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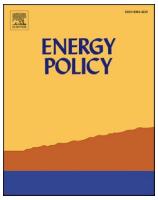

The role of public energy advising in sustainability transitions – empirical evidence from Sweden

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ABSTRACT

Public energy advising is a policy measure used to provide customized energy information and advice to energy end-users. It aims at encouraging and promoting decisions leading to reduced environmental impact from energy use. While the independent function of public energy advising is unique and important, in Sweden, the role of energy advisors is changing. With new and more complex client demands as well as increasing competition from other forms of advising, there is a need to examine the shift that public energy advising is facing. The aim is to provide an overview of the activities performed by public energy advisors in Sweden and to explore the roles that they play in the transition to a sustainable energy system. Based on a qualitative analysis of 129 activity reports from Swedish municipal energy advisors, this paper shows that public energy advisors do not only play a role on an actor-level, but also on a system-level, by undertaking activities connecting the target groups to other actors in society and translating national policy to the local level. These system-level roles represent an important potential for policies aimed at accelerating the energy transition, and thus they should be encouraged and maximized.

1. Introduction

In order to speed up the transition to a more sustainable energy system, policy measures encouraging energy efficiency and an increased energy production based on renewable sources are crucial. Among a variety of energy policies, energy advising has been identified as a measure to provide information and advice that are adapted to individuals and their circumstances (Darby, 1999). Energy advising consists of both tailored advising, with a high degree of customization, as well as education and information, that are less adapted to individual demands (ibid.). Through such advice, energy users become aware of their environmental impact and adapt their decisions and behavior in order to reduce negative impact (e.g., through implementation of electricity efficiency measures) and to increase positive impact (e.g., investments in renewable electricity production) (e.g. Darby, 2020; Henryson et al., 2000; Mahapatra et al., 2011a; Owen et al., 2014; Risholt and Berker, 2013).

Energy advising can be performed by a variety of actors, e.g., private actors such as consultants and industry association, internet platforms, or public actors. Public energy advisors are characterized by the fact that they receive their funding and mission from the government, are independent from commercial interests, and are (most often) free of charge for their clients. As such, they are used as a policy measure with the potential to prioritize the interest of the common good towards a democratic and sustainable energy system. In the European Union, the Renewable Energy Directive (2009/28/EC) and the Energy Performance of Buildings Directive (2018/844/EU) require all member states to provide citizens and organizations with adequate advice on renewable, highly energy efficient alternatives. This explains why most of the European countries have public actors providing services related to energy (Mahapatra et al., 2011b).

Previous studies have associated energy advising with rather positive results on reduced environmental impact from energy use (e.g., Benders et al., 2006; Nair et al., 2010a; Owen et al., 2014). Yet, in pace with changes in society and with technological development, demands on public energy advisors are changing (Eriksson and Kjeang, 2021). To start with, public energy advisors require new sets of competences to handle new and more complex types of client demands. For instance, with renewable electricity technologies increasingly becoming affordable for the wider public and with the number of prosumers growing, the type of questions handled by energy advisors is expanding from mainly focusing on energy efficiency measures to also including investments in renewable electricity technologies such as solar photovoltaics (PV) (e.g. Karjalainen and Ahvenniemi, 2019; Owen et al., 2014). Likewise, in an

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increasing number of countries, energy advisors have expanded their client groups, from strictly targeting households, to also providing support to households, associations, small- and medium-sized enterprises (SMEs), and municipal companies (e.g. Heiskanen et al., 2013; Kjeang et al., 2017a). Meanwhile, with market developments and the increased importance of digitalization, information and advice about energy is becoming increasingly accessible through multiple sources, e.g., blogs, forums, and websites (e.g. Hyysalo et al., 2013; Hyysalo et al., 2018; Westelius, 2008) as well as by private actors such as installers or technology retailers (e.g. Aspeteg and Mignon, 2019), or even NGOs (e.g. Heiskanen et al., 2013; Salo et al., 2016). As a consequence, public energy advisors are experiencing increased competition and they sometimes struggle to stand out from the rest and remain relevant.

Against this background, we argue that there is a need to examine the shift that public advising is facing by exploring the activities performed and roles played by public energy advisors in the specific context of Sweden. The aim of this paper is hence (1) to provide an overview of the activities performed by public energy advisors in Sweden and (2) to explore the roles that they play in the transition to a sustainable energy system.

While this study focuses on the specific context of public energy advising in Sweden, it contributes with a basis for more informed decisions related to public energy advising, especially organized in a decentralized fashion and geographically located in municipalities. Other countries in need of inspirations and input with regard to (local) public energy advising may also learn from the findings of the study. Through a thorough overview on activities, topics, target groups, and roles included in the mission of public energy advisors, our results point at a number of specificities of public energy advising used as a policy. More specifically, it appears that the fact that public energy advisors have a mission of supply neutrality in the advice that they provide makes them unique in a context where other sources of advice are mainly commercial ones. Additionally, results show that, in Sweden, public energy advisors play an essential role in translating policies from the national level to the regional and the local level (and back). Meanwhile, the fluctuating client demands indicates that citizens lack the ability to communicate their needs and to find access to support, which is one of the areas where improvements have to be made. Lastly, we suggest that the overview provided in the paper can support further research aiming to evaluate the impact of public energy advising, to explore gaps in the current services or overlaps with services provided by other actors, and to improve the policy.

As presented above, this study focuses on municipal energy and climate advising in Sweden. Sweden has a long tradition of energy advising and like in many other European countries, Swedish energy advising is a public service that is free of charge and sponsored by the government as a way to achieve national targets related to decreased CO_2 emissions and increased renewable energy investments. In Sweden, all energy advisors are employed by municipalities and mainly funded by the Swedish Energy Agency on a project basis (1–3 years). As such, they formally report their activities to the Swedish Energy Agency at the end of each project period. In the paper, we analyze 129 reports submitted by the whole cohort of Swedish public energy advisors at the end of the project period the project period 2018–2020.

