Role of Gender Participation in Household Energy Technology to Achieve Sustainability: A case of Kathmandu

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Research Article

Keywords: Gender Participation, Household, Energy, Sustainability

Posted Date: December 1st, 2020

DOI: https://doi.org/10.21203/rs.3.rs-113822/v1

Version of Record: A version of this preprint was published at Discover Sustainability on March 23rd, 2021. See the published version at https://doi.org/10.1007/s43621-021-00027-w.

Abstract

Introduction: Sustainability has become a global topic for quality of life on energy efficiency consideration. This study aims to evaluate the sustainability level of household energy consumption from the gender lens.

Material and Methods: 623 households above the age of 18 years were surveyed on energy use behavior in terms of economic, social, and environmental aspects to evaluate sustainability level. The study was based on interviews, observation, and air quality tests. CO2 of the urban kitchen was tested in 12 households measured in ppm.

Results: The study revealed that the lower-income group uses a larger share of their monthly income for household energy needs having unclean cooking fuel. The use of electrical appliances and income has a moderate correlation (r=.48). Social indicators demonstrate that female participation in energy decisions is higher only in female-headed and nuclear families. Environmental indicators exhibit that Kathmandu urban households are eager to use electric cooking, but they have insufficient knowledge, information, and less affordability for new technology. It resulted that the city's sustainability level is still low (56 scores) from a gender perspective.

Conclusion: The study concluded that innovative technical interventions are essential to combine with the subsidy policy to reduce inequality between low and high energy household shares. The increased women’s participation in energy technology supports getting a clean environment reducing the nation's financial burden of importing fuel.

1. Introduction

The importance of energy and gender integration in policy debates has been significant in sustainable development since the last two decades. Most studies acknowledge that women's participation in the energy sector contributes significantly to achieving global energy efficiency goals for sustainable development [1–3]. The household energy consumption in the world accounts for a 35% share of total energy, and household is the most gendered spheres of society in most cultures [4] [5]. Women's primary responsibilities are household chores that apply both in rural and urban societies of most countries such as Nepal. Numerous studies [1, 2, 10] have proved that modern energy services have improved women's socio-economic status with less time and effort involved in households' chores and reducing the health risks associated with current energy practices. Recognizing the importance of the gender dimension in energy policies, the seventh SDG has prioritized proper access to clean and affordable energy as universal rights [7]. The fifth goal emphasized gender as an inseparable entity in energy justice for sustainability.

Additionally, it highlights that expanding energy access must go beyond meeting basic needs: improving economic take-off conditions. It emphasizes innovation, sustainable consumption, and justice [2]. Development research shows that increasing women's energy management participation can achieve a

win-win situation for women and policy management [8]. However, women are mostly ignored in energy-related decisions and industries, disregarding women's productive activities [8, 9].

Nepal is one of the least energy-consuming countries globally; however, it has the highest energy intensity in South Asia - 4.5 times higher than the world average, which is 1.8 times higher than India or China [13, 14]. In Nepal, the residential sector accounts for the largest energy consumption by 80%, and cooking holds the maximum energy use for 60% of the total energy share [13]. Kathmandu city – Nepal's capital holds 22% of its total urban population [14] and is an ethnically diverse city. The city is accompanied by the complex urban problems of severe demand on resources that resulted in a frequent energy crisis, inequitable distribution, and environmental degradation. Kathmandu households have been managing the energy crisis by fuel stacking and multiple fuel uses. It has added financial burden, the use of more space, and resulted in a poor quality of life. In most parts of Nepal, energy is substituted using human muscles (somatic energy), particularly in household chores, such as washing clothes, cleaning, and grinding. Women are considered to be responsible for those household chores. Traditionally, men are considered the breadwinner, and women are managers of the house; however, women also started to earn and work outside, adding more works to women. Women are working in three different sectors of household, child-rearing, and earning outside. The use of modern energy and technology can make it easier for them to manage comfortably.

Historically, both men and women are considered as sources of empowerment as a representation of *Shakti* – male (power) and *Prakriti* – female (nature) in Hindu philosophy, particularly in global South. Similarly, the equality concept can be acknowledged through the example of *Ardhanareshowr* in Hindu doctrine. However, the concept is rarely translated into energy-related decisions in the household and policy level. The Nepalese society is driven by patriarchy that is reflected in women’s decision power. Even after the three decades of Rio summit and Beijing conference of gender advocacy have accomplished, still women are hardly seen in an equal position on energy sector.

Half of the population are women in Kathmandu [14], and they are still lagging in exercising their rights in the energy decision-making sector. A gap of unequal voices on energy needs [15] and low participation in energy decisions may hinder the SDGs' goal achievement. Gender has been aligned concern for sustainability; particularly, social sustainability demands gender equality in every activity [19, 20]. Keeping the gender lens in the energy policy can make it easier to achieve a sustainable development goal of 5 and 7. Gender integration in energy consumption plays an essential role in the sustainability path. However, it has not been adequately studied. The gender lens's importance on economic, environmental, and social aspects of energy use has been less studied in the Kathmandu context, and this paper explores the scenario.

2. Materials And Methods

This study is a cross-sectional, descriptive, and explorative study. The research can be categorized into three stages. The first stage: identifying energy use in the households and obtain informed consent from

them; the second stage: detailed questionnaire surveys were done and identified different households for interviews and test of household kitchens in three different stratum location; the third stage: comparative and evaluation of sustainability level were done in terms of energy consumption and environmental aspects in a gender perspective. The random stratified sampling survey of 623 households was accomplished in 60 neighborhoods for diverse respondents above 18 years, and air quality tests in the kitchen were done in six distinct households and fifteen for extended interviews. The query was raised mainly in three sections of the energy sustainability sector. The economic variables include energy-related appliances used in households, solar energy, and the relation between the householders' energy share and income. The social variables include gender participation in social events of local and neighborhood levels. Decision variables included purchasing decisions related to household basics, electrical appliances, and cooking fuel. The environmental variables include kitchen environment data: number of windows, exhaust fan, chimney air quality measurement, and comfort. The air quality test was done using Onset's HOBO MX1102 CO_2 sensor in the cooking areas. It has a recording range: 0 to 5000 ppm and accuracy: ±50 ppm ±5% on a non-condensing environment. The 18 indicators were recognized from literature and contextual study: five in economic, twelve in social, and eight in environmental sustainability and explored in the three study layers.

Selection of study area: Kathmandu city is the capital of Nepal—the world's 96th largest country by area. The study areas were identified in inner, middle, and outer-city as three layers based on Kathmandu's urbanization and different socio-economic contexts for household surveys. The inner-city is mentioned as city layer 1, which history dates to 2000 years old, the primary domain of an indigenous group of Newar. The middle-city as city layer-2 that urbanized from the 1980s to 2000s; inhabitants are migrated from the nearby cities and moved from the inner-city. The outer-city, as city layer 3—highly urbanized from the 2000s to the present, and the primary domain of migrants from rural and nearby urban areas, contained mixed ethnicities [17].

Statistical Analysis

The gathered data were analyzed using SPSS Software, and the qualitative analysis of interviews and observation was analyzed from ATLAS.ti software. The discussion and interpretation were obtained in a neutral voice relating literature. The correlation and cross-tabulation of those variables were employed in SPSS to identify the percentage of sustainability indicators in three study areas. The results identified in percentage and counts were converted into a ten-point scale to obtain a sustainable level. The correlational value showed that electrical appliances use positively correlated to income standard ($r=.48$, $P<0.01$).

3. Results

3.1. Economic Context and Energy Consumption

In this section, the economic condition was studied in terms of heating and cooling appliance, solar energy uses, and household income share.

3.1.1. Electrical heating and cooling appliances in the income group

The heating system's data in different expenditure groups demonstrated that the highest use of a heating system of electric and gas heater was found in the high-income group of outer-city dwellers by 68%. The lowest use of electric and gas heater was used in a low-income group of inner-city dwellers by 15%, as shown in figure 2. The contrast trend was noticeable in electric/gas heater in the high-income group of inner-city by only 22% that comparatively lower with middle-and outer-city layers (63% and 68%). It might be because the compact settlement pattern in the inner-city resulted in a less cool environment and culture of clothing adjustment.

