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Shedding Light on Women's Reproductive Health

Exploring the Interplay between Energy Access, Sexual and Reproductive Health and Rights and Gender in the Global South

TESSA NABER

2024

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Abstract

This paper aims to provide a comprehensive analysis of the intricate relationship between energy access, sexual and reproductive health and rights (SRHR) and gender. It delves into the multifaceted ways in which limited access to modern energy sources intersects with gender disparities and impacts SRHR outcomes, particularly for women. Firstly, this paper will address the intersection of gender with both energy access and SRHR. It highlights the gendered dimensions of energy access, emphasizing how women often bear the disproportionate burden of energy poverty and the gendered dimensions of SRHR, advocating for a gender-transformative approach. Secondly, this paper explores the existing literature on the effects of energy poverty on women's SRHR, identified in household energy use and energy access for public services. Lastly, this paper identifies some key research and policy gaps and proposes some recommendations for further research. It advocates for integrated approaches, prioritizing the intersectionality of energy access, SRHR, and gender in sustainable development initiatives. Overall, this paper seeks to contribute to a deeper understanding of the complex interplay between energy access, SRHR and gender to provide insights for policymakers, practitioners and researchers.

Keywords: Energy access, SRHR, Gender, Energy poverty, Health

1. Introduction

Energy access, gender equality and health and well-being, including sexual and reproductive health and rights (SRHR), are brought into sharper focus by designating them as distinct Sustainable Development Goals (SDGs). These goals, outlined in the United Nations Sustainable Development Agenda, aim to end poverty, promote well-being and safeguard ecological systems of the planet by 2030 (Habtezion, 2016). However, the likelihood of achieving the goals outlined in this Agenda is uncertain due to ongoing implementation challenges (Bennich et al., 2023). One strategy for decision-makers to advance this process is to identify interventions that exploit synergies among the SDGs, thereby driving progress on multiple individual goals (Bennich et al., 2023).

By emphasizing the interconnected domains of SDG 3 (good health and well-being), SDG 5, (gender equality), and SDG 7 (affordable and clean energy), it becomes evident to acknowledge the necessity of improving one goal for advancing the others. Access to modern and sustainable energy is not merely a matter of convenience or economic development; it is now closely tied to fundamental aspects of human health and well-being, with SRHR being a key component (Habtezion, 2016). However, despite the recognition of these intersections and the need for leveraging synergies between them, there is a substantial gap in understanding the nuanced dynamics at play and in developing targeted interventions to address these.

This gap is evident in the ongoing reality of energy poverty. Basic services such as electricity for lightning and cleaner cooking technologies are still a luxury for many rural women and men. In developing countries, one out of every five individuals lacks access to electricity and about one billion people globally lack access to electricity in healthcare facilities (High-Level Coalition on Health and Energy, 2021). This exacerbates health disparities and compromises essential services, particularly affecting women's sexual and reproductive health. Moreover, approximately three billion people worldwide are daily exposed to high levels of health-damaging pollutants due to reliance on biomass for cooking due to a lack of access to clean fuels and technologies for cooking, contributing to adverse reproductive health outcomes due to pregnancy complications (High-Level Coalition on Health and Energy, 2021; International Energy Agency (IEA) & World Bank, 2015). Women, especially in the Global South, bear the primary responsibility for household cooking activities, facing unique and severe challenges due to energy poverty (Clancy et al., 2020).

Recognizing the gendered dimensions of energy access helps to analyze its impact on women's SRHR and underscores thereby the urgency of addressing these issues. However, significant research and policy gaps remain in understanding how energy access intersects with gender equality and SRHR. Addressing these gaps is crucial for further research for developing targeted interventions to improve outcomes for women in the Global South.

Therefore, this paper seeks to explore the research question: **‘How does the intersection of energy access and gender influences women’s sexual and reproductive health and rights (SRHR), focusing on the Global South’’.** In order to answer this research question, a thematic qualitative content analysis will be carried out of the available literature and research done on this topic, including academic studies and policy reports from NGOs and international organizations. The scope lies on the intersection of gender, energy poverty and SRHR, with a noticeable geographical focus on the Global South. If relevant, global observations in the Global North are mentioned.

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2. The Intersection of Energy Access, SRHR and Gender

Energy access, gender equality and sexual and reproductive health and rights (SRHR) are critical components of sustainable development and the SDGs. These elements intersect in ways that significantly impact the well-being of women and girls. Understanding these elements and how they are mutually reinforcing can inform more effective policies and programs that advance gender equality and health outcomes, as a global commitment pushing for national implementation and local action. However, in order to be able to understand this mutual reinforcement and implement this in policy, each of the concepts needs to be defined and explained in relation to the other.

2.1 Energy Access and Gender

Access to reliable and affordable energy is essential for improving living standards and economic growth. Energy and electricity can drive economic and social development by increasing productivity, enabling new types of job-creating enterprises and reducing household workloads and thus freeing up time for paid work (Pueyo & Maestre, 2019). There is no single internationally-agreed definition of energy access, but significant agreements exist throughout different definitions (IEA, 2020). Figure 1 demonstrates the elements of energy access; household access to a minimum level of electricity, household access to safer and more sustainable cooking and heating fuels/stoves, access to modern energy that enables productive economic activity and access to modern energy for public services (IEA, 2020).

