Energy Utilities and Housing Companies in Sweden

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ABSTRACT

To achieve the Sustainable Development Goals (SDGs), it is important that the SDGs are integrated at both national and municipal levels, and that the business sector is involved in this work. This paper analyses how well the SDGs are integrated as well if there are any conflicting energy and climate targets among municipalities, energy utilities and housing companies in Sweden, and in relation to national and EU targets. The targets are categorized as; climate impact, efficient energy use, and share of renewable resources. Three key indicators are in focus; timeline and level of targets, terminology, and system boundaries. The study focuses on the Linköping and Norrköping region, which has 300,000 inhabitants and is located 150 km southwest of Stockholm, Sweden. By using directives, company annual reports and interviews, the companies' decision-making processes and targets have been mapped.

The results identify differences in system boundaries and timelines as reasons to potential conflicts regarding climate targets. Ambitious targets at the municipal level are identified as a driving force, but with target fulfilment two decades or more before national and EU targets. Regarding the category of efficient energy use, the level of targets and terminology differs. Lastly, regarding renewable resources, terminology and timeline differ. Furthermore, it is concluded that the SDGs are not integrated to a large extent in the business sector or at a local level. Overall, this may create challenges in communication, collaboration and exchange of knowledge in order to succeed and achieve the SDGs.

Introduction

In 2015, the United Nations (UN) adopted the 2030 Agenda for Sustainable Development, which outlines 17 sustainable development goals (SDGs), including 169 targets, that have been put in place to work for sustainable development and to stimulate action (UNGA, 2015). The SDGs address the global challenges for a sustainable future, including poverty, inequality, climate, environmental degradation, prosperity, peace and justice. The European Union (EU) has a vision of climate-neutrality in 2050, which is in line with the Paris Agreement objective to keep the global temperature increase below 2°C and pursue efforts to keep it at 1.5°C (EC, 2018). This paper focuses on targets related to climate and energy. Based on the EU framework, the Swedish climate and energy policies are made up of three main goals, which in this paper is categorized as climate impact, efficient energy use, and share of renewable resources (EC, 2014; Ministry of the Environment, 2018):

- Sweden shall have net-zero emission of greenhouse gases (GHG) by 2045. Moreover, territorial emissions shall be decreased by 85% compared to 1990.
- The energy intensity shall be decreased by 50% by 2030 (compared to 2005).
- 100% of electricity production shall come from renewable resources by 2040.

A study commissioned by the Swedish Government states that Sweden has good prospects for achieving the SDGs, but that there are significant challenges (Agenda 2030 Committee, 2019). The need for municipalities to integrate the SDGs more is highlighted. Furthermore, the investigation stresses the importance of a well-functioning business sector with sustainable business models and the sector's involvement in order to fulfil the SDGs. The UN Global Compact is a voluntary initiative aiming to inspire and incorporate the SDGs into business operations. This is the world's largest corporate sustainability initiative, which enables businesses to take action on the SDGs through dynamic self-assessment, benchmarking and improvement (UN, 2020; UNGA, 2018).

It is common for businesses to ensure quality, safety and efficiency by certifying work processes according to international standards. The International Organization for Standardization (ISO) is an independent international organisation. There are synergies between the ISO and the SDGs, as economic, environmental and societal dimensions are addressed by the ISO. Five SDGs regarding health, industry, cities, consumption and climate (SDGs 3, 9, 11, 12, and 13) have more than 200 associated ISO standards each (ISO, 2019). Since 2017, larger Swedish companies have been obliged to issue a sustainability report[1] (The Swedish Parliament, 2019). The report should contain a business model, information on environmental issues and any products or services likely to have adverse consequences, and how the company manages any risks. Since 1977, municipalities are obliged to have a plan for the supply, distribution and use of energy (The Swedish Parliament, 1977).