The data of space cooling appliances showed that it was used extensively in all income groups in three city layers (Fig. 2). The highest percentage of electric fans were used (66%) by middle-income respondents of outer-city. The lowest use of the electric fan was found in the low-income group of outer-city by 12%. The surprising trend of using electric appliances was noticeable, with a poor correlation between using cooling appliances and income ($r = .22$, $p < 0.01$). The high-income group of the inner and outer city used moderately less use of electric fans by 16% and 22%. The reason might be because of the new building design with enough ventilations. The results showed that higher income had more significant use of heating appliances, gas and electric heaters, and less natural ventilation. The result revealed that income and heating appliances have a moderate positive correlation ($r = .48$, $p < 0.01$), the higher the income and high use of appliances.

3.2.1 Solar Energy Uses

Solar energy as a photovoltaic (PV) panel started to use in the last two decades in Kathmandu for lighting and bathing purposes due to the electricity crisis (18 hours' load shedding in a week). The data showed that the higher use of solar panels was by the middle-income group of middle-and outer-city by 3.7% and 3.5% of total respondents (Fig. 3). The male and nuclear family headed almost those households. The least users of solar panels were the low-income group by only 0.5% of total respondents. It was due to higher installation costs that resulted in incredibly less acceptance in urban households.

The data showed that 8% of Newar, 11% of male-headed families, 16% of modern households, and 15% of respondents who lived in their own house used solar energy (Fig.4). It represented that the Newar ethnicity of middle-income dwellers demonstrated renewable energy knowledge and practice, and they have a quality of life in the electricity crisis. It implies that renewable energy as solar is influenced by headship, ethnicity, building types, and ownership variables.

3.1.3. Income and Energy Share in Urban Households

The indicator demonstrated that the affordability of energy uses amplified disparity in the city. Comparing the proportion of income and energy cost share in three city layers, low-income groups of inner and middle-city spent 13% and 14% of their income while the same group of outer-city spent only 11% (Fig 5). The middle-income households spent an energy cost of 6%-7% of their income in three city layers. The high-income group of middle-and outer cities' energy share of total income is lower than other city layers (3%). The reason for it is that a higher percentage of high-income groups dwelled in outer city layers. It implied that the higher the earnings as they can afford higher energy costs but remaining a small amount in their income.

3.2. The Social Context of Energy Consumption

In this section, social sustainability indicators elaborate on a contextual way of life, customs, values, aspirations, knowledge-perception, and men and women's participation in energy decisions. The twelve different individual indicators are analyzed under four categorized social indicators.

3.2.1. Gender Participation in Social Activities

The participation of men and women in different social activities varied in different ethnicities. The result showed that 42% of females from Brahmin/Chhetri, 33% of females from other unidentified ethnicities, were involved in social activities compared to males of the same group (Fig 6). In contrast, 51% of males from Newars and 27% of males from Rai/Limbu/Tamang had higher participation than females of the same group in the social events.

The results of a higher percentage of Brahmin/Chhetri women in social activities demonstrated a broader social opportunity. Simultaneously, the observation findings showed that the venue of the social activities was changed. For instance, historically, all the festivals and gatherings occurred within the home, but later, the event venues were taken place to restaurants and party palaces. The results showed that the food vendors had gained commercial market due to the celebration venue's shift from home to restaurants. Besides, cleaner energy, for instance, LPG and electric cooking in households, reduced women's drudgery.

3.2.2 The Tendency of Shifting Technology and Adaption

The trend of shifting towards cleaner fuel with new technology could resolve the fuel crisis. Respondents were asked about their interests in changing new technology for the cooking system if energy cost was reduced compared to the existing one. A higher percentage (50%) of inner-city (middle-city - 41%, outer city - 44%) respondents were eager to shift to the electric cooking system. In contrast, a quarter of respondents were confused and reluctant to use it due to various reasons. It underlined majorly two significant reasons. Firstly, a lack of information about the electric cooking system could not increase interest in dwellers, and secondly, dwellers could not afford extra utensils needed for the new cooking system. For instance, 86% of inner-city respondents showed unawareness, and 88% of middle-city respondents expressed unreliability and unaffordability on the technology due to the extra cost of specific utensils.

50% of respondents had a fear of frequent power shortage in the city as unwillingness. However, electricity has been a continuous supply in the city since 2017 (Fig. 7).

Observations and interviews showed that an induction stove available on the market had a single burner that made it challenging to cook varieties of food in a short time. The result implied that respondents had a low willingness to shift towards electric cooking due to fear of affordability, accessibility, proper information gap, and design issues and remained to use LPG as cooking fuel.

3.2.3. Knowledge and Perception

The knowledge of clean energy use and efficiency practice has a significant role in achieving social sustainability. The rainwater harvesting trend was higher in the Newar group (13%), inner-city dwellers (8%), headed family (12%), modern houses (17%) living in their own house (16%) (Fig.8). The lowest rainwater harvesting was found in rental dwellers (5%), traditional houses (2%), and other unidentified ethnicities. The reason for it might be that unidentified people were migrants living in rental spaces, did not have built a rainwater collection system in the building, and lived in a single room without a terrace. It showed that knowledge and practice on rainwater uses were higher, particularly in Newar ethnicity, male-headed families, nuclear family composition, and self-owned dwellers. It revealed that residency type, headship, and building design construction method influenced the rainwater harvesting trend and behavior.

3.2.4 Participation in energy decisions

In the participation of minor household decisions, joint decisions scored a higher percentage in inner-and middle-city by 41% and 44%, respectively. At the same time, female decisions were increased by 44% in middle-city households. The increased number of females in household decisions as jointly and singly implied that increasing participation and leading quality in decisions increased. The electrical appliances and cooking purchase decisions were increased in three city layers by 47% to 67% and 38% to 43% (Fig. 9). The result showed that urban households had a trend of joint decisions in most of the household decisions.

3.3. Environment context for energy consumption in the urban household

The environment context of urban households is described as the kitchen environment in terms of ventilation, electric kitchen hoods to reveal the air quality of space. The study showed that higher energy consumption occurred in the household for cooking activities. Thus, the kitchen was taken as a significant study place in the household in this paper.

3.3.1. Use of electric kitchen hoods and ventilation

The use of exhaust fans and chimneys were higher in modern buildings compared to traditional and mixed buildings. The data showed that 23% of modern buildings contained exhaust fans, and 22% consisted of chimneys, while the traditional building contained exhaust fans only by 0.3% of chimneys by 0.16%. Mixed buildings contained 2% exhaust fans and 1% chimneys (Fig. 10). It showed that the electric kitchen hoods used to evacuate cooking smoke were higher in modern buildings than traditional ones. The observation indicated that most new buildings consisted of kitchen hoods and ventilation for a healthy indoor environment.

The inner-city respondents used exhaust fans by 5% and chimneys by 4%, respectively. The middle-city respondents used exhaust fans by 10% and chimneys by 11%, respectively. Similarly, outer-city respondents placed exhaust fans and chimneys by 10% and 11%, respectively. Overall, the use of exhaust fans and chimneys in the kitchen was higher in the owned household by 20% and 21% compared to rental households' kitchens. Besides, natural ventilation is indispensable in cooking space for comfort and hygiene. The results showed that urban kitchens without windows were found by 37%, in inner-city, and having a single-window by 71%.

3.3.2 Kitchen environment

WHO standards and American Society of Conditioning Engineers (ASHRAE) has provided ventilation standards to maintain a level of CO_2 and suggested to have windows open for fresh air flow and healthy air quality. Carbon dioxide level has potential health issues when it will be above 1000 ppm (Fisk et al., 2013) and impact human decision level.

