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Everyday Energy Information Literacy and Attitudes towards Energy-Related Decisions: Gender Differences among Finns

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Abstract: Many household-level decisions are made in families and, in studies, gender has been found to be an important factor affecting both household energy consumption behavior and household-level decisions related to energy use. This article scrutinizes everyday energy information literacy (EEIL) based on qualitative data collected from Finnish households in 2018 and reflects the findings by the gender differences that emerged from the quantitative analysis. The data (n = 415) included Finnish households (n = 323) and the residents of Ii municipality (n = 92), a pioneering municipality striving for carbon neutrality. The results indicate that there are gender differences in the dimensions of EEIL. Scrutinizing the qualitative data revealed the nuances of the differences. The qualitative data brought depth to the analysis by deciphering examples of respondents' views and perceived challenges in improving energy efficiency at home. The examples also illustrate the respondents' need for energy counselling and trusted parties from whom they hope information and advice. The article provides new information on gender differences in EEIL. Gaining more information on different groups and their attitudes, capabilities, and preferences helps to achieve carbon neutrality targets as a society. The results may be utilized in tailored communication for specific target groups and in communities' decision making and policies.

Keywords: climate change; energy information literacy; energy literacy; energy transition; everyday life; Finns; households; information literacy

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1. Introduction

Climate change is one of the biggest challenges of our time. Climate change mitigation by rapidly reducing greenhouse gases is urgent [1–6]. It has been acknowledged for decades, and there is a consensus in the scientific community about its core substance. However, only over the past few years have policymakers and citizens become more aware of the urgency of the measures. Europe has taken a leading role in climate actions and aims to be the first climate-neutral continent by 2050 [7]. Finland has an even more ambitious goal: carbon neutrality by 2035 [8,9]. The vast majority of greenhouse gas emissions, for example 75% in Europe, originate from producing and using energy [10]. This emphasizes the role of energy policy in climate change mitigation. Energy transition that aims to replace fossil fuels by renewable energy is in motion. The importance of interactions and discussions that involve all levels of societies in climate change mitigation policies is emphasized [6]. Citizens are essential in either supporting or hindering these necessary changes in societies, which require ambitious policies. Individuals make energy choices not only in their own lives, but also in their interactions within various organizations, companies, politics, and other social surroundings. Everyday energy information literacy (EEIL), from values, attitudes, and knowledge to behavior, is thus more than an individual (carbon) footprint, but reaches beyond as a (carbon) handprint.

Furthermore, because of Russia's war of aggression in Ukraine, Europe has faced an energy crisis. Increasing investments in clean energy are required [4]. The importance of energy infrastructure in societies has become an issue, and energy has become an

instrument of warfare (see [11]). The crisis has been especially challenging for central Europe, which is dependent on Russian gas. Because of the interdependence of the energy markets, the entire European energy market is in turbulence. This has also been reflected in Finland. Electricity companies have become bankrupt, which has caused difficulties for consumers. The prices of electricity contracts have become more expensive, and the fixed-price electricity contracts that have been typical of consumers in Finland (see [12]) have been largely replaced by exchange-priced contracts.

The exchange-priced contracts and volatility together with high prices have challenged consumers to be more aware of their electricity consumption. Demand response, where consumers adopt their electricity use price hours, have thus become more relevant in household energy behavior. Demand response also contributes to climate change mitigation: Timing electricity consumption during lower price hours means there is green energy available and curtailing consumption in peak price hours when the supply of green energy is restricted. Ruokamo and colleagues [12] studied household preferences and willingness to participate in demand response.

People's energy choices are driven by various factors. Fact-based rational behavior is accompanied by affective issues, such as values and attitudes that guide our decisions. To make informed energy choices, we need abilities to seek and access energy information, evaluate, and use it in an appropriate way in various situations. Especially in the era of social media, the abilities to evaluate information and its source are crucial. Online propaganda and trolls purposely distribute false information. There is also mis- and dis-information available on climate change and energy. Information processing skills are essential to tackle these challenges and make informed decisions on energy.

In studies related to household energy consumption, the role of gender has been considered from different viewpoints. For instance, understanding energy-consuming household practices, their roles in decisions related to renovations and energy saving, and the discussions relating to them. Ellegård and Palm [13] found that men and women carried out different activities in the home and hence consumed energy in different ways. This has been further studied, e.g., by Tjørring [14], in anthropological investigations of ten Danish families and their decision-making processes. The study showed that "the different practices of men and women in the house influence the negotiation and decision-making process for doing energy renovations. Because men and women do different things in the shared household, they prefer to invest in different forms of renovation that affect their particular practices". Furthermore, Tjørring, Jensen, Hansen, and Andersen [15] studied the flexibility of electricity consumption in private households. In this field study, 71 Danish households received incentivized text messages, suggesting that they shift electricity consumption to certain hours of the day. When text messages were sent to women, there was a significantly greater response than when they were sent to men. Based on qualitative in-depth interviews, we found that an important reason for this was gender differences regarding responsibility for the use of electrical household appliances.

The role of gender and thermal comfort negotiations in household energy use behavior were studied by Sintov, White, and Walpole [16] from diary observations. The dynamics of negotiations are not always in balance, as, according to the discussions, women might be more likely to "give in" in conflicts. Shrestha et al. [17] conducted a review on the importance of gender perspective in household energy-saving behavior and energy transition for sustainability. According to the review, "gender, income, family composition, ownership, and education are significant influencing factors in energy-saving behavior, and gender differences are rooted in socialization, responsibility, and choice of energy appliances that have impacted energy decisions influencing energy-saving behavior and sustainability goals". In a larger view, according to Lieu and colleagues [18], energy transition has not included genders equally: "Women's viewpoints are absent in existing energy transition pathways and should explicitly be included ex-ante".