The residential and services sector accounts for 40% of the EU's total energy use and 36% of the GHG emissions (EP, 2018). The sector is highlighted as having great potential for energy efficiency improvement (EP, 2018). In Sweden, the corresponding values are 40% of total energy use and 10% of GHG emissions (Swedish Energy Agency, 2018). The GHG emissions from heating of residential and services premises have dropped by 90% since 1990 in Sweden. The main reason is the transition from fossil energy carriers such as oil to district heating and heat pumps (The Swedish EPA, 2018). In 2008, the Swedish government stated that fossil fuel is not to be used for heating purposes (Ministry of the Environment, 2008). This has led energy utilities that provide district heating and cooling to phase out fossil fuels from their production (Fossil Free Sweden, 2018). It can be added that the EU and the Swedish Government say that district heating and cooling utilising combined heat and power plants provides an opportunity for improved resource efficiency, as the technique make use of energy that would otherwise be wasted (Ministry of the Environment, 2008, 2018). A number of studies also emphasise the role of combined heat and power in the energy transition from fossil fuel to renewable resources (Kim et al., 2019; Lake, Rezaie, and Beyerlein, 2017; Lund and Mathiesen, 2015; Sayegh et al., 2016). Within Sweden's multifamily dwellings, district heating is the predominant energy carrier with a 90% share (Swedish Energy Agency, 2018). This leads to the actors in this paper to be interconnected and having a business relationship.

The aim of this paper is to analyse whether there are any conflicting targets, in terms of energy and climate, among municipalities, energy utilities and housing companies in Sweden. The targets are categorized as; climate impact, efficient energy use, and share of renewable resources. The analysis focuses on key indicators of timelines and level of targets, terminology, and system boundaries. Furthermore, how well the SDGs are integrated at EU, national, municipal and business sector levels is also analysed.

Case study – The energy and housing sector and their efforts towards sustainable development

Linköping and Norrköping are two neighbouring municipalities and the main municipalities in the East Sweden region. The region is the fourth largest metropolitan area in Sweden and is located 150 km southwest of Stockholm, with 160,000 residents in Linköping and 140,000 in Norrköping. Collaboration is common in this region, for instance regarding issues of sustainability. The municipalities of Linköping and Norrköping signed a common climate vision in 2008 (Linköping and Norrköping Municipalities, 2008). Both municipalities have declared their support for Agenda 2030 and the SDGs (Linköping Municipality, 2018b; Norrköping Municipality, 2017b). Moreover, Linköping Municipality has adopted a target of carbon neutrality by 2025 (Linköping

[1] Two out of these three criteria should be met: (1) More than 250 employees, (2) a balance sheet total of more than SEK 175 million (EUR 16.7 million), or (3) a company's net sales amount to more than SEK 350 million (EUR 33.5 million).

Municipality, 2018a). Norrköping Municipality aims to use only renewable resources by 2030 and to reduce its energy use by 30% by 2030 compared to 2005 (Norrköping Municipality, 2017a). Both municipalities have set their goals within geographical boundaries, within which all activity is accounted for, e.g. in the business sector.

The study includes two energy utilities and four housing companies. The energy utilities produce electricity and district heating, among other products. The housing companies are large customers, as their building stock is significant and uses both electricity and district heating. The actors act both nationally and locally, and are governed differently because of differences in their shareholders. Public utilities may experience strict management, e.g. when targets to achieve the SDGs are set, while decision-making in the private sector may be governed by other values and be done more freely. Energy utility 1 is a local energy utility owned by Linköping Municipality, and has approximately 230,000 customers in the private and business sectors. Energy utility 2 is investor-owned and is a subsidiary of one of the major European public energy utilities. It operates in several regions and cities in Sweden and has around 1,000,000 customers. Housing company A is a major local actor and the largest company managing multifamily buildings in the region, with a property value of SEK 25.8 billion (EUR 2.46 billion). The company is owned by Linköping Municipality, as is housing company B which manages buildings in the public service sector and has a property value of SEK 9.1 billion (EUR 0.9 billion). Housing company C is one of the major private property owners in Sweden. It operates in several cities in Sweden's densely populated regions. The property value amounts to SEK 24 billion (EUR 2.3 billion), and half of its portfolio consists of residential properties, with the rest being office and commercial properties. Lastly, housing company D is one of Sweden's largest public utilities with a property value of SEK 92 billion (EUR 8.8 billion). It operates nationwide and is wholly owned by the Swedish state. It manages buildings and facilities for education, research, and innovation.