The cooking culture and ventilation positions impact on air quality of the kitchen. The households D13, D12, D3, D2, D8, and D6, had maximum air quality in terms of CO_2 level above 1000 ppm, and the highest was 3683 ppm in D12; the average level was 603 ppm as shown in table 1 and figure 11. However, this household had an average (2-3) cooking items but showed a high CO_2 level. It might be because of the cooking area's improper ventilation position, lacking kitchen hood, and exhaust fan. In comparison, the D6 household demonstrated a maximum of 1782 ppm and an average of 591 ppm (Fig. 12). The lower value of CO_2 resulted from cross ventilation of two windows and a modern chimney. Similarly, the D2 household consisted of an exhaust fan and proper ventilation and an average CO_2 of 600 ppm.

The results demonstrated that cooking culture might impact increasing CO_2, but the kitchen's air quality can be improved, placing modern chimneys and ventilation room design. It was found that the kitchen's air quality was low with high CO_2 in the windowless cooking area and lacking kitchen hoods. Women stated that eye irritation and mild respiration problems during cooking, but they considered it as usual. It showed that not only women, remaining family members, were less aware of the kitchen's air quality standards.

Table 1. Detailed data of air quality tested households

Households	Area	Family members	Samples	Date	Temperature	Relative humidity	Air quality - CO2
D12	18 sq.m.	3	1428	1/31/19 to 02/15/2019	Temp.- 10 °C- 23°C	70%	Min.-367 ppm Max-3683 ppm Avg. -603 ppm St.dev. -241
D13	6 sq.m.	1	2344	02/15/19 to 02/23/19	Temp.- 13 C-18C, Avg. 14 C	77%	Min. 291 ppm, Max. 2239 ppm, Avg. 703 ppm St. Dev. 480
D8	22 sq.m.	3	2330	02/24/19 to 03/04/19	Temp.- 15°C- 20°C, Avg. 17°C	60%	Min. 343 ppm, Max. 2521 ppm, Avg. 519ppm St. Dev. 314
D3	9 sq.m.	4	2890	4/10/2019 to 04/20/2019	Temp. Avg. 25°C	59%	Min. 340 ppm, Max. 2266 ppm, Avg. 623ppm St. Dev. 341
D2	34 Sq.m.	5	7510	12/07/19 to 01/02/20	Temp. Avg. 13°C	68%	Min. 331 ppm, Max. 1981 ppm, Avg. 647 ppm St. Dev. 363
D6	31 sq.m.	5	4583	01/10/20 to 01/25/20	Temp. -11°C, 9°C-16°C	75%	Min.202 ppm, Max. 1782 ppm, Avg. 591

	ppm St. Dev. 379

3.4 Sustainability level

In comparing three study city-layers, it was found that electric fan use was higher in the inner-city. The use of an electric heater, vacuum cleaner, and solar use was higher in the middle-city. The results showed that middle-city used higher energy use. The middle-and outer-city started the use of solar energy, and it had assisted in achieving SD value of 56 (Annex A5 & A6). Similarly, inner-city was prevalent in cultural activities and fuel stacking nature keeping extra cylinders. The female participation in EAP is higher compared to middle-and outer city layers.

In contrast, joint participation in EAP and clean cooking were higher in the middle-city layer than in the rest areas. Meanwhile, the awareness and knowledge of rainwater harvesting and female participation in CFP were higher in the outer city. It resulted in the middle-and outer city having gained social sustainability values of 56, and the inner-city achieved 48 (Annex A5 & A6).

It was evident that the cooking culture influences the air quality of the kitchen. The ventilated kitchen, use of exhaust fans/chimneys were larger in the middle-city. While comfort feeling during cooking and clean energy use were expressed in higher among outer-city dwellers, however, the presence of windowless kitchen at the same time. The sustainability values showed that the outer-and middle-city households received the same SD of 70 by, and inner-city achieved 50 points (Annex A5 & A6). The low SD score of the inner-city was due to high cooking culture and a lack of ventilation and kitchen hoods. The overall score of economic, environmental, and social aspects of inner-city epitomize low energy sustainability (49 points), outer-city (58) on average, and middle-city (61) has ranked higher among three. This study shows that the city's overall energy sustainability from a gender perspective acquire 56 points combining three aspects.

4. Discussion

As asserted by Gatersleben [21], Masera et al. [18], Bisu et al. [22], and Muller & Yan [23], multiple fuel use does not always ensure awareness about energy-saving compelled to use mixed fuels and resulted in the fuel stacking model in three city layers. It created a social gap between rich and poor within the same neighborhood due to the corrupted market. Consistency with Barr [4], Gatersleben [21], and Lutzenhiser [24], social sustainability is strongly based on culture and practice. In urban Kathmandu, electric appliances had been increasing extensively, particularly in the middle- and higher-income groups, for instance, electric heater and fans, but it was used consciously for limited hours. The natural ventilation and wearing clothes in layers were practiced as an adaptation model in Kathmandu for extreme weather. It had demonstrated that culture and belief still entrenched in Kathmandu urban dwellers in energy use and saving practice.

Aligned with Davis [25], Gatersleben & Vlek [26], Levett [27], and Nasir et al. [28], ownership demonstrated a significant role in energy uses and saving behaviors. The results showed that joint decisions were higher in all categories except in female-headed families. Female-headed and low expenditure households had higher involvement of females in energy purchase decisions. It revealed that when the women had financial power in hand, they could decide what they wanted for the home.

In contrast to Mills & Schleich [29] and Rosenthal et al. [30], clean technologies as solar energy could not establish a remarkable energy-saving behavior in Kathmandu. It had facilitated the achievement of a quality of life in fewer households. The electricity crisis had edified about solar energy knowledge and practiced in fewer households for lighting and bathing purposes. However, the inhabitants were found less eager to continue it. Rental and low-income respondents could not afford it because of the higher cost and inaccessibility to the sunspaces.

Clancy et al.[1], Habtezion [2], Oberhauser [6], and Gatersleben [21] claim that modern energy services with electric appliances have improved women's socio-economic status by reducing the time and effort involved in households' chore, and this is also the case in Kathmandu. The increasing use of electric appliances was reinforced to reduce urban drudgery and enhance new kitchen culinary recipes in a limited time. Besides, men also started to help with kitchen chores. Besides, environmentally, kitchen design and culture had been improved due to electric kitchen hoods for air quality. In contrast, the air quality results showed the inner-city kitchen environment, especially in the rental spaces lacking ventilation, exhaust fans, and chimneys. Simultaneously, few studies showed that poor air quality of the rooms or increased CO_2 concentrations adversely impacts decision making performance. Fisk et al.'s [19] study showed that people who stayed below 600 ppm have higher decision-making capacities. People living with less ventilation demonstrated health problems frequently.

Sustainable development 2019 report showed that Nepal was ranked in 103 positions with 68 SD scores [31]. In comparison, this study of Kathmandu city obtained 56 scores. This difference in scores might be because this analysis had combined only 5 and 7 SDGs goals in the integration approach rather than an individual. Besides, energy accessibility and gender equality are still challenging for both the city and national context. Most researchers [17, 45] and government data showed that Nepalese households used electricity, only 50 MJ/household/monthly or 90-100 kWh that is relatively lower than in developing and developed countries. It is worthy of using less energy. However, social sustainability suggested that it is equally critical of a certain standard of quality of life, as discussed by Gatersleben and Vlek [26], Carrera and Mack [34], and Santoyo-Castelazo and Azapagic [35]. It is essential to balance quality of life using energy-efficient appliances in the households holding habitual saving behavior. It implies improving overall comfort to women, and they can participate in economic development.

Economic sustainability showed that high income spent more than low-income groups, but shares were low due to high-income affordability power. These conditions are perceived in most developing and in-lined with a research by Harris [36], Santoyo-Castelazo and Azapagic [35], and Van der Kroon et al. [20]. It increased a disparity in society when there was no subsidy for low-income that continues a vicious cycle

creating a gap of energy share. The use of appliances in all city layers is low. However, it has been increasing rather than in the last decades, but women are still lower status in the technical knowledge.