For understanding people's decisions related to household energy consumption behavior and their interaction with information, their competencies and capabilities to seek, evalu-

ate, and use the information, need to be investigated. Literature related to household energy use have been studied to some extent and also in relation to financial literacy (see [19–21]). A gender gap has been detected in the energy literature [22–24]. When compared with men, even women with university education were found to have a lower energy-related financial literacy [24], but more positive attitudes towards energy conservation and environmental issues, as well as energy-related self-efficacy [25]. On the contrary, Kalmi et al. [21] found that women were more likely to be energy literate when compared with men. Moreover, studies have shown that women have received higher scores in energy-related attitudes, values, and self-efficacy [25] than men regarding energy knowledge [23,26]. Women have been found to be more likely to underestimate their abilities when compared with men [27] and show lower confidence in, for example, mathematics [28]. Similarly, in a study on subjectively measured energy information literacy among university students [29], men were found to be more confident and women were more motivated to seek energy information.

2. Aim of the Study, Methods, and Data Collection

The aim of this study was to increase the understanding of Finns' EEIL and attitudes related to household energy decisions as well as their need for guidance. Gender differences are studied as, according to the literature, gender is one of the main factors that influences household members' everyday energy decisions and attitudes towards the topic.

According to the augmented definition of EEIL [30], an everyday energy information literate person has (1) a sound conceptual knowledge base and an understanding of energy-related issues in everyday life and the abilities to (2) recognize an energy information need; (3) identify likely information sources and use them to search relevant information; (4) assess the quality of the information and its applicability to a specific situation; and (5) analyze, understand, and use the information to make informed decisions in energy-related matters, as well as the ability to (6) understand the connection between one's own actions and climate change, and the (7) willingness and ability to improve one's own actions towards behaving in a sustainable way, including using renewable energy and saving energy (see [30] (pp. 65–74)).

The research questions are as follows:

RQ1: Are there gender differences in Finns' everyday energy information literacy?
RQ2: What kind of challenges have Finns faced relating to household energy efficiency improvements?
RQ3: How do Finns perceive their need for energy counselling and guidance?
RQ4: Were there gender differences in open-ended responses relating to RQ2 and RQ3?

2.1. Data Collection

This study focuses on household data collected using postal questionnaires from a random sample of Finns and a sample of the residents of an energy-wise town in Finland, the municipality of Ii. This household data include responses from 415 Finns (see Table 1).

The first part of the household data were collected with a postal questionnaire in September 2018 from 700 residents of Ii municipality in northern Finland. The response rate was 13.1% (n = 92). The Municipality of Ii was chosen for the study because it represents a pioneering municipality in striving for carbon neutrality. The second part, also collected in September 2018, consisted of a random sample of Finnish households. The questionnaires were sent by mail to a random population sample of 2000 Finns, of which 323 returned the questionnaire completed. The response rate was 16.2%.

The data collected from Finns and from residents of Ii municipality were compared statistically (e.g., *t*-test) and only minor differences were found [30]. This is why the data were combined for further statistical analysis. By combining these, we obtained the strength for the statistical analysis, because the data set otherwise would have been small. Moreover, Ii is not the only municipality in Finland that has climate actions, which may partly explain why the differences were minor. There are various actions on municipal and other levels of

society with varying emphasis and approaches to energy and climate issues. Nevertheless, readers should bear in mind this limitation when interpreting the results.

A postal survey was chosen as a method for collecting data. It was considered to be the most reliable way to reach the target audience, who were residents of Finnish households. Information on the sample and postal addresses of the participants were acquired from the Digital and Population Data Services Agency. The agency conducted the random sampling using the following instructed criteria: the sample included Finnish-speaking adults between 18 and 75 years old whose postal addresses were in Finland (or in the area of Municipality of Ii). The gender distribution of the population was also considered and aimed to be equal.

The survey questionnaires were in Finnish, which limited the respondents to those who speak Finnish. However, most Finnish people speak Finnish as their mother language (share of Finnish speakers 87.6% in 2018) [31]. Moreover, presumably, the majority of the rest of the population, such as Swedish speakers, are fluent in Finnish.

Nonresponse bias may occur, because some people are more informed and interested in a topic of a survey and thus more willing to participate in these kinds of surveys [32] (pp. 59–60). This is also highly likely for this survey, as energy-related issues are generally perceived as being quite complex. However, when we think about the municipality of Ii, the interest may not be connected to exact expertise on the topic, even though themes of energy and climate change are highlighted in, e.g., the communication by the municipality (see, e.g., https://ii.fi/en/climate-actions-and-renewable-energy (accessed on 29 May 2023)).

The purpose of the questionnaire was explained in the cover letter in order to examine people's perceptions and knowledge regarding energy-related matters. Both groups had an option to fill in the questionnaire digitally as the link was printed on the cover letter.

Survey questions on respondent demographics and backgrounds included their year of birth, gender, level of highest education, income, and whether their occupations or education relate to the energy industry or electricity market. The everyday energy information literacy measure [30] was included in the questionnaires, as well as closed-ended questions related to climate friendly behavior and energy knowledge. The aim of these developed question sets was to obtain more knowledge on the behavioral and cognitive dimensions related to awareness, attitudes, and knowledge on energy-related issues.