This case study is conducted within the Sustainable Region research project, which is a collaborative project between energy utilities, housing companies and academia. The purpose is to analyse and facilitate conditions for sustainable development, towards a resource-efficient region. The research project and its actors have previously been used in several studies (Blomqvist, 2019a; Blomqvist et al., 2019b; Blomqvist et al., 2019c).

Methodology

The first step involved gathering data on the actors' energy and climate targets. This was mainly obtained from sustainability reports, annual reports and websites in order to map the involved actors' work on sustainability[2]. Directives from municipalities and at national or global levels were also gathered. To establish the decision-making process, or to clarify any other issues, semi-structured interviews were used. Interviews were also used in order to investigate how the actors plan to achieve their goals and which types of activities may be relevant. This step and the following steps of the methodology are described in Figure 1.

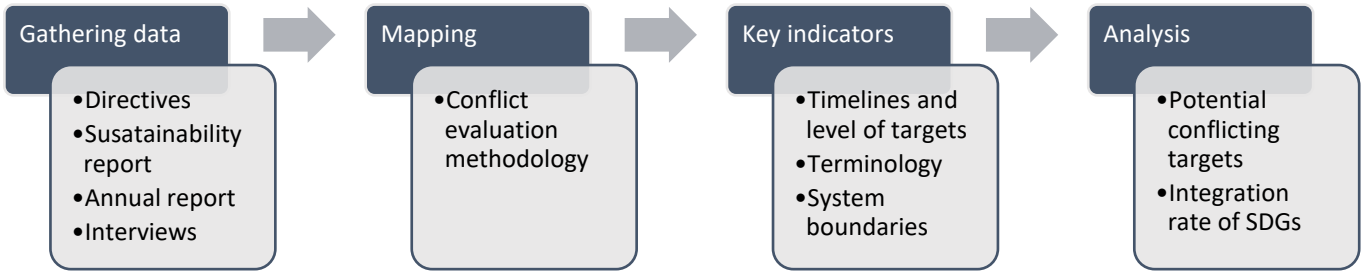

Figure 1. A visual description of the methodology used in this study.

[2] References: Akademiska Hus, 2019; E.ON Sweden, 2019; EC, 2014, 2018; Lejonfastigheter, 2019, 2020; Linköping Municipality, 2018d, 2018a, 2018c; Lundbergs Fastigheter, 2019; Ministry of the Environment, 2018; Norrköping Municipality, 2017a; Stångåstaden, 2019; Tekniska verken, 2019

The next step in the methodology was to map the targets, which was done using a conflict evaluation methodology as described in Figure 2. Conflicts arise when there is a consensus on the goal but disagreement on how to achieve the goal. This means that priorities need to be made and changes are required in the intended workflow to reach the goal. Target conflicts highlight the importance of examining the intended path to goal achievement in order to determine whether or not the goal will be achieved (Bartholdsson, 2011).

		Do we agree on the goal?	
		Agree	*Disagree*
Do we agree on how to achieve the goal?	*Agree*	**Agreement**	**Disagreement**
	Disagree	**Conflict**	**Disagreement**

Figure 2. A methodology for conflict evaluation, inspired by Bartholdsson (2011).

Key indicators are used to analyse whether there are potential conflicting targets. These are visualised as step 3 in Figure 1. Key indicators in this study are:

- Timelines and level of targets – Until when is the goal set, and at what level?
- Terminology – What terms are used when setting goals and activities to achieve the SDGs?
- System boundaries – What do the studied actors include in their stated goals and indicators, and what is not included? What can be the consequences of different activities to achieve the goals and surrounding activities that are relevant to the sector?