5. Conclusion

This study shows a positive relation of economic sustainability to energy use representing a correlation (r=.48) between energy consumption and income. The lower-income group uses a larger share of their monthly income for household energy needs with unclean cooking with a less healthy kitchen lacking a chimney, exhaust fan, and ventilation. Social indicators elaborate that Kathmandu dwellers have a low willingness to shift towards electric cooking due to fear of affordability, information gap, and design that resulted in continued LPG use increasing national dependency. Female participation has been increasing in the form of joint decisions on energy decisions. However, females are still less vocalized in technology-related decisions. Environmental indicators demonstrate that females of lower-income groups suffer from unhealthy cooking space due to unawareness and unaffordability for the electric kitchen hoods. The maximum CO_2 value goes up to 3683 ppm and an average of 703 ppm. It resembles that kitchen air quality can be improved using kitchen hoods and a proper ventilated design. The study shows that the inner-city has lower (49 scores) energy sustainability, and the middle-city achieves higher among the other areas (61 scores), with an overall score of Kathmandu is 56 only. It suggests that women should be encouraged to participate in the technology movement, and proper information dissemination for integrated energy policy to reduce gender inequality, maximizing clean energy for a better quality of life. Conclusively, gender and energy have a broader impact on sustainability that current research has shown so far, and it should be further investigated in different related variables.

Declarations

Competing interest

The authors declare that they have no competing interests.

Authors contributions

BS contributed to manuscript writing. SRT, SBB, and MMK had contributed ideas and reviewing the manuscript. All authors read and approved the final draft of the manuscript.

Acknowledgements

The authors would like to thankful to Energy for Sustainable Social Development Program, Institute of Engineering, Tribhuvan University. At last, the authors would like to appreciate for the publication team, reviewers, and residents of Kathmandu.