Furthermore, the questionnaire included open-ended questions that were related to orientation towards energy issues and interest in counselling or guidance. Plans to enhance the energy efficiency of the households and the challenges the respondents faced were inquired by asking "Considering the energy efficiency improvements you have already done in your household and what you are planning to do in the next three years, what challenges do you experience related to these (improving your household's energy efficiency)?". Moreover, the participants were asked "Would you like to receive energy counselling/guidance?", and if they responded "yes" we further inquired "What kind of information and support would you prefer? In your opinion, by whom should this counselling/guidance be offered?". The aim of the open-ended questions was to complete the closed-ended ones and to provide a chance to talk more about the theme.

2.2. Data Analysis

The closed-ended questions of the survey were analyzed by statistical methods using IBM Statistical Package for the Social Sciences (SPSS) version 24.0 and 25.0. Principal component analysis was used for exploring the component structure and finding the latent variables of everyday energy information literacy. All of the components with an eigenvalue >1 were extracted, according to the Kaiser–Guttman criterion. To improve the interpretability of the extracted components, an orthogonal rotation technique (Varimax criterion) was applied, yielding statistically independent components. Mean component scores were calculated using the regression method. Parametric tests, such as *t*-test, were applied to explore the gender differences.

The open-ended questions were analyzed using data-driven content analyses. Excel was also used for assembling the qualitative data. The data were categorized into themes (see Tables 2–4) so as to scrutinize the aspects of recipients' views on energy efficiency and related challenges (Table 2) and need for energy counselling or guidance (Tables 3 and 4). Rough categories were also made to depict potential gender differences in recipients' views. Note that open responses of the respondent may include coded parts included to different categories.

3. Results

3.1. Background Information

The background information of the respondents is presented in Table 1. Over half of the respondents were men (n = 224, 54.8%) and less than half were women (n = 185, 45.2%). Almost half of the respondents had a university degree (n = 178, 43.8%). Household income among respondents was typically between EUR 2000 and 6000 (n = 230, 57.8%).

Table 1. Respondents' sociodemographic characteristics (n = 415). Acta Universitatis Ouluensis B187, 2021.

Character	Respondents
Mean age	55 years
	N (%)
Gender	
Female	185 (45.2)
Male	224 (54.8)
Other	0 (0.0)
Education	
Comprehensive school	72 (17.7)
Upper secondary school	156 (38.4)
Bachelor's degree	108 (26.6)
Master's degree	70 (17.2)
Monthly household income	
Less than EUR 2000	61 (15.3)
A EUR 2000–6000	230 (57.8)
More than a EUR 6000	107 (26.9)
Work or education related to the energy industry or the electricity market	47 (11.4)

3.2. Gender Differences in Everyday Energy Information Literacy

Finnish respondents were mostly (n = 353, 86.5%) unanimous in that being informed about energy issues is important (women n = 161, 87.0% vs. men n = 187, 83.5%). They also felt that they knew where to seek energy information (n = 318, 77.8%). Men in particular were confident in their information seeking skills (women n = 124, 67.0% vs. men n = 189, 84.4%) and reported using the information in the choices of their everyday life (n = 272, 66.2%, women n = 126, 68.1% vs. men n = 141, 62.9%). Knowing who to believe in energy issues was difficult for half (n = 213, 52.2%) of the respondents, but for women more than men (women n = 100, 54.1% vs. men n = 109, 48.7%). The challenges related to the reliability of the information available on the internet were particularly recognized.

Responses to value and attitude statements were positive overall. Renewable energy production (n = 367, 90.2%) (women n = 167, 90.3% vs. men n = 196, 87.5%) and energy saving (n = 390, 94.9%) (women n = 173, 93.5% vs. men n = 212, 94.6%) were favored by almost all of the respondents. Over 60% (n = 258, 63.5%) of the respondents wanted to do more to save energy if they knew how (women n = 121, 65.4% vs. men n = 134, 59.8%). Over 80% (n = 347, 84.4%) (women n = 155, 83.8% vs. men n = 188, 83.9%) recognized that carbon dioxide emissions from the use of fossil fuels caused global warming. Almost as many (n = 320, 77.7%) (women n = 152, 82.2% vs. men n = 164, 73.2%) believed they could contribute to reducing carbon dioxide emissions through their own actions and decisions.

Over one third (n = 143, 35.0%) (women n = 69, 37.3% vs. men n = 73, 32.6%) of the respondents agreed with "I believe I need to change my lifestyle to prevent climate change", and almost as many in general (n = 137, 33.6%) disagreed with the statement, especially men (women n = 55, 29.7% vs. men n = 79, 35.3%). Almost 60% (n = 239, 58.1%) (women n = 106, 57.3% vs. men n = 130, 58.0%) of the respondents reported that experts' recommendations had a major effect on their energy decisions (see more [30] (92–100)).

Principal component analysis was conducted to explore the structure of the developed everyday energy information literacy measure and to find its latent variables (see also [30]). Bartlett's test of sphericity was significant ($p < 0.001$). The Kaiser–Meyer–Olkin measure of sampling adequacy value was 0.796. Communalities varied between 0.404 and 0.836. The internal consistency representing reliability of the EEIL measure was analyzed by Cronbach's alpha, and it was consistent (0.745). The principal component analysis indicated that the proposed EEIL measure's component structure was multidimensional [30].