The key indicators constitute the basis for analysing potential conflicting targets and consequences that may arise during the work to achieve the goals. Integration of the SDGs is also studied, from the global level through the EU level, national level and municipal level, down to the business sectors represented by the energy utilities and housing companies in this study.

Results

The energy utilities and housing companies in this study have targets and processes to work for sustainable development. However, the integration of the SDGs into their sustainability work varies among the studied actors. The two energy utilities have integrated the SDGs in their sustainability work, while the four housing companies lack a clear connection to the SDGs. Their sustainability work is instead primarily based on and communicated by the three dimensions of sustainability: environmental, economic and social. However, two housing companies also emphasise that parts of their sustainability work are based on the UN Global Compact. ISO standards and their connection to sustainability are also emphasised by several actors in the study.

The municipalities support Agenda 2030 and the SDGs, but lack clear methods or goals for how to contribute to fulfilling the SDGs. Although, the municipalities carry out sustainability work that is based on the three dimensions of sustainability. Moreover, both municipalities limit their work to their geographical areas, which includes all actors acting within the municipality's boundaries. This fact, along with integrating Agenda 2030, stresses the need for collaboration between municipal and local businesses, with organisations, academia and other actors exchanging knowledge and accelerating the work. During this study it was demonstrated that the municipalities are involved in several networks where issues relating to sustainability are addressed.

The results from the case study regarding potential conflicting targets are presented in Tables 1, 2 and 3. The tables relate to targets for climate impact, energy efficiency and share of renewables. An analysis of conflicts follows, in which negative effects on the SDGs or other less favourable solutions are highlighted.

Climate target

Reducing the GHG emitted to the atmosphere is a key component in SDG 13, as well as the EU's vision of climate-neutrality in 2050. Sweden has a target to become one of the first fossil-free welfare nations. This is expressed as net-zero emissions of GHG by 2045. The target also includes important milestones to ensure that the emission of GHG will be reduced. The work categorised in this section also includes clear contributions to SDGs 7 and 11, as the work aims to reduce energy use and improve sustainability in urban areas.

Table 1. Compilation of goals related to climate impact. The compilation includes SDGs, EU, national and municipal levels, as well as targets of the energy utilities and housing companies. The table is accompanied by an illustrative timeline of the actors targeted years of fulfilment. Bold and underlined years indicate fulfilment of the goal, whilst the others are sub-targets.

		Main SDG	Additional contribution to SDGs	Timeline
Global			 	
EU		A vision of a climate-neutral EU in 2050. GHG emissions shall decrease by 40% by 2030 (compared to 1990) in domestic EU emissions.		**2050**
National		By 2045, Sweden shall have a net-zero emission of GHG. Moreover, by 2045 GHG emissions from domestic activities shall decrease by 85% compared to 1990. The goal also includes milestones of a 63% decrease by 2030 and 75% by 2040.		**2045**
Municipal		• Linköping has a target of becoming a carbon neutral municipality by 2025. The target is limited to carbon dioxide, but the municipality is also working to reduce emissions of other gases with an impact on the climate. • Norrköping has no firm target regarding GHG emissions. However, the municipality aims to reduce its energy use by 30% by 2030 (compared to 2005) and to only use renewable resources. In turn, this will have positive effects on GHG emissions.		**2025** 2030
Company	Energy	1. Through the owner directive, energy utility 1 shall minimise GHG emissions and work to achieve the municipal goal of carbon neutrality by 2025. The utility has no targets of its own, but is making significant efforts in connection with this matter. 2. Energy utility 2 has a target to reduce GHG emissions by 50% by 2025, compared to 2017.		2025
	Housing	A. The company does not have a stated target for GHG emissions, but is owned by Linköping Municipality and is included in the municipality's target of being carbon neutral by 2025. B. The company is also owned by Linköping Municipality and is thus included in the target of becoming carbon neutral by 2025. It works to reduce its GHG emissions each year along with its energy use, which it aims to reduce by 20% by 2025 compared to 2015. C. The company has no firm target regarding GHG emissions, but is keen to only use renewable or recycled energy by 2025 and achieve further energy efficiency which will have positive effects in connection with this matter. D. The company has moved from a goal to "eliminate the carbon footprint" to climate neutral internal operations and construction operations by 2025. In 2045 their projects, such as new construction, will be climate neutral.		2025