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Figures

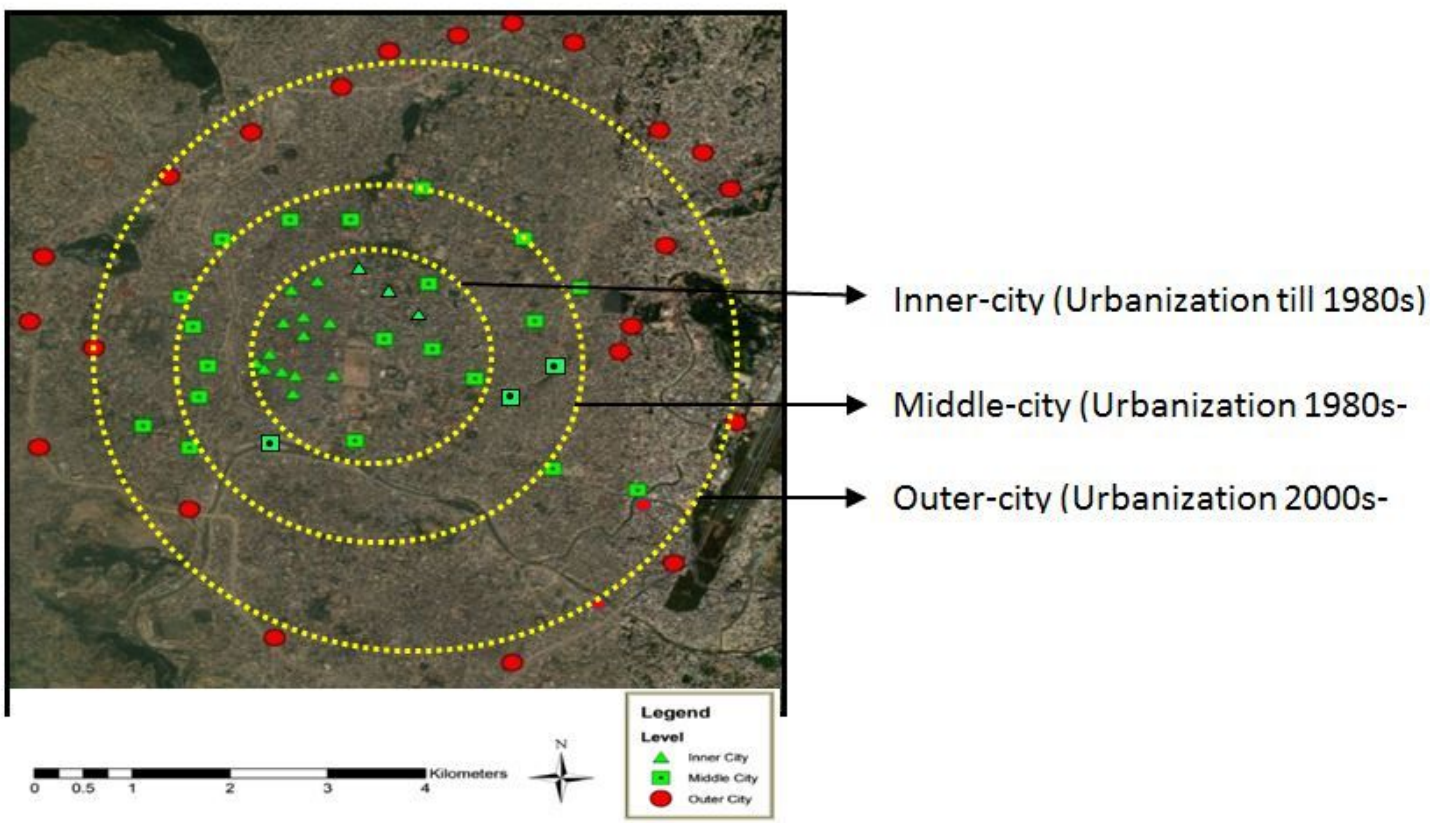

Figure 1

Selection of neighborhoods in three city layers

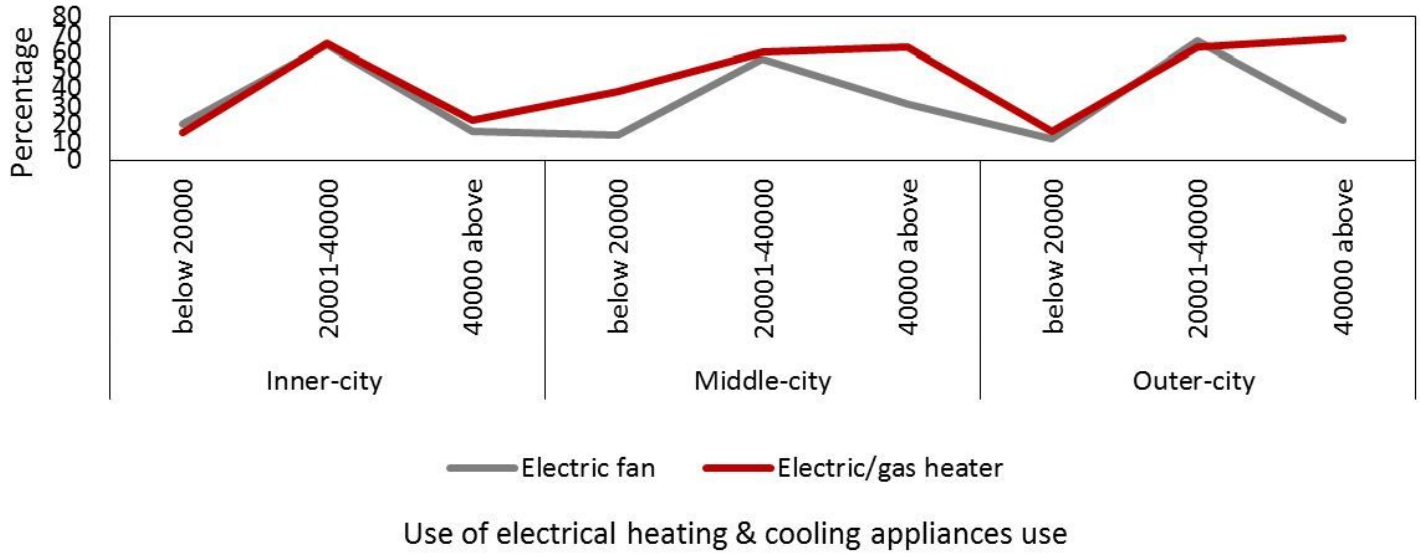

Figure 2

The relation between Heating Appliances and income

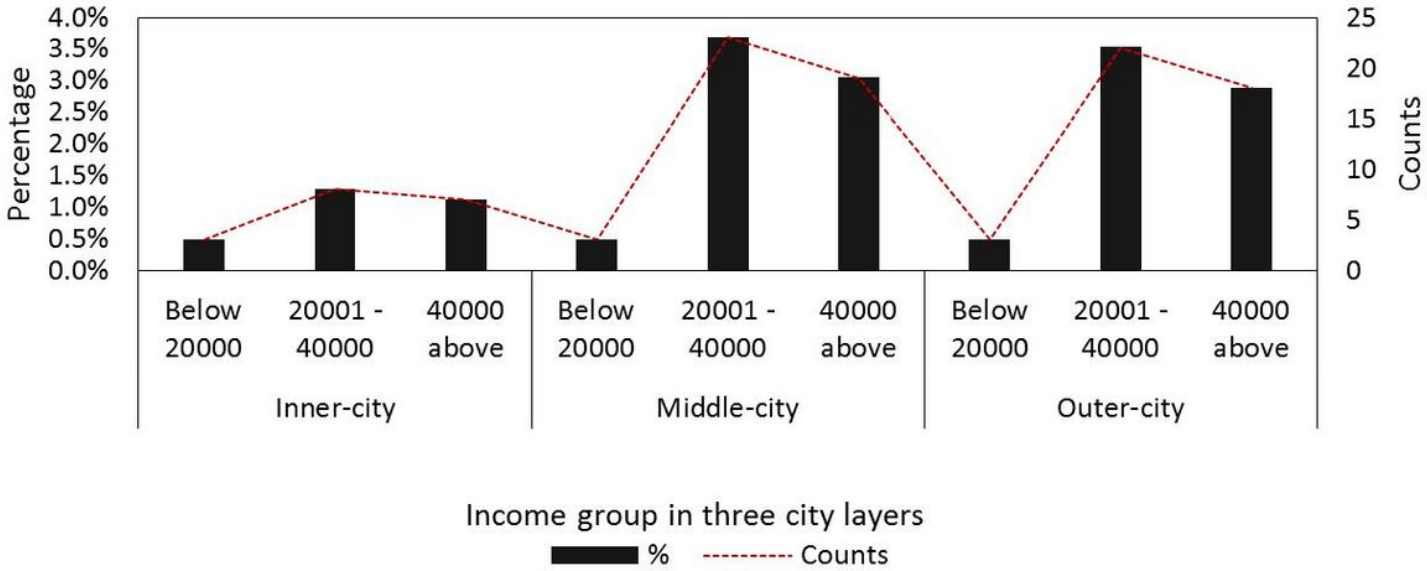

Figure 3

Use of solar use in different income groups