2. Frame of reference

2.1. A variety of energy advising activities

In the energy policy literature, special attention has been put on the role of energy advising in influencing energy users to reduce their climate impact (Darby, 1999; Eriksson and Kjeang, 2021; Henryson et al., 2000; Khan, 2006; Mahapatra et al., 2011b; Palm, 2010).[1] Energy advising is presented as a powerful policy instrument (Darby, 1999; Eriksson and Kjeang, 2021; Kjeang et al., 2017a, 2017b; Mahapatra et al., 2011b; Palm, 2010) as it encourages citizens to make decisions related to energy efficiency, for instance by promoting measures such as changing energy consumption behavior (Darby, 1999; Gyberg and Palm, 2009; Henryson et al., 2000), investing in more energy efficient technology (Heiskanen et al., 2013; Henryson et al., 2000), or building and retrofitting more energy efficient houses (Halleck Vega et al., 2022; Owen et al., 2014). However, undertaking these measures can be difficult, especially if the energy users lack information and knowledge about available options (Gyberg and Palm, 2009; Henryson et al., 2000; Khan, 2006; Steg, 2008). Energy advising hence aims to reduce these challenges through the provision of information, education, and (customized) advice (Darby, 1999; Henryson et al., 2000).

While the literature in general focuses more on energy advis*ing* than on energy advis*ors*, energy advising is performed by different actors, such as professional energy advisors (Achtnicht and Madlener, 2014; Karjalainen and Ahvenniemi, 2019; Virkki-Hatakka et al., 2013), municipal energy advisors (Eriksson and Kjeang, 2021; Halleck Vega et al., 2022; Khan, 2006; Kjeang et al., 2017b; Mahapatra et al., 2011b; Palm, 2010; Revell, 2014), installers (Galvin and Sunikka-Blank, 2014; Janda and Parag, 2013; Nair et al., 2010b; Novikova et al., 2011), NGOs (Owen et al., 2014; Salo et al., 2016), or even peers/networks of neighbors (Novikova et al., 2011; Nygrén et al., 2015), teachers, and grocery stores (Salo et al., 2016). Some of these actors play an informal role in advising clients, members, or students beside their core mission, whereas some actors have been given a formal role of providing energy advice (e.g., by policymakers or governments). In Europe, most of the actors with a formal mission of providing energy advice are public actors (i.e., they are governed by public actors, have a public organization form and/or are publicly financed) (Mahapatra et al., 2011b). These public energy advisors have been shown to perform a variety of activities and in the following sections, we make an attempt at organizing the activities presented in the previous literature about energy advising.

2.1.1. User-centered activities

Most of the activities performed by energy advisors are targeted at citizens, households or, to a smaller extent, to local associations and SMEs. They can be characterized by different levels of customization:

Tailored advising comprise activities that provide information and recommendations that are personalized and contextualized to suit the energy users' needs (Darby, 1999). Tailored advising has been underlined as the central activity performed by energy advisors and it is seen as an important means to achieve changes to energy behavior (Darby, 1999; Eriksson and Kjeang, 2021; Heiskanen et al., 2013; Salo et al., 2016; Steg, 2008). Researchers highlight that the personal interaction between advisors and their client (i.e., the energy user) is what differentiates it from e.g., information and education (Darby, 1999) and makes the client more prone to undertake energy saving measures (Salo et al., 2016). Tailored advising is however very time- and resource consuming, and it requires that each advisor has good technical knowledge and communication skills (Darby, 1999).

Education is offered by energy advisors to smaller groups of people, and it treats specific topics in the form of e.g., seminars or study circles (Frimanson, 2020; Khan, 2006; Kjeang et al., 2017a). Here, the information can be more personalized (e.g., questions of specific interest for a participant can be answered or discussed), but the seminars or study circles are standardized to address the participant groups' interests (rather than individual interests).

Informational activities aim to disseminate general information about energy issues to raise awareness and knowledge among a large group of recipients as well as to influence their energy use. While some researchers point at the potential of mass-information in reducing energy consumption (Henryson et al., 2000), others have found tailored information to be more effective than general information in changing user behavior (Darby, 1999; Kjeang et al., 2017a; Steg, 2008). Providing information is

[1] Note that only a few studies have public energy advising as the single focus. Instead, they include a combination of different advising organization forms, including public, private, and NGOs (e.g., Heiskanen et al., 2013; Owen et al., 2014).

a time efficient activity for the advisor, but it can sometimes be too general to result in changed energy behavior (Abrahamse et al., 2005; Benders et al., 2006). General information is thus suggested to be used only as a complement to tailored advice programs (Darby, 1999).

2.1.2. Advisor-centered activities

In order to sustain their place as important advice providers in the community, energy advisors also have to perform some activities centered on their attractiveness or legitimacy, as well as on the maintenance of their competences:

Promotional activities aim at promoting the advisors' services and legitimacy (Darby, 1999; Mahapatra et al., 2011a, 2011b; Reeves, 2016; Revell, 2014). Through a variety of channels, energy advisors reach out to new potential clients and explain how they can support them. Such visibility aims to reach a broad audience, raise awareness of their services, and sustain a good client base.

Professional skills development includes participation in training programs (Eriksson and Kjeang, 2021; Henryson et al., 2000; Janda and Parag, 2013; Kjeang et al., 2017a) and networking with other energy advisors to exchange knowledge and experience (Eriksson and Kjeang, 2021). These activities enable the advisors to keep their skills and knowledge up-to-date and ensure that they provide relevant and reliable advice.

2.2. Public energy advising: a changing role

As described above, previous literature has described a broad set of activities traditionally performed by public energy advisors. Nevertheless, in recent years, new types of activities, target groups, and challenges have increasingly been mentioned in empirical studies, indicating a shift in public energy advising.

To start with, from being mainly oriented towards energy efficiency (e.g., through advice and implementation of energy efficiency measures), the frame of activities performed by public advisors has broadened to include advice related to technology investments. With a decreasing price in microgeneration technologies, activities related to investments in solar PV (e.g., the organization of events related to solar PV, information, and advice targeted at potential adopters of solar PV) seem to have become a part of the daily work of public advisors (e.g. Gustafsson and Mignon, 2019; Kjeang, 2019; Owen et al., 2014). The literature also acknowledges that, along with an increased public interest in sustainability issues, public advisors' activity portfolio is broadening (Zaunbrecher et al., 2021), e.g. through an increasing role in advising citizens on aspects such as sustainable food and goods consumption (e.g. Salo et al., 2016) and sustainable mobility (e.g. Eriksson and Kjeang, 2021; Frimanson, 2020).