Timelines and level of targets. The year 2025 is a common denominator in the region, as Linköping and all involved companies have targets for 2025 that will have positive effects on the climate target. Norrköping has no firm target on this subject but has other goals, such as reducing energy use, that can have positive effects. However, the targeted year comes five years later. It is worth noting that Linköping Municipality has a target that is 20 years before the corresponding national target, and 25 years before the EU target.

Linköping has no firm target to decrease GHG emissions, whereas the national target includes an 85% reduction by 2045 compared to 1990. However, it is stated that measures to reduce GHG emissions are a vital part of this effort. Nonetheless, the missing supplement formulation may enable the municipality to freely compensate for emissions to meet the goal, and not necessary by also reducing emissions. The example of freely compensating emissions may lead to a less desirable outcome. The impact of an activity may be reduced in several ways. With reference to what is commonly called the energy hierarchy or carbon management hierarchy, one of the first steps is energy conservation to minimise the final energy user's demand. The next step is to increase energy efficiency, which reduces final energy use. The remaining energy demand is to be supplied by renewable resources. The last step may also include low carbon or net-zero carbon technologies where any remaining emissions are offset or compensated. However, if previous steps are skipped and the focus is only on the last step, offsetting or compensating, it may also mean that emissions continue. This will not contribute to meeting the Paris Climate goal. If all steps are completed the offsetting can be done by investment. It has also become environmentally economical for companies and governments to buy carbon offsets via the emissions trading market. The offsets may then be used to support projects that reduce GHG emissions.

Terminology. Several terms are used, all addressing the same subject, namely efforts to reduce the impact on the climate caused by GHG. Terms used in this study include "carbon neutral", "climate neutral", "net-zero GHG emission" and "eliminate the carbon footprint". These terms are similar, with subtle differences in meaning. In a strict sense, the terms "carbon neutral" and "carbon footprint" only include carbon dioxide, which is the most abundant gas causing the greenhouse effect. These concepts can be broadened to include carbon dioxide equivalents, but this is not automatically included and should be looked out for when comparing statements on this subject. The other terms, however, "climate neutral" and "net-zero GHG emission", include all substances classified as GHG and communicated as carbon dioxide equivalents.

System boundaries. The municipalities have a geographical demarcation of their goals, i.e. it includes all activities that occur within the municipality. This means that the municipality must influence and encourage all actors in the municipality to contribute to the goal achievement. Collaboration is time-consuming and difficult to value, which can make it challenging to achieve penetration in the work and to see clear results of collaborations.

In the efforts to improve the housing companies' climate impact, the energy carrier is an important factor, e.g. the energy carrier for heating purposes. The latter issue is debated from a system perspective as the boundaries reveal different conclusions. For example, when conducting an energy renovation of a multifamily dwelling or a new construction, it is common to choose between district heating and a heat pump solution. With a heat pump, the electricity demand will increase. However, this electricity may be purchased with a green certificate or a share of the demand might be produced by solar power. This will improve the climate impact of the building if the system boundaries only include the building. However, if the system boundaries are extended, the heat pump solution is seen to decrease the heat demand in the district heating system. Consequently, less electricity is generated from the combined heat and power plants, which may use renewable resources. So, with wider system boundaries, the demand is increased but local production is decreased, which results in less available electricity on the market. This loss of available electricity must be replaced elsewhere. A common way of assessing the impact of changes in electricity use and production is to use marginal production. The loss of electricity from renewable resources would then be, in worst case, replaced by electricity from coal condensing power plants. This would lead to increased global GHG emissions, which is not a desirable solution and constitutes a sub-optimisation. This highlights the need for collaboration and communication to fully understand the system in which the actors operate. However, it is time consuming work and can be hard to attach value to.