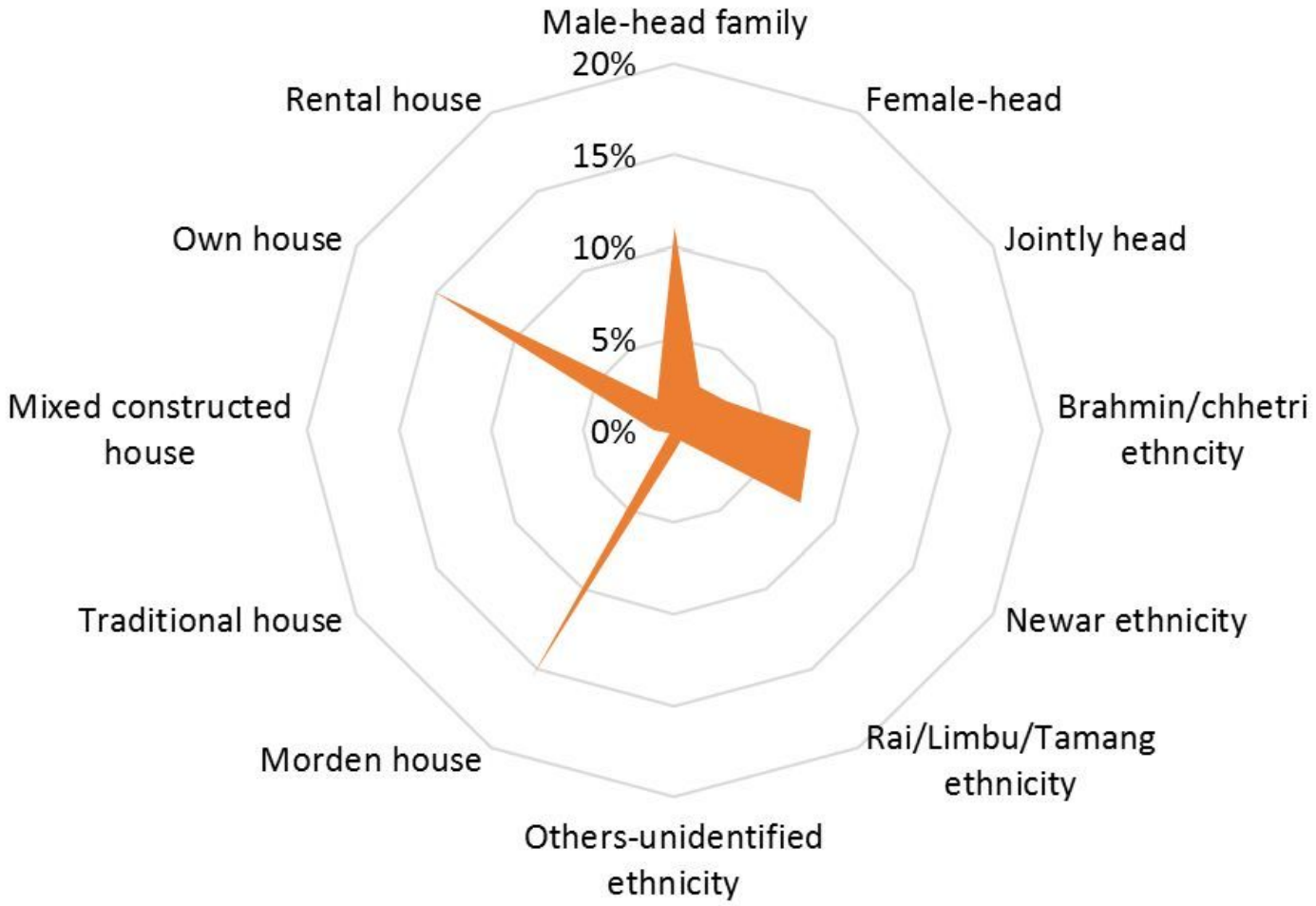

Figure 4

Solar energy uses in different variables

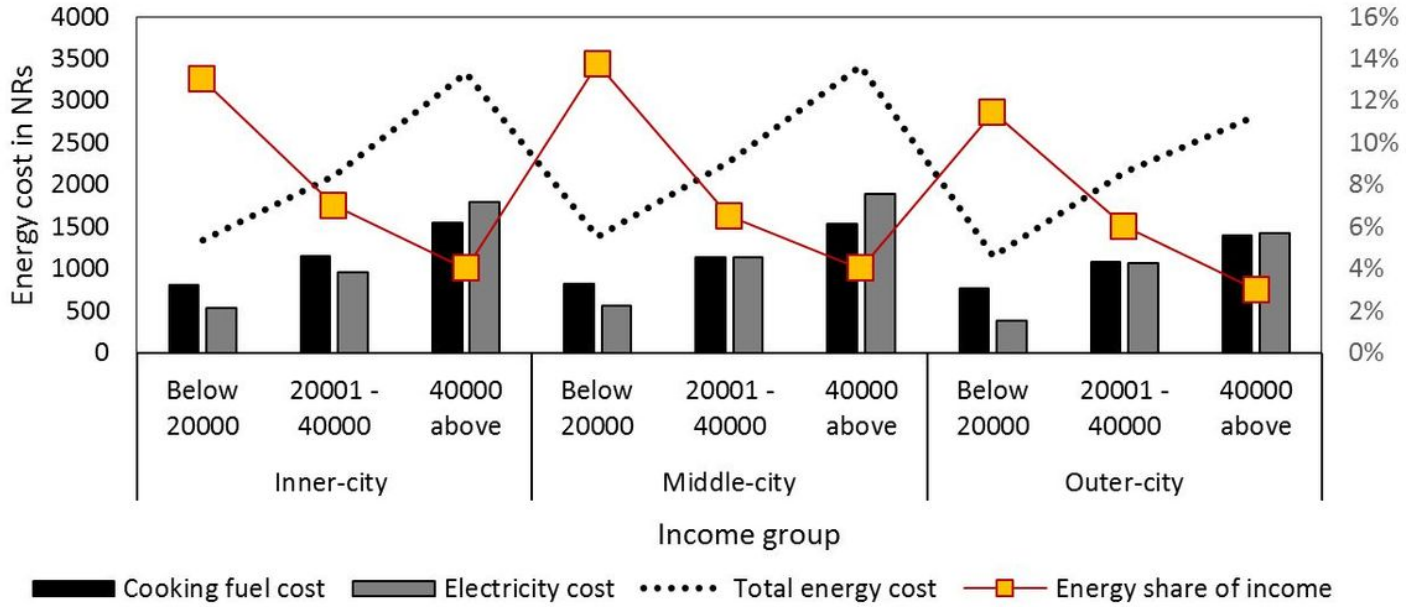

Figure 5

The proportion of income and energy share in three city layers

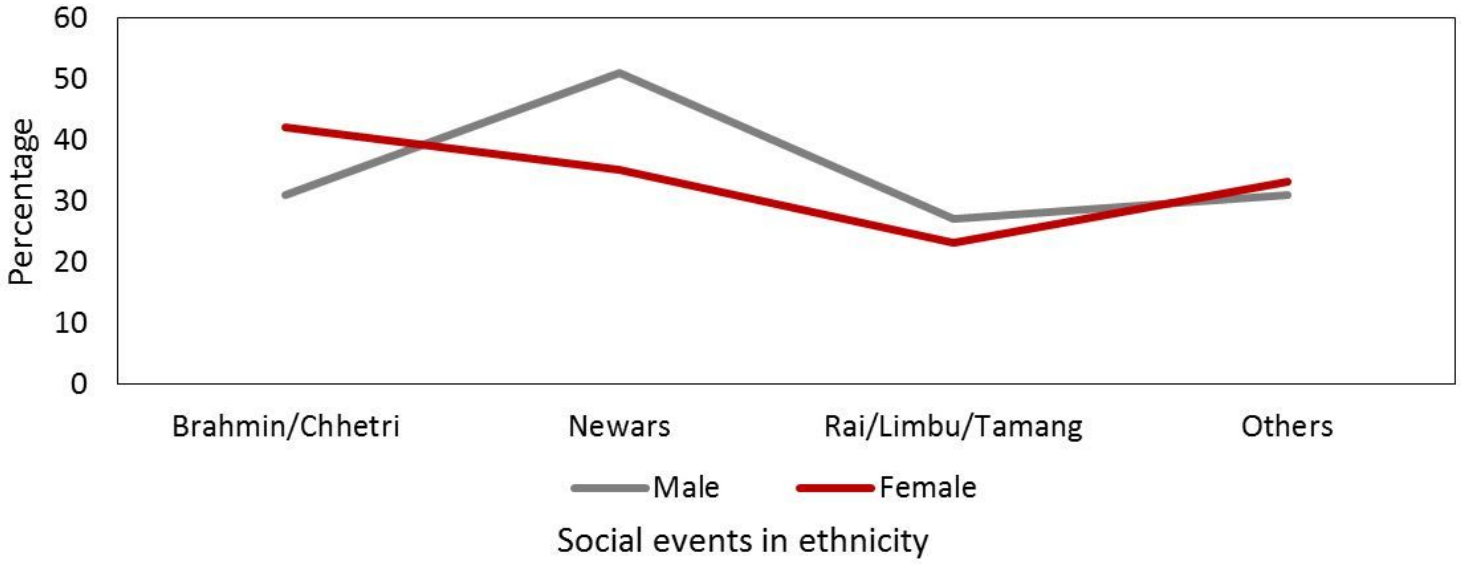

Figure 6

Gender Participation in Social Activities and Events in Different Ethnicities