Another new trend is that public advisors' sphere of influence seems to have grown from solely including households to also including SMEs, associations, and sometimes even governments. Indeed, while the primary target group has been (and still is) local households (Revell, 2014; Salo et al., 2016; Stieß and Dunkelberg, 2013), additional groups such as local SMEs (Hampton, 2018; Khan, 2006; Kjeang et al., 2017a) and local associations (e.g. tenant associations) (Vega et al., 2022; Virkki-Hatakka et al., 2013) can now receive support from public advisors. Some scholars have even highlighted that public energy advisors play an important role in linking local actors to local, regional, or national governments (Darby, 2017; Eriksson and Kjeang, 2021; Granberg and Elander, 2007; Gustafsson and Mignon, 2019). Doing so, they take an intermediary role and facilitate the translation of national goals to the local level or the translation of local concerns to higher levels of decision making (Gustafsson and Mignon, 2019).

Finally, as a consequence of digitalization and of the market development of retrofitting technologies, public energy advisors' communication channels and competitors have changed. From providing advice and information through the phone or during home visits at the client's house, advisors increasingly use new ways to diffuse information and advice (Kjeang et al., 2017b). Some advisors have started to use social media or to develop their own digital platforms (Eriksson and Kjeang, 2021; Frimanson, 2020). This shift is presented as an opportunity for policies because it means that there is potential to make advising more efficient (e.g., Westelius, 2008).

As described above, while the expanding role of public advisors, in terms of new activities, target groups, and channels, represents new opportunities for policies, such a shift also implies new challenges for the advisors. For instance, as suggested by Hampton (2018), it is expected that a broadening of the advisors' activities also requires new knowledge and experience. Advisors may find that their area of expertise does not cover all questions coming from their target groups, they may struggle to acquire the missing knowledge, and they may lose legitimacy. Likewise, new target groups require new networks. Advisors may be faced with challenges to get access to these networks, they may struggle to build acceptance and legitimacy in these networks, and it may require large efforts to find activities matching the needs of these new target groups. Finally, as suggested by e.g., Kjeang et al. (2017b), despite the obvious advantages of digitalization, the emergence of new digital channels also means that new types of actors have emerged. Public advisors are hence faced with a new type of competition, not only from private actors such as private installers and technology retailers (e.g., Aspeteg and Mignon, 2019), but also from blogs, databases, and websites (e.g., Hyysalo et al., 2018; Palm, 2018). Such competition casts doubt on the purpose of public energy advising and hence questions its relevance and effectiveness.

Against this background, we argue that there is a need to examine the shift that public advising is facing by exploring the activities performed and roles played by public energy advisors.

3. Method

Given the explorative nature of the research aim, this paper uses a qualitative research design based on rich secondary data on Swedish municipal energy advising. The data was analyzed through an inductive thematic approach, as informed by the Gioia methodology (Gioia et al., 2013) in order to identify activities performed by the energy advisors and find commonalities and differences between them.

3.1. Study context

The context of this paper is public energy advising in Sweden.[2] The public energy advisors are funded by the Swedish government, coordinated by the Swedish Energy Agency, and employed and carrying out their services on a municipal level. They often collaborate on a regional basis, in networks managed by regional energy offices.

The service was first established by the state in the 1970s as a response to the oil crisis to reduce oil dependency and to improve households' energy efficiency. Its policy mission has changed several times since.[3] The latest reform of the service was made in 2016 and since then, the energy advisors' mission has been to promote reduced climate impact from energy use and contribute to national energy and climate goals (Swedish Government, 2016). This mission is to be achieved by providing (commercially) neutral and independent advice that is locally and regionally adapted to households, SMEs, and associations.

Advisors' funding depends on the population size of the municipality and to get the funding granted, the advisor position should not be less

[2] Public energy advising goes under the name of "Municipal energy and climate advising" in Sweden. Apart from regular energy advising, it includes advising on transportation, which hence motivates the 'climate' dimension of their name.

[3] For an overview of the historical development of the service, see Kjeang, A. E., Palm, J., Venkatesh, G., 2017a. Local energy advising in Sweden: Historical development and lessons for future policy-making. Sustainability 9, 2275.

than a half-time position. Hence, municipalities organize their energy advising service in different ways: one advisor at one municipality, shared employment at one municipality (part-time advisor combined with another position), group of advisors at one municipality, or one advisor for a group of municipalities (Eriksson and Kjeang, 2021). In total, for the project period 2018–2020, there were approximately 200 advisors distributed over 129 (groups of) municipalities in Sweden.

Following the reform in 2016, the Swedish Energy Agency introduced time-limited projects focused on specific topics in which all energy advisors participate (Swedish Energy Agency, 2022). The purpose of these projects is to facilitate national efforts on certain topics, to increase the knowledge about energy advising in Sweden, and to provide support and common methods for all advisors, aiming for more coherence in the advising across the country. The Swedish Energy Agency sets the topics and provides the advisors with material and methods to carry out advising activities within these topics. The focuses of the projects follow the funding periods and there can be more than one focus per period. It is mandatory for the advisors to participate in at least one of the focus projects and the requirements are proportional to the size of the funding, i.e., a bigger municipality needs to perform more activities than a smaller municipality. The energy advisors obtain points for different activities and report these activities separately at the end of each project period. During 2018–2020, there were two focus projects, one on solar PV and one on sustainable transportation.

While the context of the study is specific to Sweden, using public energy advising as a policy instrument is far from being unique. Indeed, as per the Renewable Energy Directive (2009/28/EC) and the Energy Performance of Buildings Directive (2018/844/EU), all member states of the European Union are required to provide citizens and organizations with adequate advice on renewable, highly energy efficient alternatives. While all European countries may choose to organize energy advising as they want, several countries (e.g., Austria, Belgium, Denmark, France, Germany, Greece, Portugal) have chosen, as in Sweden, to have local energy advisors to provide such services. Meanwhile, other countries organize public energy advising in other ways, e.g., through hotlines, national advising boards, private advisors. Against this background, we therefore argue that the results of the study can be used by policymakers in other European countries that are interested in learning from the Swedish context of public energy advising. In countries using another organization for the public energy advising (e.g., energy advising provided by commercial actors or public energy advising located at the regional or national levels), our results can also be a relevant contrasting example.