This may make it difficult for the business sector to commit to, which emphasises the need for organisations and authorities like municipalities to be the driving force for collaboration and to involve the business sector.

It is noticeable that housing company D, unlike the others, has a target to make new buildings climate-neutral by 2045. The other housing companies focus on the management of the existing built environment. The majority of a building's climate impact occurs during the use phase. However, a life cycle assessment for a building also shows, albeit with variation, that a significant part of a building's climate impact occurs during construction, where the building material accounts for most of the share. Therefore, it is encouraged to act on the construction part of a building's life cycle.

Efficient energy use

This section has an evident connection to SDG 7 regarding affordable, clean energy. One target of this goal is to double the rate of improvement in energy efficiency. The work categorised in this section also includes clear contributions to SDGs 11 and 13, as the work aims to improve sustainability in urban areas, reduce carbon emission and use primary energy resources. The goals regarding energy efficiency are presented in Table 2.

Table 2. Compilation of goals related to efficient energy use. The compilation includes SDGs, EU, national and municipal levels, as well as targets of the energy utilities and housing companies. The table is accompanied by an illustrative timeline of the actors targeted years of fulfilment.

		Main SDG	Additional contribution to SDGs	Timeline
Global			 	
EU		Energy efficiency by 32.5% of the final and/or primary energy use by 2030, compared to 2007, achieved collectively by the EU. Possible upward revision in 2023.		2030
National		The energy intensity should decrease by 50% by 2030, compared to 2005, and is expressed as less input energy per GDP.		2030
Municipal		• Linköping's action plan states that the municipality's organisation and building stock shall be energy efficient. Moreover, businesses, non-profit organisations, universities and other municipalities shall become involved in the work. • Norrköping's energy plan states that energy efficiency should be improved by at least 30% in 2030 (compared to 2005).		- 2030
Company	Energy	1. Energy utility 1 has a vision of building the world's most resource-efficient region and, expresses a focus of reducing its use of primary energy. 2. Energy utility 2 stresses that its energy solutions contribute to improved energy efficiency.		-
	Housing	A. Aims for a 25% decrease in purchased energy per square meter by 2025 compared to 2011. New constructions should have a specific energy use of 63 kWh/m^2, compared to the national requirement of 85 kWh/m^2. B. Aims for a 20% reduction in final energy use by 2025 compared to 2015. It is measured as kWh/m^2 but is not public. C. By 2020, the final energy use of its building stock should be below 100 kWh/m^2. D. The company aims for a 50% decrease in delivered (or purchased) energy by 2025, compared to 2000, and expressed in terms of kWh/m^2.		2025 2020

Timelines and level of targets. Sweden has set a higher target at national level than the EU level. It is noticeable at municipal level that an expressed target is lacking or is below both national and EU levels, especially when all other targets are more ambitious compared to the national level. This could be explained by the energy use already being regarded as low, whereas the relative potential for efficiency becomes low as well. However, as discussed earlier, the involvement and interaction of municipalities with other actors is crucial in order to fulfil the goals, both locally but also to contribute to the national target.

There are various reference years regarding this target. Furthermore, various target levels have been set by the housing companies, which could be explained by the differences in building portfolios. Nonetheless, the incoherency regarding this target may lead to a source of uncertainty or difficulties in comparison and communication. When compared to the previous climate targets, it can be noted that the timelines are less coherent regarding energy efficiency than climate impact. This may be explained by energy efficiency being more easily measured and more dependent on building portfolio. Moreover, the housing companies must answer to clear energy efficiency targets set by the Swedish National Board of Housing, Building and Planning which is a central government authority that review developments within the fields of housing, building and planning.