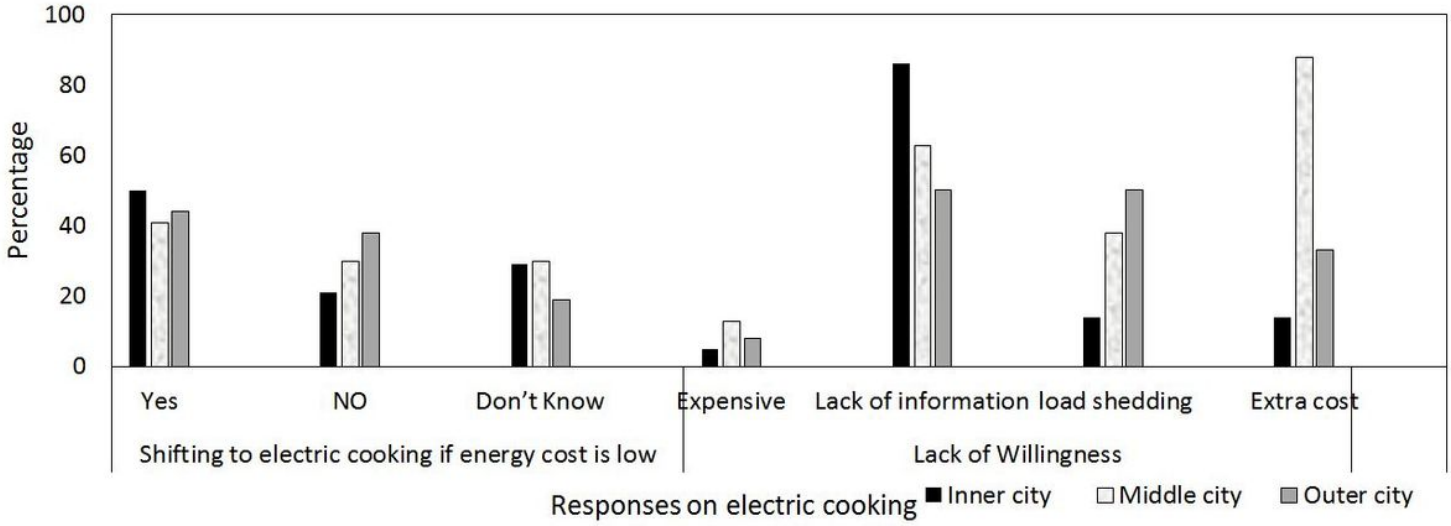

Figure 7

Respondents views on the electric cooking system

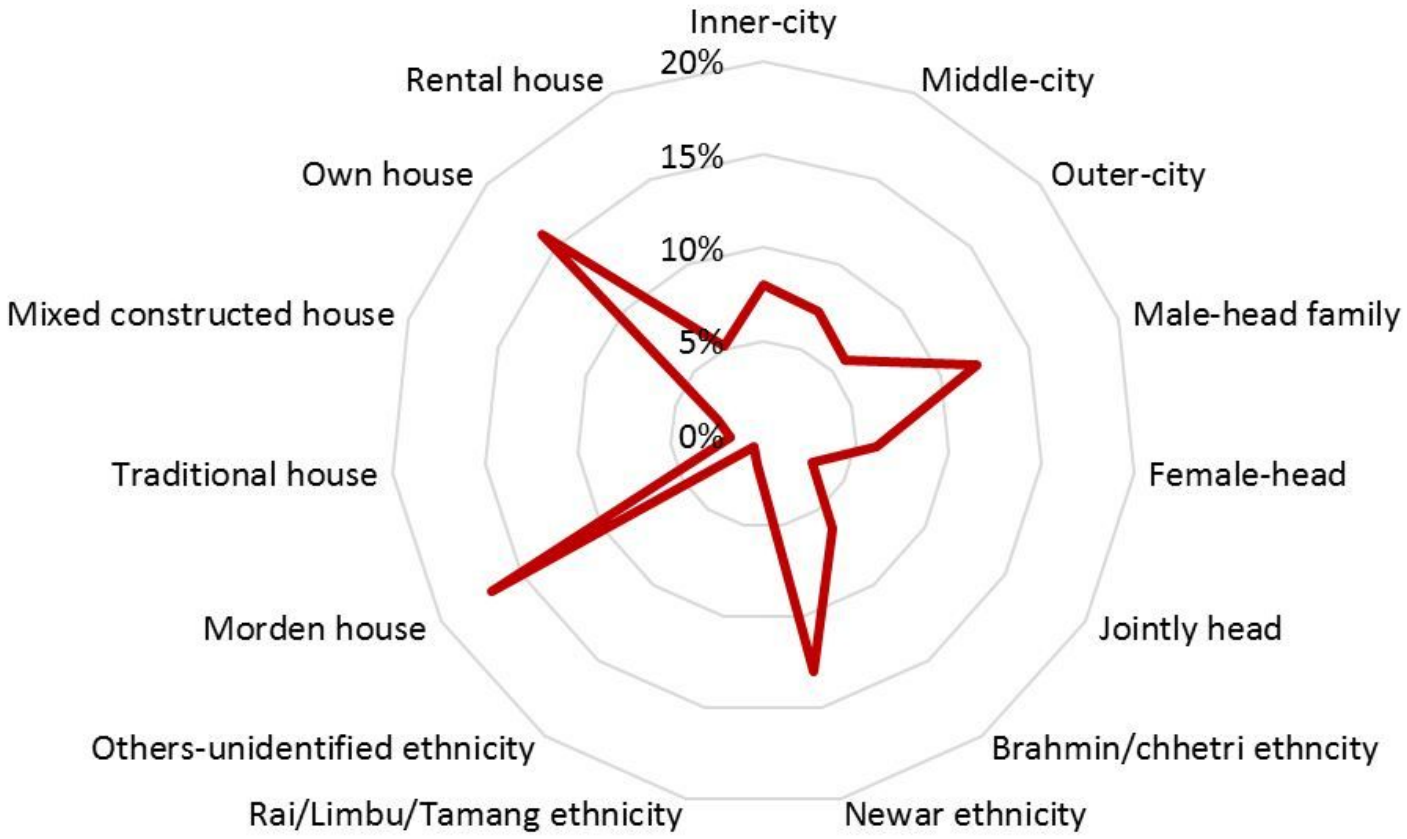

Figure 8

Rainwater harvesting in different variables

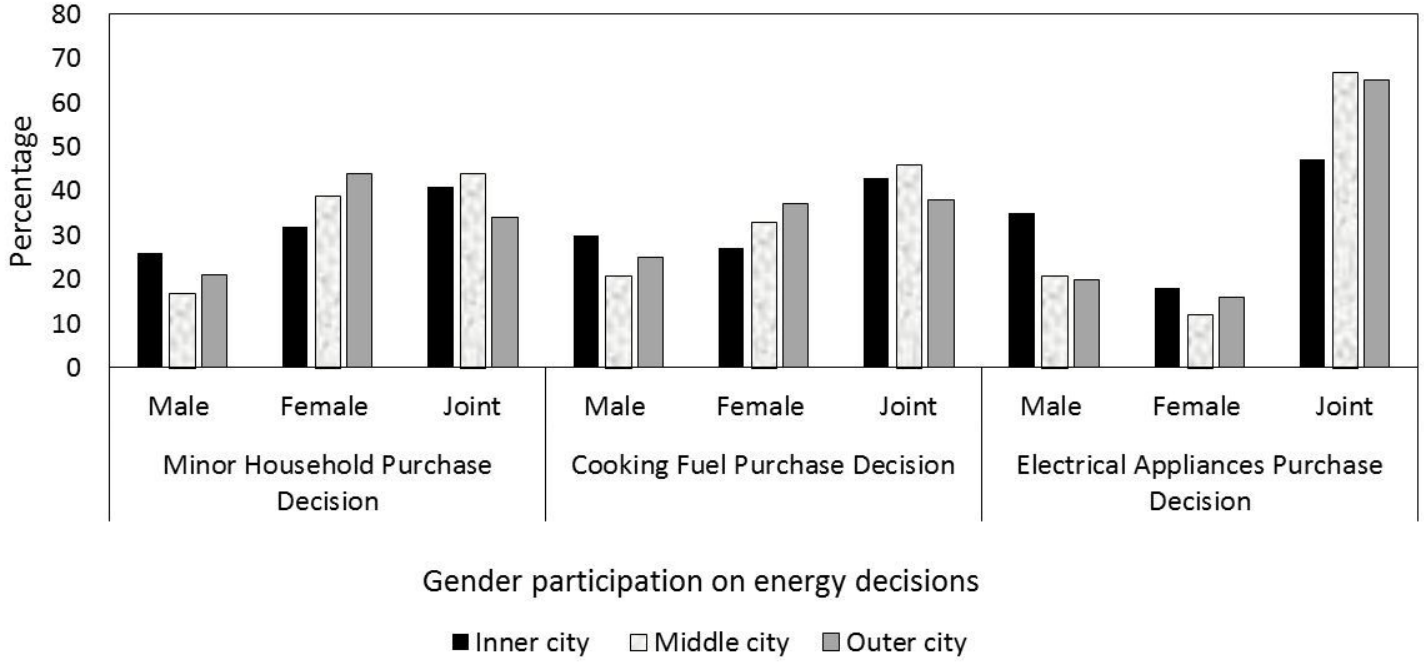

Figure 9

Decision participation in cooking fuel purchase – influences of various variables