3.2. Data collection

The data collected is secondary data in the form of 129 activity reports from the Swedish public energy advisors for the project period 2018–2020. The reports describe how the funding was used by describing activities and results to the Swedish Energy Agency. These reports are mandatory to obtain funding for the next period. Hence, the 129 reports included in the study cover the whole cohort of energy advisors in Sweden. The reports were written in Swedish and range between 2–13 pages, some of them including pictures or graphs. They all follow the same template for reporting given by the Swedish Energy Agency, as demonstrated in Table 1, which makes the data set coherent and comparable.

It is important to note that the reports are self-reporting documents written by the energy advisors to their funding agent, which may affect the content and cause biases. However, there is no requirements regarding the content of the report, i.e., the fulfillment of set goals. Hence, there is room in the reports to express deviations from the original plan. Given the outbreak of COVID-19 during the activity period, descriptions of deviations are present in all reports. The cross-comparison between the reports from the whole cohort of energy advisors reduces the impact of potential individual dishonest reports.

Table 1
Questions in the reports from the Swedish energy and climate advisors.

Question	Sub-questions
1. The project's goal fulfillment.	a. What were the goals of the energy and climate advising (according to the Swedish Energy Agency's decision document)? b. How does the project's results relate to the project's goals? For each of the project's goals, report the most important results and assess to what extent and/or in what way these contribute to the project's goals being achieved or can be achieved.
2. Project implementation.	a. Describe the various parts of the advising and how the target groups of households, SMEs, and associations have been reached by the advising. b. Brief description of those who contacted the energy and climate advisors and received advice. c. Description of participation in public events such as housing fairs, markets, municipal events with target group-adapted material.
3. Results.	a. Describe results and conclusions generated within the framework of the advice. b. For municipalities that have received coordination grants for sparsely populated municipalities: Describe the results of the coordination and how the provision of continued advice has been promoted.
4. Comment on any significant deviations in goal fulfillment and/or implementation in relation to the Swedish Energy Agency's decision on support for the project.	a. If the project has not achieved the goals or if significant changes have been made in the project's implementation compared to the project decision, justify this. Also describe what has been done to counteract these deviations.
5. Dissemination and utilization of the results in society	a. How has the municipality/municipalities worked to disseminate the results of the advice and/or in other ways ensured that it is useful? Describe completed activities to disseminate the results of the advising and/or in other ways ensured that it is useful in society. b. Tell us if you have suggestions for results that you might wish were communicated through the Swedish Energy Agency's channels, and if so, feel free to suggest how this could be done.

3.3. Data analysis

The data was analyzed through an inductive thematic approach, as informed by the Gioia methodology (Gioia et al., 2013). This methodology takes a systematic approach to generating new concepts and ideas in inductive research with the aim of ensuring qualitative rigor, which suits the exploratory approach chosen in this paper. A first-order analysis identifying a myriad of concepts in the data is followed by a second-order analysis, where similarities and differences among the many concepts lead to the emergence of themes that might help to describe the observed phenomena. Lastly, the themes are distilled into aggregate dimensions. Together, these steps build a data structure that graphically represents the progress of the analysis (Gioia et al., 2013).

As a first analysis step, the 2–13 pages documents were coded exploratorively using NVivo, resulting in a large amount of first-order concepts. We mainly looked for repeted themes appearing in all (or most of the reports) related to the first part of the study aim (i.e., to provide an overview of the activities performed by public energy advisors in Sweden). This first coding step resulted in four clusters of first-order concepts: activities, topics, communication channels, and target groups (see Fig. 1 "examples of first-order concepts" and "second-order concepts"). The main part of the emerging codes covered activities performed by the advisors, and the three other clusters allowed for an enhanced understanding of the activities by answering questions of about what, how, and to whom the activities were performed. The second analysis step was to identify patterns among the activities (see Fig. 1, "aggregate dimensions") and relates to the second part of the study aim (i.e., to explore the roles that they play in the transition to a sustainable energy system). The activity codes were compared to find similarities and differences and then categorized into second-order themes based on the overarching aim of the different activities. A distinction was seen between spreading general information, educating on different topics, providing tailored advice, promoting events and services, and developing the advisors' own competence. When suitable, terminology from existing literature was used for the emerging themes (see section 2.1), while still remaining open for new themes not yet figuring in the literature. Lastly, the themes were distilled into aggregate dimensions to account for the overarching focus level of the activities, i.e., if the activities target the energy users, the advisors themselves, or the broader energy system level. One of the authors was responsible for going through the data and coding it into concepts, and then both authors discussed them to refine the concepts and to create the themes and aggregate dimensions. The analysis of the activities resulted in a data structure that is shown in Fig. 1.

4. Findings

The findings indicate that public energy advisors in Sweden perform a variety of activities covering different energy related topics, such as solar PV and energy efficiency. They target different groups of energy end-users, i.e. households, associations (particularly tenant associations), and SMEs. In order to reach the different target groups, the advisors employ multiple communication channels depending on if they target individual actors (one-to-one communication), groups (one-to group communication), or the wider public (mass communication). The activities performed are either *direct* towards the target groups, or *indirect*, i.e., the focus is on supporting the advisory role or the system.

4.1. Topics of advice

The topics of advice depend both on what questions the target groups have and the activities the energy advisors planned. The topic most frequently mentioned is solar PV (i.e., apparent both in incoming questions and in planned seminars and events). This is easily explained by the fact that solar PV was the theme of one of the ongoing focus projects from the Swedish Energy Agency, and the energy advisors were thus committed to performing more activities related to this topic. The incoming solar PV questions concerned possibilities for solar PV on the energy users' houses, available subsidies, and support on reviewing quotes from different installers. Being neutral and independent, the advisors do not promote any particular installer, but rather help the energy users to make informed decisions.

A second theme is electric vehicles and at-home charging, which is in line with the focus project by the Swedish Energy Agency on sustainable transportation. Many seminars combined solar PV and electric vehicles, discussing possible synergies from adopting both technologies.