Terminology. On a national level the efficient use of energy is expressed as energy intensity in relation to economical terms. That is, supplied primary energy divided by the gross domestic product (GDP). Energy intensity is often described as a top-down view of the aggregated energy use in an economy. Energy intensity is affected by for example countries climate, lifestyles, population density, and economic structure as ratio of industrial or service-based sectors. Underlying differences may lead to difficulties in comparing energy intensities between countries or regions. Energy efficiency are, on the other hand, often described as a bottom-up perspective of more technical character, on products or individual activities, i.e. kWh/m^2.

For the housing companies, the targets for improved energy efficiency differ. The focus is on either reducing total energy use (expressed in terms of kWh/m^2) or reducing the amount of delivered (purchased) energy. It is the delivered energy that is the basis for calculating a building's energy performance in accordance with the Swedish National Board of Housing, Building and Planning. This is why this approach to measuring energy efficiency is used by most actors, even though a goal to reduce the amount of delivered energy does not necessarily mean a reduction in energy used. For example, as defined by the Swedish National Board of Housing, Building and Planning, a building's energy performance can be improved if a heat pump is placed inside the system boundary rather than outside. The amount of energy used can still be the same. In the same way, a target regarding reduced energy use says nothing about the origin of the energy. In order to reduce the amount of delivered energy and at the same time maintain indoor comfort, the housing companies must either build energy-efficient buildings or invest in renewable energy in connection with the building. Targets that focus on reducing delivered energy can provide fewer incentives to reduce energy use than targets that focus on reducing energy use. At the same time, a target with a focus on delivered energy can provide more incentives for the installation of e.g. solar power in connection with the building.

System boundaries. As discussed in the previous section, there are differences in the system boundaries regarding the terms "delivered (purchased) energy" and "total energy use". On a general note, in order to improve the energy efficiency targets expressed by the housing companies, they can do it in several ways. The housing companies may carry out energy renovation, ensure a high level of energy efficiency in new constructions, or sell off less energy efficient buildings to improve their portfolios performance. However, the latter option will not improve the value at municipal or national level, nor the work to fulfil the SDGs. The authors stress that this is a general note, and is not seen in this case study. However, it shows the responsibility that municipalities and other forms of governance have, although they lack power of action in connection with this issue.

Share of renewable resources

This section has a clear connection to SDG 7 regarding affordable and clean energy. One target for the goal is to substantially increase the share of renewable energy. The work categorised in this section also includes clear contributions to SDGs 11 and 13. The work aims to improve sustainability in urban areas, and to reduce GHG emissions by increasing the production of bioenergy and solar power as part of the renewable share. The goals regarding renewable resources are presented in Table 3.

Table 3. Compilation of goals related to renewable resources. The compilation includes SDGs, EU, national and municipal levels, as well as targets of the energy utilities and housing companies. The table is accompanied by an illustrative timeline of the actors targeted years of fulfilment. Bold and underlined years indicate fulfilment of targets, whilst the others are sub-targets.

		Main SDG	Additional contribution to SDGs	Timeline
Global			 	
EU		The share of renewable energy shall be at least 32% of the final energy use in 2030. Possible upward revision in 2023.		2030
National		By 2040, electricity production should be based 100% on renewable resources.		**<u>2040</u>**
Municipal		• Linköping states that it shall be at the forefront in terms of energy use and shall produce electricity from renewable resources. Linköping adopted a plan for solar electricity to constitute 5% of the total electricity use in 2025 and 20% in 2040. • Norrköping aims to use only energy from renewable resources by 2030.		- **<u>2030</u>**
Company	Energy	1. In its effort to achieve carbon neutrality, energy utility 1 aims to phase out fossil resources from its production by 2021. Moreover, it sets out to increase the share and production of electricity from renewable resources, such as solar and wind. 2. Energy utility 2 aims to deliver only renewable and recycled energy by 2025. It is phasing out fossil fuel and investing in production using renewable resources.		2021 **<u>2025</u>**
	Housing	A. By 2025, the company aims to own renewable power production, such as wind and solar power, which corresponds to the company's properties electricity use. B. Has no firm target, but works to meet the municipality's target for solar power and thus increase the share of renewable resources in the electricity mix. C. The company lacks any firm target, but has taken a decision to purchase only electricity from wind power generation and has built solar power plants at several locations. D. Wants to influence and cooperate for fossil-free and renewable energy. Invests in renewable electricity production that corresponds to its demand.		2025 -