The five components were identified in Finns' everyday energy information literacy (Figure 1): attitude towards climate change and energy issues (attitude), willingness to acquire energy information and change one's own behavior towards a climate-friendly mode (advocacy for change), perceived access to energy information (access), applying energy information in everyday life (awareness), and assessing energy information (assessment).

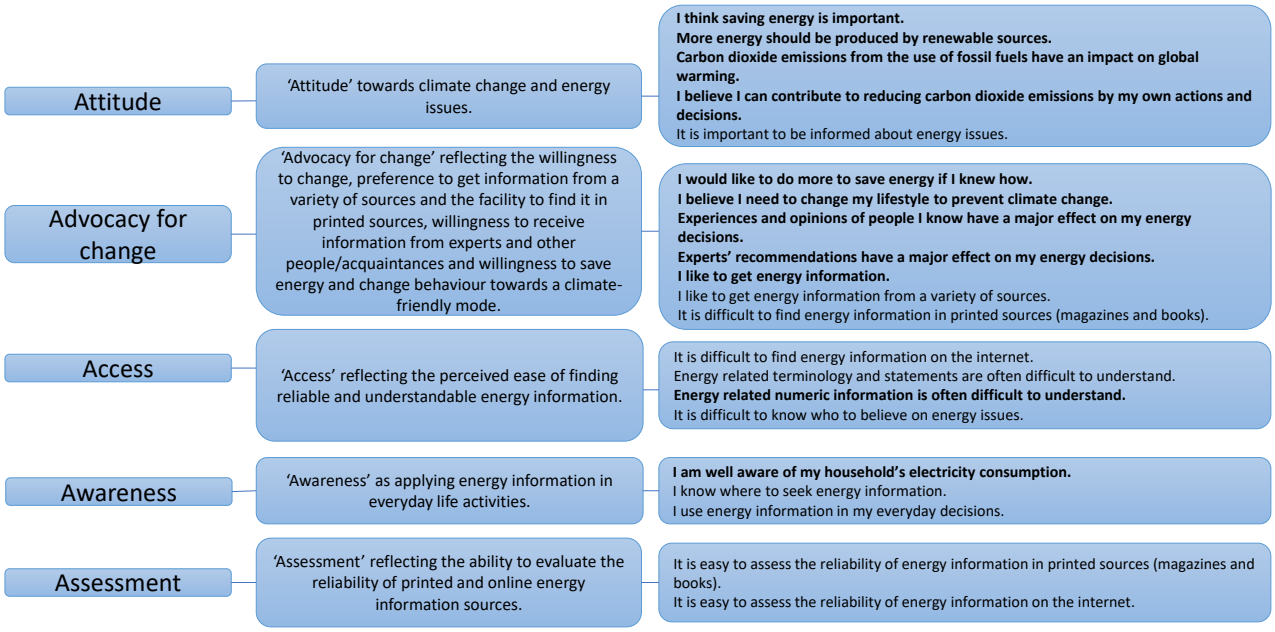

Figure 1. The content of the augmented everyday energy information literacy (EEIL) components (see also [30]). Acta Universitatis Ouluensis B187, 2021.

Statistically significant gender differences appeared in two out of five everyday energy information literacy components (Figure 2). These two were attitude (towards energy issues and climate change), where women received significantly higher scores (M = 0.259 vs. M = −0.138, t(242) = 3.385, $p = 0.001$), and access (to energy information), where the scores for females were lover when compared with male respondents (M = −0.323 vs. M = 0.248, t(242) = −4.633, $p < 0.001$).

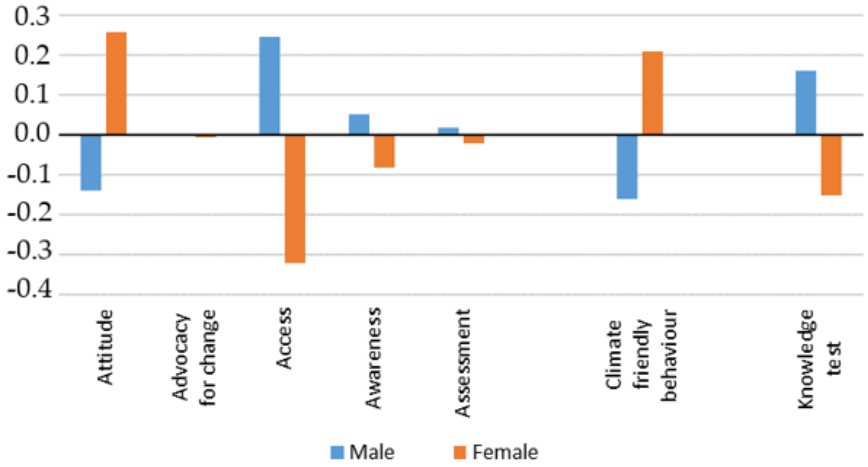

Figure 2. Gender differences in the components of everyday energy information literacy measures, questions related to climate friendly behavior and in the energy knowledge test (see also [30]). Acta Universitatis Ouluensis B187, 2021.

Gender differences were not statistically significant for components representing advocacy for change, awareness, and assessment. The values for gender differences for these components were advocacy for change (M = −0.006 vs. M = −0.001, t(242) = −0.035, p = 0.972), awareness (M = −0.081 vs. M = 0.051, t(242) = −1.022, p = 0.308) and assessment (M = −0.020 vs. M = 0.020, t(242) = −0.316, p = 0.752).