Further, a lot of the advising concerns energy efficiency, both in terms of behavioral measures to reduce energy consumption, available subsidies, and technical changes. The latter includes questions about heating systems, retrofits of buildings, and of changing to more energy

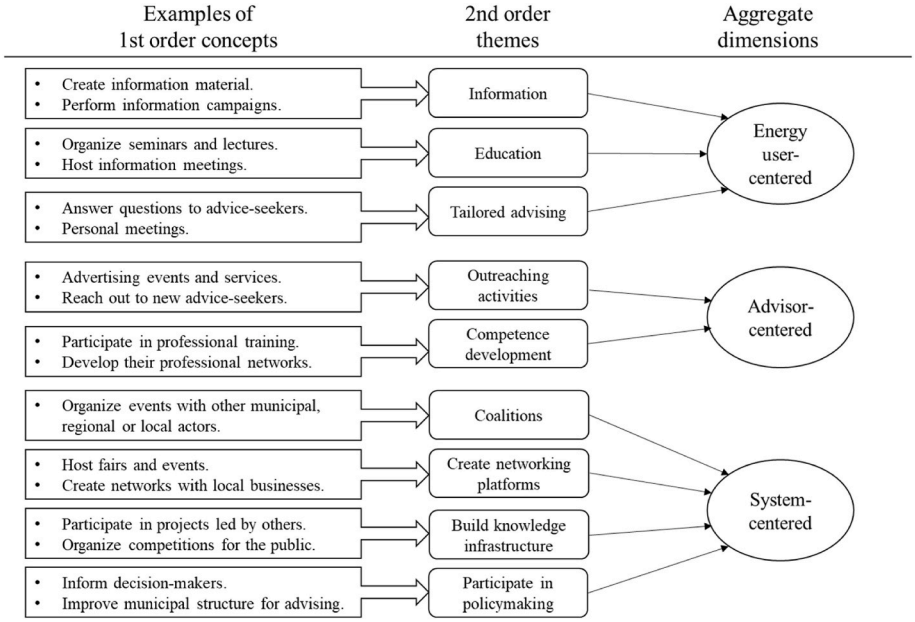

Fig. 1. Data structure obtained after the analysis of energy advising activities.

efficient equipment or building parts, such as windows or insulation.

Lastly, advisors also work on the broader topic of sustainability in order to raise awareness about climate change in society, e.g., by organizing events about sustainable mobility and climate change.

4.2. Communication channels and target groups

The energy advisors use several different communication channels to reach their target groups with information and advice. These channels were used for different communication types: one-to-one communication, one-to-group communication, and mass communication (Table 2).

The different communication channels in Table 2 are used for different purposes. One-to-one communication channels are most suitable for providing tailored advice to individual energy users, be it households, associations, or SMEs. One-to-group communication channels allow the energy advisors to address groups of energy users at the same time, making it useful for information, education, or outreaching activities in the form of fairs and events. Mass communication channels are used to distribute information about some topic or about the energy advisors events and services to as many as citizens or organizations as possible.

Following the COVID-19 pandemic, many advisors were forced to turn to more digital channels, such as webinars and online meeting platforms (e.g., Zoom). Many advisors made the reflection that these new channels were useful and will be used in the future, whereas others highlighted the importance of meeting in real life, especially through home visits.

The reports show that energy advisors do not use channels and communication types to the same extent. Some advisors receive a lot of incoming questions and consequently spend a lot of time on one-to-one communication, answering emails and phone calls or performing home visits. Others have less incoming questions and need to perform more outreaching activities, calling for one-to-group or mass communication. By attending e.g., a housing fair, they can both give spontaneous advice on the fair and book meetings with the passing people at a later time. Municipalities that employ several advisors have more resources to work more proactive and arrange events to promote e.g., sustainable energy use or transportation among inhabitants.

Table 2
Communication channels used by energy advisors in Sweden.

Communication type	Channel	Description
One-to-one	Physical meetings	At the advisor's office or at the energy user's place.
	Telephone and email	To answer shorter questions.
	Digital tools	Online meeting platforms (e.g., Zoom), where advisors can meet people online.
	Fairs and events	Advisors talk to people passing by their stands.
One-to-group	Business events	Events hosted by actors (not public advisors) aimed at SMEs.
	Mail	Advisors send information to dedicated recipients, e.g., newly moved-in people.
	Newsletters	Advisors co-write newsletters aimed at dedicated target groups.
	Fairs and events	Advisors participat at fairs and events hosted by other actors (not public advisors) to provide information or advice.
Mass communication	Websites	Advisors publish general information and advice.
	Social media	Facebook, Instagram, Youtube, etc. where advisors can spread information, advice, and other content.
	Local TV, radio or newspapers	Advisors participate in or develop articles, advertisements etc.
	Public spaces	Advisors buy advertisements in buses, grocery stores or other public spaces.
	Libraries	Advisors distribute material or lend out equipment.

The energy advisors tend to prefer different channels to target different groups. Households mostly actively contact the energy advisors to ask for tailored advice about their housing situation. Tenant associations and other associations also actively take contact with advisors, but to a lesser extent, whereas SMEs rarely seek advice, which thus requires that the advisors instead reach out to them. Other target groups include farmers, for which some advisors host dedicated seminars, or schools, for which some advisors perform activities to create awareness for the younger generation. An overview of the most common activities, topics, and types of channels for the three main target groups is found in Table 3.

To reach out to SMEs, the advisors need to be more proactive. Many advisors stress challenges to reach SMEs, since SMEs often cannot afford to invest time or money into energy efficiency measures. Much of the outreaching activities to SMEs are performed using one-to-group communication channels, such as mailings or visiting specific business events. Nevertheless, only few SMEs answer, which is challenging for advisors, since they have a mission to help SMEs reduce their energy use.

Since the target groups have different demands and needs, the advisors need to perform a large variety of different activities in order to fulfil their mission of providing information and advice to all target groups. The following section dives deeper into the activities the advisors perform.

4.3. Advisors' direct and indirect roles

Depending on in which way energy advisors contribute to the mission of promoting reduced energy use through information and advice, they play either direct or indirect roles.

The direct roles are played through activities targeting energy users, which constitute the main part of the identified advisory activities. These roles include information, education, and tailored advising. The overarching aim is to provide the target groups with locally adapted information and advice to help them reduce their energy and climate impact.