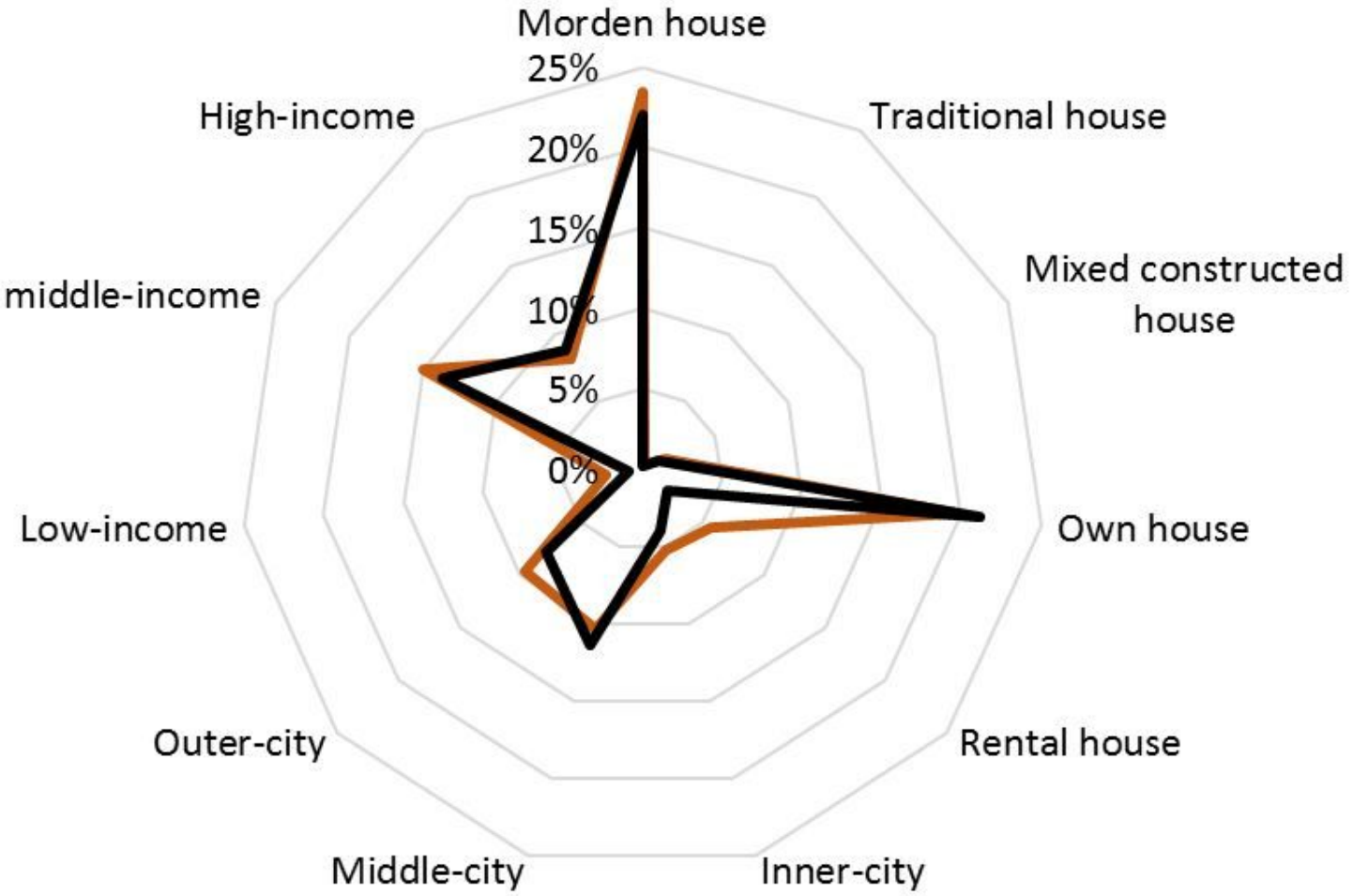

Figure 10

Use of exhaust fans and chimney in various building type

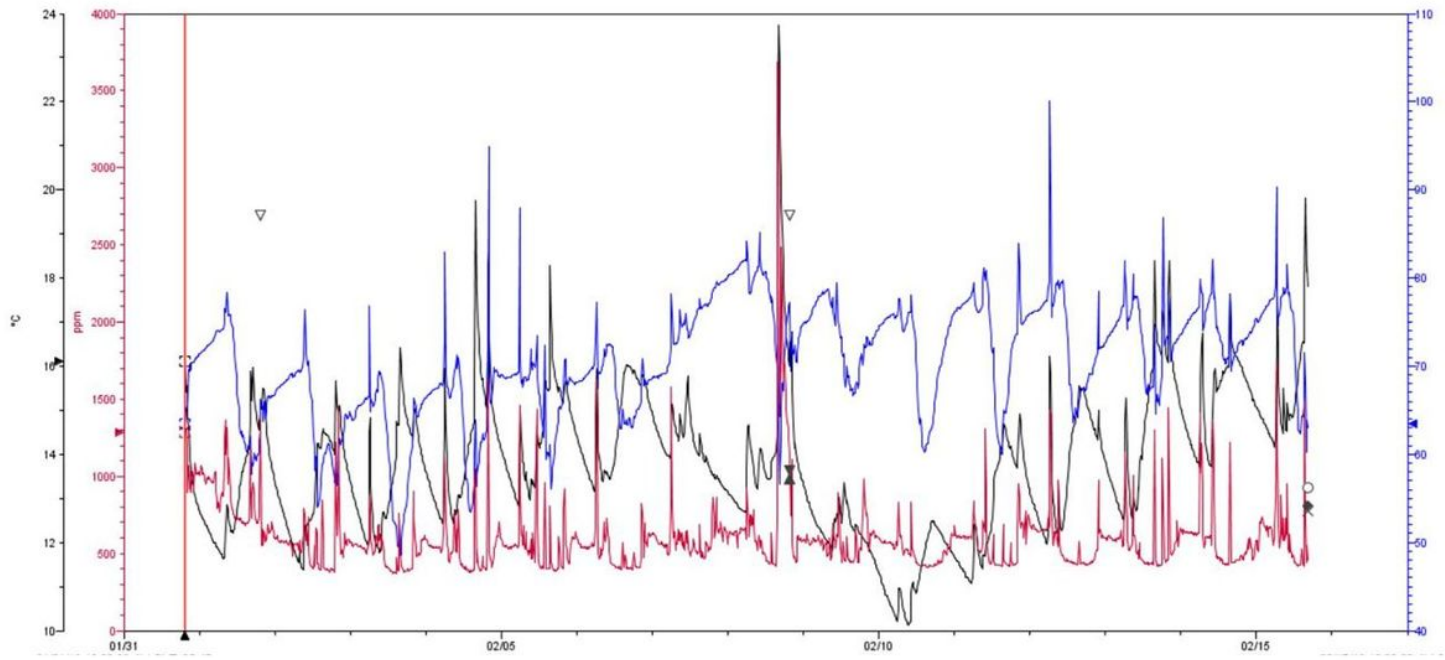

Figure 11

Indoor air quality in the kitchen of Env1, D12, inner-city

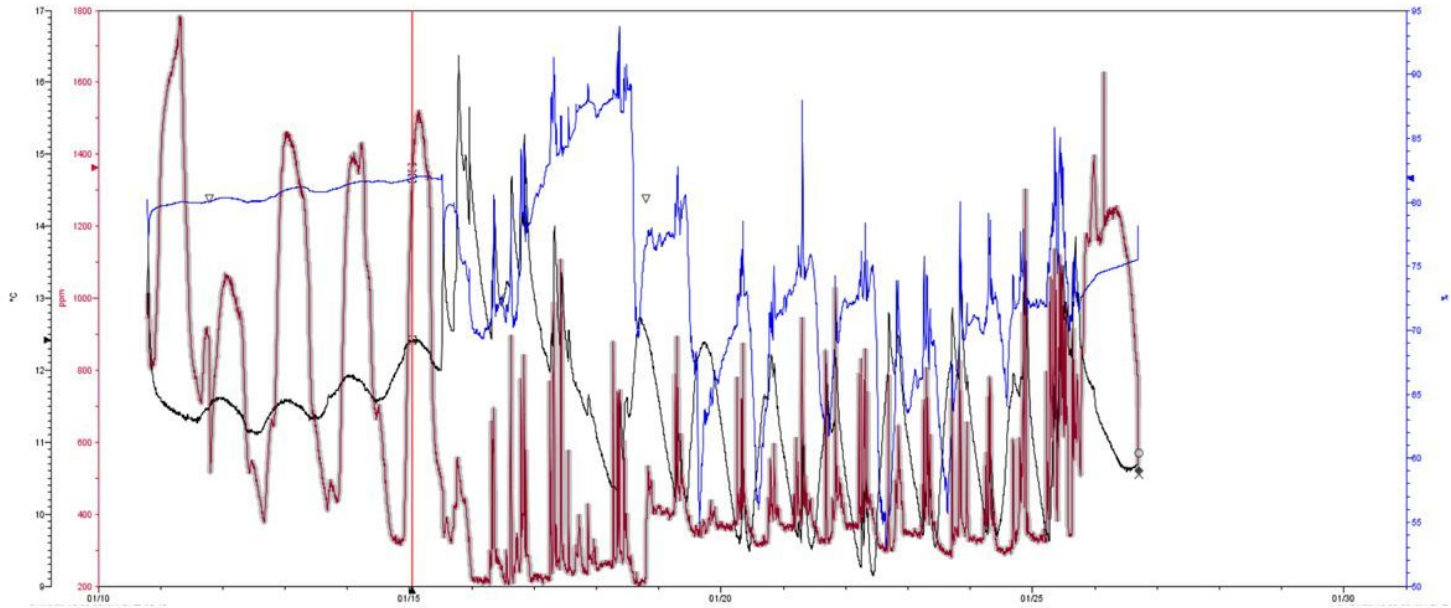

Figure 12

Indoor air quality in the kitchen of D6, Middle-City

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- Annex.docx