In addition to these five components of everyday energy information literacy, climate friendly behavior and energy knowledge were also scrutinized in the survey. Women scored significantly higher in climate friendly behavior (M = 3.162 vs. M = 2.790, t(380) = 2.661, p = 0.008). However, in the energy knowledge test, the gender differences were not statistically significant. Nevertheless, male respondents received slightly higher scores (M = 7.865 vs. M = 7.553, t(399) = −1.796, p = 0.073) when compared with the female respondents. The gender differences are represented in Figure 2.

The open-ended questions of the survey and potential differences in responses between genders are further examined. The questions related to challenges experienced related to improving household energy efficiency and to what kind of information and support would the respondents prefer relating to energy counselling and guidance.

3.3. What Kind of Challenges Have Finns Faced Relating to Household Energy Efficiency Improvements? (RQ2)

In open-ended questions, the recipients reported on challenges related to making improvements on their home's energy efficiency. There were 200 responses to this open-ended question (n = 161 Finns and n = 39 Ii municipality residents). These open-ended responses were categorized based on the themes that emerged from the respondents' responses. Four themes were identified: money, technical issues, knowledge, and lack of influence (see Table 2). In addition, there were other challenges or respondents reported to have no challenges or could not say or identify any.

Table 2. Perceived challenges for enhancing energy efficiency. N = 200 (n = 161 Finns, n = 39 Ii).

	Money	Technical Issues	Knowledge	Lack of Influence	Other	No Challenges	I Cannot Say
Female	38 (20.5)	16 (8.6)	11 (5.9)	21 (11.4)	16 (8.6)	7 (3.8)	6 (3.2)
Male	50 (22.3)	18 (8.0)	4 (1.8)	23 (10.3)	11 (4.9)	14 (6.3)	4 (1.8)
All	88 (21.5)	34 (8.3)	15 (3.7)	44 (10.8)	27 (6.6)	21 (5.1)	10 (2.4)

Money was the most common challenge. It was referred to, e.g., as expenses and own financial situation, as follows: "Financial challenges" (female = f), "Financial situation" (f), investment prices: "Investments are expensive, meaning of use of money" (male = m) and payback period: "Cost/payback period" (m).

Technical issues and lack of knowledge were related to each other, such as the information needed when comparing and choosing the devices. These issues were stated in responses such "Unfamiliarity with options" (f), "Comparison of solar panels" (f), and "Access to information about energy-saving devices" (m). Furthermore, the decisions were not always easy to make: "I'm not completely familiar with solar heat, maybe I should change the hot water heater, get a battery" (f).

Solar energy was emphasized in the qualitative data collected from the residents of Ii municipality. In these responses, financial issues were considered: "Solar photovoltaic or solar thermal panels under consideration, but still too expensive in relation to the yield" (m). Technical and financial issues were also pondered together: "It is not possible to store solar electricity and the electricity companies do not pay enough if the electricity is transferred to the grid" (m). Knowledge related to utilizing solar energy was considered challenging: "information about the purchase + installation and use of solar panels in a private household is difficult to obtain" (f). The reason solar energy is strongly present in the responses from the municipality of Ii may be due to various projects related to solar energy and pioneering carbon neutrality. The type of residence also has an effect.

Lack of opportunity to influence was experienced especially in rental apartments and condominiums: "You can't change many things in an apartment building" (f), "You can't influence in a row house apartment" (f) and "When you are living on a rented apartment, you can't influence everything" (m). There was also confidence in outsourcing energy matters: "I can't say because I'm not familiar enough with it. Energy matters have not been so important. In an apartment building, things are being taken care of" (f). There was some frustration with the lessor "The attitude of the lessor" (f) or others' indifference to energy consumption: "Generally speaking, the energy consumption of a real estate is not recognized or cared about" (m). On the contrary, some felt positively that they had an opportunity to have an influence in the condominium: "Not very big challenges, I'm on the board of the housing association, so I can propose reforms" (m).

Lack of influence was also related to critics towards energy policies and societal issues. Some had confidence in technology and promoting green energy policies instead of human energy behavior in solving the emission problems: "Really the problem is not the energy consumption, but the way of the production. There is no reason to decrease consumption, but to insist for carbon neutral energy production ways" (f). On the other hand, some felt that energy behavior is the solution for matching energy supply and demand: "If we all saved electricity, there would not be a need for a new nuclear power plant" (f).

Frustration in energy policies was present among a few responses, especially the regionally unequal transmission fees that have been debated in the media over the years: "The large share of the transmission fee in the price of electricity is practically a robbery" (m), "Why are they collecting money through the transmission fee?" (no gender information).

On the other hand, some people may feel that (compared with others) they have done enough to save energy (and that there is nothing more they can do): "My consumption is really low. I am a frugal old lady" (f).

Lack of influence was also experienced due to personal health and age: "Will my health and life expectancy be enough? I already 73 years old" (f). The trend of energy prices was also a concern: "Energy price and its direction, in 15 years I probably won't be making any decisions (time is running out)" (m).

In addition, the bigger picture was regarded in some responses, including climate change, politics, and own health: "Changing environment, world politics, own health condition" (m).

Other challenges respondents mentioned were, for example, everyday-life inconveniencies, such as lack of time and effort: "Requires regular investment, easy to move forward in a haste" (f), "There are a lot of other things to do" (m), and "Lack of vigilance" (f).

Some challenges, related to, for example energy, consumption behavior and habits, were also seen as manageable: "Nothing but a consumption habit" (m), "A little effort, nothing more" (m), and "You can always reduce consumption" (f).