In contrast, the indirect roles are not played through directly addressing the energy users. We identify two types of indirect roles. First, advisor-centered roles aim to strengthen the quality and legitimacy of energy advising services, making energy adivisors more known and reknown, and ensuring that they provide relevant and qualified advising. These include outreaching activities to advertise their events and services, as well as competence development to increase their knowledge about different topics.

Second, we found that public energy advisors play certain system-level roles that contribute to the transition to a more sustainable energy system. Through these roles, public energy advisors contribute by connecting different actors in the system (hence acting as intermediaries), build knowledge infrastructure, and participate in policymaking. Table 4 provides an overview of the identified roles and activities. The activities and roles for each target are ordered based on the prevalence in the reports.

Table 3
Overview of activities, topics, and channels for the different target groups.

Target groups	Activities	Topics	Channels
Households	Tailored advising, education, information	Solar PV, heating, energy efficiency	One-to-one, mass comunication
Associations	Outreaching, tailored advising, education	Solar PV, available support and subsidies, EV and charging	One-to-group, one-to-one
SMEs	Outreaching, tailored advising, networking platforms	Energy efficiency, solar PV	One-to-group, one-to-one

Table 4
Overview of roles and activities for each level of influence.

Target	Roles	Activities
Energy user	Provide tailored advice	Answer incoming questions. Personal meetings. Home visits. Spontaneous advising at events. Lend out energy measuring equipment. Perform follow-up of advising. Assess tenders. Perform energy analyses. Advice in meetings with building contractors.
	Educate	Organize seminars, lectures, and webinars. Host information meetings. Organize study visits. Organize workshops. Organize study circles. Participate in educational activities.
	Provide information	Create information material. Perform information campaigns. Perform demonstrations of new technologies. Share general advice, news, and good examples. Provide tools for calculating PV potential.
Advisors	Perform outreaching activities	Advertising events and services. Reach out to new clients. Analyze target groups. Create local communication plan. Develop or update website. Develop graphical profile.
	Develop competences	Participate in professional training Develop their professional networks. Participate in study visits.
System	Build coalitions	Organize events with other municipal functions, other energy advisors, regional energy offices, or local actors. Visit energy users together with other municipal functions. Educate and advise other energy advisors.
	Create networking platforms	Host fairs and events. Create networks with local businesses.
	Build knowledge infrastructure	Participate in projects led by others. Organize competitions for the public.
	Participate in policymaking	Inform decision-makers. Establish or improve municipal structure for advising. Contribute to municipal energy and climate work.

4.3.1. User-centered activities and roles

From the reports, it is clear that activities and roles targeting energy users constitute the main part of the identified advisory activities. Among those targeting energy users, the advisors can choose between different degrees of personalization. Through informational activities, the advisors can provide general knowledge about energy issues by performing activities targeting a large group of people, e.g., information campaign. Meanwhile, education allows the advisors to be more specific about a topic and personalize the information, e.g., seminars on solar PV investments for farmers. Finally, tailored advising is the ultimate degree of personalization and encompasses all activities where the advisors have direct contact with one energy user at a time. The most personalized advising is given when the advisor visits the energy users at their home and can assess the suitability for different measures, e.g., how a solar PV installations could look like on a householder's roof.

To help with technology investments, some advisors perform demonstrations of new technologies, such as showing how a solar PV can look like, lending out electric bikes, or demonstrating how an electric car works. Advisors organize such events alone or in collaboration with local actors, such as installors of solar PV.

While it is easy to measure how many advising activities that have been performed, it is much harder to assess the impact of the advising on different energy-saving measures, technological or behavioral. Some advisors perform follow-up of their advising, by e.g., sending out surveys or calling the energy users back. Many advisors find it difficult to evaluate their advising and express a wish for a nation-wide standard for follow-up to facilitate that work.

4.3.2. Advisor-centered activities and roles

A share of the advisors' time goes to advisor-centered activities, which aim at strengthening the role of the advisors and support the activities targeting the energy users. To start with, outreaching activities include different marketing efforts to promote events and services they offer through e.g., advertisements in local newspapers aimed at increasing their visibility. These activities also encompass updating websites and reaching out to new clients, e.g., by sending mail to new inhabilitants or households. Additionally, competence development is undertaken through participation in professional training and experience exchanges with other energy advisors. This ensures that the advisors provide relevant and up-to-date advise.

Many advisors mention that a satisfied client will spread the word about the advising, which leads to increased demand of their services, hence it is important for them to ensure a high standard of the advice they give. Some advisors experience a high demand and thus spend little time and money on advertisements, whereas others struggle more to establish a client-base in the municipality. In general, the advisors report that the people who get advice from them are very satisfied, whereas they strive to reach out to more people.

4.3.3. System-centered activities and roles

While activities and roles targeting the energy users and the advisors are on an actor level, our analysis of advisors' reports show that they also perform activities and play roles that go beyond the project- (or actor-) level. These roles contribute to the advisory function as a whole and can be characterized as intermediary roles, connecting the advisors not only to the energy users, but also to other actors in the system. As with advisory-centered activities and roles, the system-centered activities and roles support the advisors in providing qualitative advice to the target groups but also in improving the system. We identified four different types of system-level roles performed by the advisors: coalitions, create networking platforms, build knowledge infrastructure, and participate in policymaking.

Coalitions are done with several different actors to ensure better services to the target groups. The advisors collaborate with other municipal functions to e.g., get in contact with local SMEs or coordinate communication efforts. Since many advisors are alone in their role in their municipalities, the network of energy advisors regionally and nationally is of great importance. They can arrange events together or help each other with common material. Lastly, they can team up with local actors on events.

Create networking platforms is done when the advisors organize events where they bring actors together, such as fairs, workshops, or by creating local business networks. As such, they provide meeting places where actors, who would otherwise not meet, can interact.

By spreading knowledge between actors in the system, e.g., by participating in projects led by others, advisors *build knowledge infrastructure*. For example, they participate in focus projects coordinated by the Swedish Energy Agency, where they get together to develop information aimed to be distributed to energy users. Another way of building knowledge infrastructure is by organizing competitions for the public, where the public is asked to contribute e.g., their best energy-saving hacks, which are later shared with everyone.