Timelines and levels of targets. At EU level, the total energy use is included. Sweden had a corresponding target, but as of 2017 the target only includes electricity production, which should be based 100% on renewables by 2040. Furthermore, at municipal level a similar target is either lacking or the total energy use is targeted, and it is ten years ahead of the national target. Thus, there is incoherency between the targets.

Terminology. The terms “renewable energy” and “renewable and recycled energy” are used by a municipal and energy utility. This presents a potential conflict, and the difference is due to the energy utility using combustible waste as fuel at its combined heat and power plants. This technology is used by several energy utilities in Sweden. However, the waste contains fractions of fossil resources, such as plastics, which is why it is not classified as fully renewable. Instead, it is said to be recycled or energy. In dealing with this issue, the EU’s waste framework directive must be prioritised in accordance with the waste management hierarchy: first prevention, then re-use, then recycling, and then energy recycling or recovery (with the final step being disposal). The fraction of fossil plastic going to energy recycling should be minimised. In doing so, prevention is the best and preferred action. This may be achieved, for example, via a tax on virgin plastic, by decreasing or banning disposables made of plastic, or by allocating emissions to the producers to incentivise minimised use of plastic. Other activities include promoting bio-based plastic and material recycling.

System boundaries. The housing companies aim to invest in renewable energy. This is an interesting development as a result of the availability of new energy technology. The study shows a willingness to invest in solar power or other solutions adjacent to the buildings, thus utilising the electricity directly for the buildings’ operations. However, another solution that is also suggested is investing in wind power or solar power that is not adjacent to any buildings. In such matters, housing companies have historically turned to energy utilities or similar providers. Nowadays they can be more self-sufficient, which in turn increases the need for collaboration and communication, but above all it is an important factor for accelerating sustainable development.

Conclusions

The paper analyses whether there are any conflicting energy and climate targets among municipalities, energy utilities and housing companies in Sweden and in relation to national and EU targets. The targets are categorized as; climate impact, efficient energy use, and share of renewable resources. The targets are analysed with a focus on three key indicators of timelines and level of targets, terminology, and system boundaries.

When considering climate impact, ambitious targets at the municipal level are identified as a driving force with target fulfilment two decades or more before national and EU targets. Moreover, it is concluded that none of the business actors have a target related to GHG emissions. Instead, they are included by the municipality’s targets, which has a geographical demarcation. Moreover, the municipalities have no stated target to reduce GHG emissions but to become neutral or a net-zero emitter. It is seen that different system boundaries may result in incentives leading to sub-optimisations or solutions that are less effective. To achieve the target will require communication and collaboration on the initiative of the municipalities.

When regarding efficient energy use, the targeted levels differ as well as the timelines among the housing companies. The energy utilities and one of the municipalities lack any stated target. The other municipality does have a target, but the targeted value is below the national target. As it is a relative target it may be irrelevant due to already low energy use, but it is the only target with a lower ambition level.

When regarding the third category, the share of renewables, it is concluded that there are various targets on this subject. There is a difference in targeted fulfilment years between an energy utility, the national level and the EU level. Incoherency in terminology is also identified, as actors also embrace recycled energy alongside renewable energy.

Furthermore, the paper analyses how well the SDGs are integrated at EU, national, municipal and business sector levels. It is concluded that the main goals addressed in this study are SDG 7 and SDG 13, with additional contributions to SDG 11. The integration or communication of the SDGs differs among actors in the business sector and municipalities. Sustainable development is a central part of the business models but is more commonly communicated in the economic, social and environmental dimensions than by relating the work the SDGs. Altogether, this may present challenges in relation to the necessary communication, collaboration and exchange of knowledge in order to succeed in achieving the SDGs.

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