In some responses, aesthetics as well as everyday-life inconveniencies were a part of the consideration of energy device purchases: "The air source heat pump is ugly and loud" (f) and "How could I install solar panels on the roof of the house and make it look good" (f, Ii municipality data).

3.4. How Finns Perceive Their Need for Energy Counselling and Guidance (RQ3)

The recipients were asked about their need for energy counselling. The open-ended question on the questionnaire was specified as "Would you like to have energy counselling (no/yes)". If they answered yes, they were asked to write "What kind of information and support would you prefer and who should offer the information?". There were 56 open answers to this question (n = 46 Finns, n = 10 Ii municipality residents).

3.5. Who Should Provide Energy Information?

Here are the themes and preferred sources of energy information that emerged in these open-ended answers. There were four categories identified as preferred source of information, namely: municipalities and cities, companies, authorities, and experts (see Table 3).

Table 3. Perceived need for energy counselling (no/yes). Who should provide energy information? N = 56 (n = 46 Finns, n = 10 Ii municipality residents).

	Yes (%)	Municipalities and Cities (%)	Companies (%)	Authorities (%)	Experts (%)
Female	40 (21.6)	6 (3.2)	7 (3.8)	1 (0.5)	2 (1.1)
Male	34 (15.2)	2 (0.9)	5 (2.2)	2 (0.9)	2 (0.9)
All	74 (18.1)	8 (2.0)	12 (2.9)	3 (0.7)	4 (1.0)

Recipients often mentioned municipalities and cities as a reliable and preferred source of energy information: "Unbiased and reliable information with prices, for example, from a municipal energy advisor" (f), "For example, I think the municipality should offer it" (m), and "I do not know. Maybe the municipality could provide advice" (f). As a contrast to commercial operators, municipal advice was preferred to be free of charge: "The municipality or city should give free advice to those who want it" (f).

In addition, companies from the energy sector were also regarded as a potential source of energy information: "Electricity company, housing association, a city employee responsible for environmental issues, etc." (f), "Electricity, heat, and water supply companies" (m), and "Electricity company" (f).

For example, media and electricity bills were considered as prominent information channels: "There could be tips in the electricity bill and TV would be a good source of information" (f).

Authorities were mentioned as a preferred source of energy information as well as up to date information: "New and latest information. From the building supervision authorities" (m), "Authorities" (m), and "Authorities and NGOs" (f).

Respondents requested energy information from professionals: "From experts" (no gender information). These were referred to as competent and unbiased actors or gave more practical and concrete advice, such as price comparison and in comparing various options (see also what kind of information and support is needed): "From parties who know the technologies and have experience" (m) and "Objective experts/operators, concrete comparison of different options, e.g., price comparison" (m). Expert lectures were requested

in higher education institutions: "It would be nice to have an expert in the field lecture on the subject at universities" (f).

3.6. What Kind of Information and Support Is Needed

Recipients were asked about what kind of information and support they needed. Based on the open-ended replies, there were four categories identified: information on everyday energy saving, energy investments, and how energy is produced, as well as non-commercial, unbiased information (see Table 4).

Information on everyday energy saving were the most popular theme. People were interested in how to measure their own consumption and ideas on how to improve energy efficiency: "How to save energy in my household" (f), "Ordinary, how to measure/track your own consumption more precisely" (f), and "Information on improving energy efficiency, tips" (f).

The recipients themselves also shared ideas on how energy information could be brought closer to people's everyday lives and thus made more understandable, and reachable: "On a societal level, I think energy advice could be applied to very different places and situations, such as for example the fruit section of shops, on means of transportation, neon signs −> the form and style of the advice would play an important role: non-accusatory, but catchy information presented in an insightful way and as a starting point the significance of energy from the consumer's point of view" (f). The format of information was addressed, especially how to attract interest: "The information should be in an interesting format, one that would raise interest in the matter" (f).

Respondents were interested in investing in clean energy technology. Information on energy investments were needed, especially for solar energy: "Above all, about solar energy" (f), "How solar panels produce electricity in winter" (m). There was also interest towards wind power systems: "Information on how solar energy or wind energy could be utilized in households and what types of systems are available today" (m).

Because of the cold climate, heating is a major energy consumer in Finnish homes and thus naturally different options are considered: "Information about different heating options" (f).

Even before energy crises, there was an incentive among respondents to reduce electricity consumption and find cost-efficient investments: "How could our household's electricity consumption be reduced even further, but in a way that would not require a terribly big investment financially" (f).

Tailored advice is needed, considering circumstances with aging houses and residents (see also challenges relating to household energy efficiency improvements). Because of urbanization, there are areas in Finland that houses do not sell, and thus investments are unprofitable: "Comparative and fact-based information. What should be done in the houses of aging people, we are probably the last residents in the house" (f).

Respondents needed information on electricity providers: "Informative about electricity producers" (f) and were interested in how energy is produced: "With what energy was it produced" (m), and "Is the electricity made by wind power" (m).

Many of the respondents considered the reliability of information, "Comparative and fact-based information" (f) and requested non-commercial, unbiased energy information from different sources (internet, library), "In everyday language, for example a public event in the library. Without the presence of companies" (f) and shared also tips on how to bring information closer to people (see also what kind of information and support is needed), "How can I save energy without financial contributions! Non-profit organizations" (f) and "Reliable advice online without marketing ideas. Unbiased advice on household energy information management" (f). A different angle was brought up as a critical but positive attitude towards commercial actors and their energy solutions: "You should approach the seller's advice with caution, although you can get ideas from them too" (f).