The advisors use their knowledge and experience to contribute to the local decision-making processes. Hence, they *participate in policymaking*. One common activity is to inform policymakers about the aggregated results of the advising, in order for policymakers to make informed decisions. Another way is to establish or improve the municipal structure for advising, to facilitate exchange with other municipal actors. Lastly, they can directly contribute to the municipal energy and climate work,

e.g., through being part of the work with action plans or strategies.

5. Discussion

As discussed in Section 2.2., empirical observations and a few previous studies have shown that the role of public energy advisors in Sweden is changing. Our study of the total population of public energy advisors in Sweden sheds a light on topics, target groups, channels, activities and roles that are in line with energy advising as traditionally pictured (Darby, 1999; Khan, 2006) and that also provide new perspectives. To start with, our study shows that advisors receive a large amount of questions related to new technologies, in particular solar PV and electric vehicles. From an empirical perspective, this result is not surprising, since solar PV and electric vehicles are two of the priorities of public energy advising set by the Swedish Energy Agency. Nevertheless, this result is rather new from the perspective of the energy policy literature, as it contrasts with the majority of previous studies on public energy advising where energy efficiency has been the focus (e.g. Gyberg and Palm, 2009; Henryson et al., 2000). Further, building on Mignon (2017) and Mignon and Broughel (2020), it appears that the non-commercial dimension of public energy advising, makes public energy advisors unique and crucial for successful adoption. This sheds a light on the fact that public energy advisors have a mission of supply neutrality in the advice that they provide makes them unique in a context where other sources of advice are mainly commercial ones. Yet, in the reports, many energy advisors stated that the focus projects initiated by the Swedish Energy Agency, in addition to the growing demand from energy users, were determinant in the choice of topics that they actively work with. This sheds a light on the influence of the national guidelines and instructions on the work of public energy advisors. Hence, it should be acknowledged that the fact that public energy advisors are non-commercial does not make them completely neutral. To our knowledge, this perspective has not been considered in previous studies and it would be interesting to investigate this further in the future.

Our results also confirm the influence of digitalization on public advisors (e.g. Eriksson and Kjeang, 2021; Westelius, 2008). On the one hand, digitalization represents a risk of making advisors obsolete as a source of information (Kjeang et al., 2017b), on the other hand, digitalization also provides advisors with new channels (e.g., social media, websites, digital meeting platforms) to communicate and inform specific energy users and the general public. This has been increasingly used in the wakes of the COVID-19 pandemic, when many of their traditional communication channels (e.g., home visits and physical events) were unsuitable.

Further, the advisors report not only households as their main target group, but also SMEs and associations. It should however be noted that the advisors in our study express challenges in reaching SMEs; the demand of energy advice from SMEs is generally very low and public advisors struggle to get access to SMEs. This may be explained by the fact that traditionally, SMEs have been seeking advice from private energy consultants and that public energy advisors lack legitimacy and network among SMEs This calls for a deeper focus on the roles and skills of public energy advisors in comparison with private energy advisors. As suggested by e.g., Glaa and Mignon (2020), there may be a need of better coordination and clearer task division between different types of energy advisors. Meanwhile, the struggle of public energy advisors to address SMEs' needs may also suggest that, in Sweden, public energy advisors lack a set of skills needed to advise SMEs. As proposed by Hampton (2018) and of relevance for policymakers, this suggests that public energy advisors need specific competence development, e.g., in order to develop soft skills.

Surprisingly, our data indicate that the public energy advisors in our study devote much effort to advisor-centered activities and roles. Apart from competence development activities, energy advisors expressed the need of performing a variety of outreaching activities in order to make their services visible to the public and in order to increase the demand for their services. Such need of outreaching activities has not been as highlighted in the past, although it has high policy implications. Indeed, in a context where public energy advisors are financed by both national and municipal taxes, the fact that they have to actively look for an audience willing to receive their services is debatable. We argue that this is an area where additional research is needed, e.g., to evaluate the effectiveness of public energy advising as a policy and to inform policymakers of the underlying reasons explaining the lack of demand in public advising. Is it, as suggested by Glaa and Mignon (2020), because the function meant for public energy advisors is already filled by other private actors? Because, as suggested by Westelius (2008), digital platforms have filled the demand that was in the past answered by public energy advisors? Because, as explained by Boon et al. (2011), users need support to articulate their demand of support? Or is this something that is unique in Sweden? Whatever the reason, it is important that policymakers in Sweden become aware of this issue, and for policymakers outside of Sweden to take informed decisions for the future of energy advising. We therefore encourage comparisons between public energy advising in other countries and recommend future research to go deeper in understanding whether the service offer provided by energy advisors matches with the needs of their target groups, or how such match can improve. For this, it may be relevant, for instance, to ask actors in the target groups (i.e., both those that have been in contact with public energy advisors and those that have not) how they perceive public energy advisors, e.g., in terms of relevance and quality. It may also be interesting to compare the roles, target groups, channels, and activities used and performed by public energy advisors with those used and performed by private energy advisors. This may be very useful to develop our understanding of the gaps and overlaps between these actors, in relation with the need of their clients.

Another interesting finding concerns the multilevel of influence of public advisors in Sweden. Apart from playing roles for the energy users and the advisors themselves, public energy advisors play a number of system-centered roles, which have an influence on the overall energy and policy systems (see Fig. 2). Indeed, they build coalitions with other system actors, create networking platforms, build knowledge infrastructure, and participate in policymaking at the municipal level. Such roles resemble intermediary roles, which have been stressed as crucial for a transition to a sustainable energy system (e.g. Gustafsson and Mignon, 2019; Kivimaa et al., 2019; van Lente et al., 2003). As such, these roles represent an important potential for policies aimed at accelerating the energy transition and thus they should be encouraged and maximized. For instance, public energy advisors may act as linkages between citizens and national policymakers, by gathering inputs (e.g., needs or challenges) from local citizens and passing them to policymakers, or by helping to adapt national policies to the local context (as suggested, e.g., by Hodson and Marvin, 2012).

Finally, when analyzing the rich data composed of 129 reports

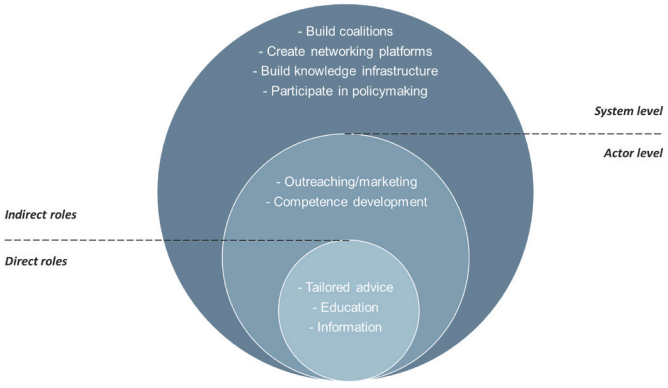

Fig. 2. The multilevel sphere of influence of public energy advising.

covering the whole cohort of public energy advisors in Sweden, it becomes clear that the activities and roles performed by public energy advisors are flexible, guided by client demand, and multifaceted. Different public advisors perform different activities and take on different roles. Some advisors are proactive, e.g., they organize events and activities before their target groups realize the need, keep themselves up to date about the latest technologies and practices, and continuously look at new ways to serve their target groups. In contrast, some advisors are reactive, i.e., they wait for energy users to contact them and prioritize the topics where they have competences. There may be different alternative explanations for such behavioral patterns. It may be due to access to resources (e.g., it is easier to be proactive when no sharp prioritization has to be done), individual traits (e.g., outgoing personality or interest in technology), seniority (e.g., new unexperienced advisors may struggle to find the relevant strategies to provide services needed in their municipality), municipal strategy (e.g., some municipality may involve public energy advisors in many activities of strategic importance), etc. In any case, in Sweden and in other countries using public energy advising as a policy instrument, improvements, diffusion of best practices, good matches between needs and offer, are important. For this, the support of regional or national coordinating instances may be important. We recommend that future research devotes effort in deepening our understanding of local energy advising, including strategies used by advisors, as well as current challenges and enablers.

6. Conclusion and policy implications

The aim of this study was to provide an overview of the activities performed by public energy advisors in Sweden and to explore the roles that they play in the transition to a sustainable energy system. Through a qualitative analysis of 129 reports of the whole cohort of public energy advisors in Sweden for the project period 2018–2020, we found that, in line with the directions provided by the Swedish Energy Agency, the main topics of advice handled by advisors are solar PV and electric vehicles, followed by the traditional topics of heating and energy efficiency. Public energy advisors use a variety of channels, including a large share of digital channels as well as home visits and seminars, targeted at different actor groups, i.e., households, associations, and SMEs. These results differ from what has been highlighted in the previous literature, where energy efficiency was the main topic, and households were the main target group.

Interestingly, we found that public energy advisors in Sweden perform not only direct roles aimed at energy users, but also two types of indirect roles supporting the advisors in providing high-quality direct activities. First, advisor-centered roles include advertising their services and competence development to strengthen their individual role as advisors. Second, through system-level roles, public energy advisors contribute by connecting different actors in the system (hence acting as intermediaries), build knowledge infrastructure, and participate in policymaking. By doing so, public energy advisors play a systemic role in the transition towards a more sustainable energy system.

These results have important policy implications. To start with, the results point at specificities in the public energy advising that makes it unique and central for energy users and adopters of new energy technologies. In particular, the fact that public energy advisors in Sweden are non-commercial and have to follow supply neutrality in the advice that they provide makes them an important resource for adopters/citizens in a context where other sources of advice are mainly commercial ones. Nevertheless, our results also show that the national guidelines are very influential regarding the areas/technologies that advisors focus on. This stresses the importance for researchers and for advisors' clients not to be too quick at considering public energy advisors as completely neutral. While they may not prioritize their own commercial interests (in contrast, with private advisors), this does not automatically mean that they prioritize the interests of the individuals that they advise, in front of the directions provided by the government and funding agency.

Moreover, the fact that public energy advisors in Sweden connect between different levels of policymaking also makes them unique (as illustrated in Fig. 2). Apart from playing roles for the energy users and the advisors themselves, public energy advisors play a number of system-centered roles, which have an influence on the overall energy and policy systems. For instance, they are fundamental in translating national policies to the local level, and to provide feedbacks from the local to the national level. These system-centered roles represent an important potential for policies aimed at accelerating the energy transition and thus they should be encouraged and maximized.

Further, the results point at a number of areas where new competences and studies are needed. In particular, we suggest that there is a need for policymakers to go deeper into understanding the roles and competences of public energy advisors in comparison with private energy advisors. This may result in areas where coordination between different types of advisors is necessary. Additionally, we suggest that public energy advisors may need to develop new competences to provide adapted advising to SMEs. Finally, we propose that citizens and other target groups may need support to communicate their needs and to find the advising support.

The paper also has some limitations that represent avenues for future research. To start with, we have made clear that this study is context specific. The activities and roles of public energy advisors identified in the study have been identified when focusing on the Swedish context and, at this stage, results should therefore not be generalized. However, the Swedish case is interesting, for instance, because it provides insights on public energy advising organized in a decentralized way and because it has been in place for more than two decades. Over the years, different formats have been tested and new ways to coordinate the local advisors have been put in place. While we encourage additional case studies of public energy advising in other countries, policymakers and energy advisors in other countries may still find inspiration and learning from this paper.

Lastly, our study identifies a number of improvement areas as well as a need of further research in challenges related to public energy advising. To start with, there is a need of understanding whether the service offer provided by energy advisors matches with the needs of the target groups. Future research should inform policymakers e.g., by asking actors in the target groups how they perceive public energy advisors, and by comparing the functions played by public energy advisors and by private energy advisors. In order to maximize the use and the relevance of public energy advising, we also suggest that future research goes deeper into understanding the potential of public energy advisors to act as change agents and system builders. Our research suggests that public energy advisors play a role as systemic intermediaries and as such, they represent an important potential for policies aimed at accelerating the energy transition.

CRediT authorship contribution statement

Ingrid Mignon: Funding acquisition, Supervision, has developed the original paper idea, written the paper, revised the paper after review, secured the funding and supervised. **Lisa Winberg:** Formal analysis, has collected and analyzed the data, developed the original paper idea, written the paper and revised the paper after review.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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