Table 4. What kind of information and support is needed. N = 56 (n = 46 Finns n = 10 Ii municipality residents).

	Everyday Energy Saving (%)	Energy Investments (%)	How Energy Is Produced (%)	Non-Commercial, Unbiased Information (%)
Female	18 (9.7)	10 (5.4)	2 (1.1)	8 (4.3)
Male	6 (2.7)	9 (4.0)	2 (0.9)	3 (1.3)
All	24 (5.9)	19 (4.6)	4 (1.0)	11 (2.7)

3.7. Perceived Challenges Relating to Household energy Efficiency Improvements: Differences Based on Gender (RQ4)

Overall, there were not many differences among men and women's responses in these open questions. Both men (n = 50, 22.3%) and women (n = 38, 20.5%) often mentioned money as a challenge, with men a little more often than women. This may be due to traditional division in household tasks: women may carry more responsibility on everyday household routines of the whole family, including energy behavior.

Technical issues were identified as a challenge by 16 women (8.6%) and 18 men (8.0%). It is interesting that both men and women addressed technical challenges, as in earlier studies, gender roles in home's energy decisions were found to be unequal. The review by Shrestha and colleagues found that [17] "In most countries, women are involved in a higher percentage of energy activities in household chores but have less gender participation in energy decisions". According to Tjørring [14] " . . . there was a cultural norm about the division between what men and women do in the home. This cultural norm placed energy renovation in the male sphere of interest" and "Decisions about energy renovations were not gender neutral but influenced by the different practices and cultural norms that existed in a house". The headline in the study by Tjorring [14] addresses the contradiction between attitudes and household decision making: "The paradox: how can women be concerned about the environment when they are not interested in energy renovation?". Furthermore, women may be neglected in energy marketing. According to Tuomela [33] (p. 47), "Households with a single female adult usually are not considered in the target group of home energy technologies, such as SHEMS (smart home energy management systems) and solar panels".

Women (n = 11, 5.9%) reported knowledge-related challenges more often than men (n = 4, 1.8%). This reflects the quantitative results that men are more confident in their knowledge. It may also imply that women, as they are found to be more motivated to seek information, recognize their need for information more thoroughly. Similarly, men (n = 14, 6.3%) reported no challenges more often than women (n = 7, 3.8%). Furthermore, women (n = 6, 3.2%) could not say or identify any challenges more often than men (n = 4, 1.8%).

Perceived challenges in approving energy efficiency may also be related to difficulties in understanding energy information. In the questionnaire, 115 (62.2%) women and 87 (38.8%) men agreed with the statement: "Energy related numeric information is often difficult to understand". Furthermore, there were 41 (22.2%) women, but only 15 (6.7%) men who strongly agreed with this statement. This reflects the earlier studies (see [27,28]), where women were found to be less confident, for example, in their mathematical skills.

Lack of influence was identified in the responses of 21 women (11.4%) and 23 men (10.3%). Other challenges, such as lack of time or effort, was reported by 16 (8.6%) and 11 men (4.9%).

3.8. Perceived Need for Energy Councelling and Guidance: Differences Based on Gender (RQ4)

There were minor differences in the need for energy counselling between female and male respondents. Among the female respondents 40 (21.6%) and male respondents 34 (15.2%) preferred to have energy counselling. This may also reflect the differences in literacy and confidence in one's own abilities (Figure 2). Of all the respondents, 74 (18.1%) preferred to have energy counselling.

Related to the question about perceived need for energy counselling, there was the item in the questionnaire of "I like to get energy information". There were 117 (63.2%) women and 129 (57.6%) men who agreed with this statement.

Women (n = 6, 3.2%) suggested a few times more often than men (n = 2, 0.9) that municipalities and cities should offer energy counselling. Companies were mentioned both by women (n = 7, 3.8%) and men (n = 5, 2.2%). Women mentioned authorities once (0.5%) and men twice (0.9%). Both mentioned experts twice (women 1.1% vs. men 0.9%).

Everyday energy saving was strongly present in women's responses (n = 18, 9.7%), but was also mentioned by a few men (n = 6, 2.7%). Both needed information on energy investments (women n = 10, 5.4% vs. men n = 9, 4.0%). Information needs on how energy is produced was mentioned by two women (1.1%) and two men (0.9%). The need for a non-commercial, unbiased information source was addressed especially by women (n = 8, 4.3%) and a few men (n = 3, 1.3%). Overall, gender differences were not evident based on the open-ended answers.

4. Discussion

The aim of this article was to increase the understanding of Finns' EEIL and attitudes relating to household energy decisions and the need for guidance.

The research questions were as follows:

RQ1: Are there gender differences in Finns' everyday energy information literacy?
RQ2: What kind of challenges have Finns faced relating to household energy efficiency improvements?
RQ3: How Finns perceive their need for energy counselling and guidance?
RQ4: Were there gender differences in open-ended responses relating to RQ2 and RQ3?

Gender differences were found in some components of EEIL. To sum up, women had more positive attitudes towards energy issues and climate change and scored higher on climate friendly behavior. Men, on the other hand, received higher scores on access to energy information.

Generally speaking, Finnish respondents considered energy saving and promoting renewables in energy production to be important. Women's energy attitudes towards climate change mitigation were more positive than men's. Similarly to earlier studies, women were found to have better self-efficacy related to energy, as well as more positive values and attitudes towards environmental issues and energy saving [25]. Some studies indicate that attitudes may be associated with behavior [30,34] and attitude items reflected climate friendly behavior items among Finnish respondents [30]. Women received higher scores in climate friendly behavior than men. Women were found to be more motivated in seeking but less confident in accessing energy information than men, who were more confident in their knowledge and evaluation skills (see also [29]). In earlier studies, women were found to be less confident, for example, in their mathematical skills [28] and were potentially more likely to underestimate their own capabilities than men [27]. In energy knowledge, the results on gender differences have been partly conflicting. The results of our study revealed no statistically significant gender differences in the energy knowledge test. On the contrary, men had better energy knowledge than women in the studies by Cotton and colleagues [26] and Filippini and colleagues [23]. Several energy-related financial literacy studies detected a gender gap [22–24]. Specifically, a gender gap has been detected even among highly educated people [24]. On the contrary, in the study by Kalmi and colleagues [21], women were more likely energy literate than men when energy literacy was measured through numeric calculations. Self-efficacy and perceived access to information may be connected to energy knowledge [30].

The findings on research questions 2–4 were based on a qualitative approach and were conducted by shedding light on respondents' energy-related views through authentic examples of the respondents' answers to open-ended questions. The themes within responses were also categorized. The aim was also to bring out potential gender differences among respondents' answers. Both men and women reported similarly within same categories.

Even though there did not seem to be major gender differences, some speculations are interesting to ponder in relation to earlier literature, as well as the quantitative results from thesis, also presented in this article. The responses to questionnaire items reflected the gender differences detected in the statistical analysis (see also [30]). When compared with men, women reported more difficulties in finding energy information and understanding, especially numeric energy information. At the same time, women's attitudes were overall more positive towards sustainable lifestyle choices and efforts to contribute to mitigating climate change. This is also in line with earlies studies (e.g., [25]). The way women wrote in their responses indicates that they were somewhat more open to counselling and guidance than men, which reflects the positive attitudes found in the quantitative analysis. Women also appreciated practical advice on everyday life energy saving. A preferred source of information is also within the everyday life context, such as municipalities and cities. Women explicitly brought up concerns regarding the reliability of information and its' source. This may be due to uncertainties experienced when accessing energy information, which is in line with the quantitative analysis. Overall, women's need for energy information is reflected by the various sources, which include both companies and objective sources. Women need practical everyday information, including investments and saving energy in everyday practices. However, the gender differences were minor, and thus not valid for making prominent conclusions.

Overall, both men and women had similar concerns, for example related to money. Respondents considered the monetary gains of energy devices. Solar panels were (in 2018) especially considered to be too expensive in relation to the yield. Technical issues and lack of knowledge were also common challenges, and these issues were often intertwined.

Lack of influence includes various challenges, such as health, age, living arrangements, energy prices, infrastructure, and societal conditions. For example, the ability to maintain household energy efficiency in old age and with limited resources were a concern. On the contrary, people living in apartment buildings experienced a lack of influence in energy matters. Influencing would require different approaches, such as participating in board meetings, which was also mentioned in open-ended responses.

Relying on energy behavior alone may reflect as reluctance to invest in energy efficiency. However, energy-efficient devices may help reach optimal results in comfortable and safe living conditions, as well as with energy curtailment. Studies have shown that it is often more effective to invest in energy efficient devices than try to reduce energy consumption by changing behavior [35]. Of course, both approaches are needed to optimize energy use.

To support energy efficiency, energy information should be considered interesting and reliable. Different target groups may also have different preferences, which should be considered. This shows, for example, in women's more positive attitudes towards energy counselling and the everyday surroundings they interact with information. Referring to Lieu and colleagues [18] and the lack of female perspective in energy transition, including women would benefit the transition worldwide.

In the Nordic welfare states such as in Finland, women have a relatively strong position in society, both in households and in politics. For example, at the moment, in April 2023, the prime minister of Finland is a woman, as well as many of the ministers in general. Women would also have a lot to offer to the energy sector, which reaches across society. This is why it is interesting to view the gender differences in everyday energy information literacy. Examining the differences between different groups allows for tailoring communication and education to better meet the information needs of a certain group. Knowing the target group increases the effectiveness of communication [36]. By considering women's positive attitudes towards climate-friendliness in energy production and consumption (see more [30] (p. 129) and [25]) and, on the one hand, the experiences of lower self-confidence when compared with men, as implied in several studies [27,28], society could benefit from women being encouraged to take a more active role in energy decisions at all levels of society.

5. Conclusions

This study increases our understanding of Finns' EEIL as well as attitudes relating to household energy decisions and need for guidance. The focus was specifically on possible gender differences as, even today, gender plays a role in household's energy decisions and related activities. Admittedly, even when women have a relatively strong position in society, they should be further encouraged to engage in energy-related aspects.

It should be considered that the data of this study were collected already couple years ago and since then, the role of energy issues and climate change has become even more important in the everyday lives of individuals. The study could be repeated and the results could be compared retrospectively. It is expected that future studies will indicate ongoing progress in people's EEIL and related competencies and thus reflect and encourage the necessary changes in human society towards carbon neutrality. Currently, government formation talks are ongoing in Finland and one important topic is climate change activities.

Highlights:

Women are less confident in their energy knowledge but have more positive attitudes towards sustainable lifestyle choices and efforts to contribute to mitigating climate change when compared with men.

Women appreciate reliable and understandable energy information in their everyday lives.

Municipalities and cities are considered a reliable and accessible source of energy information. Therefore, they have potential to take a more active role in providing energy information to citizens and thus contribute to energy transition and climate change mitigation.

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