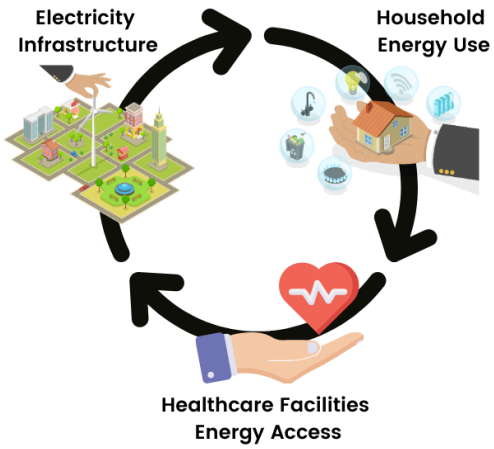

Figure 1 - Elements of Energy Access

In this paper, two elements of energy access are applied to address the intersection of energy access and SRHR. The first one is household energy access, which is a combination of access to a minimum level of electricity together with access to an energy source with minimum harmful effects on health. This type of energy is specifically focused on energy available in the household, needed for reliable and affordable access to both clean cooking facilities and to electricity (IEA, 2020). The second element is energy access for public services. This includes both energy access for healthcare facilities and energy access for street lighting. The focus of energy access for healthcare facilities ranges from lighting and communications to clean water supply. Reliable power is also needed for medical equipment necessary to safely manage childbirth or ensure immunization (WHO, 2023). Energy access for street lighting will be addressed considering safety issues in public spaces.

Within the energy transition, there are three roles identified for women as agents of change; the role as consumer, producer and decision-maker (Clancy et al., 2020; Della Valle & Czako, 2022). For the purpose of this paper, only the role for women as consumers of energy services is addressed, since the intersection of women's SRHR due to their role as consumers of energy is most clearly visible and addressed in literature. As a consumer, women make use of energy services provided. This means that they are responsible for utilizing energy services within households for various purposes, such as cooking, heating, lighting and other household powering activities, and make use of energy provided by public services, such as lighting (Della Valle & Czako, 2022).

Women can experience multiple problems of energy deprivation in their role as consumers. These challenges of energy access in a household are commonly described via the term 'energy poverty'. This concept has traditionally been used to capture problems of inadequate access to energy in the Global South, involving contextual factors, such as economic, infrastructural, social equity, education and health concerns (Bouzarovski & Petrova, 2015). However, nowadays it is also used to encapsulate issues of the Global North at the nexus of energy efficiency and affordability. In this paper, energy poverty will be defined as "an inability to realize essential capabilities as a direct or indirect result of insufficient access to affordable, reliable and safe energy services and taking into account available reasonable alternative means of realizing these capabilities" (Day et al., 2016). There are three commonly named drivers of energy poverty recognized in the literature, which are poor energy efficiency, low incomes and high energy costs (Boardman, 1991). Recent literature has broadened out to think about more political and spatial aspects, such as differences in climate and infrastructure. Therefore there are multiple variables and intersections used to clarify the three drivers.

One of the aspects that influences the dimensions of energy poverty is gender, shaping the dimension of each driver of energy poverty. Traditionally, when speaking about energy and energy services, the energy discourse was directed at the users in general, treating them as a homogenous group, and thus neglecting the differences in this process between men and women (Feenstra & Clancy, 2020; PREEEP, 2011). However, access to energy is not

gender-neutral; rather, it intersects with existing gender inequalities, resulting in differential experiences of energy poverty and its associated health risks for women worldwide. Men and women have different roles, different access and different control over resources in the household, community and in society in general (Clancy et al., 2020). This means that they also have different energy needs, interests and responsibilities on the basis of their gender (PREEEP, 2011). It is important that awareness is created of these gendered realities of energy usage to provide a just energy system and transition (Clancy & Feenstra, 2019). Gender relations are a dynamic concept depending on time, place and context, therefore, the gender dimensions of energy poverty will also vary across social, cultural, economic and political contexts (Feenstra & Clancy, 2020).

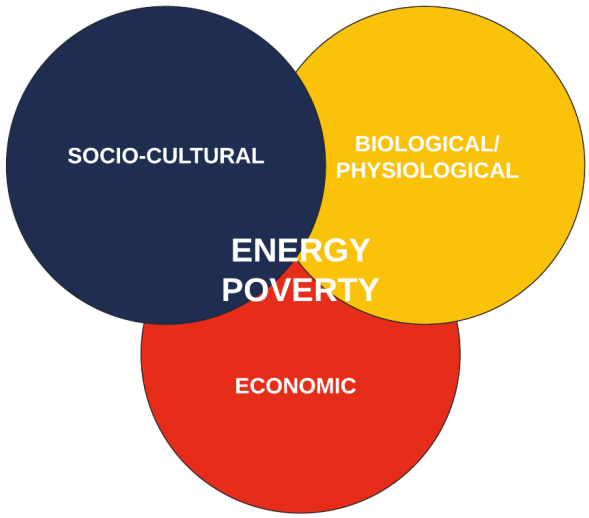

Figure 2 - Drivers of energy poverty

Women and men vary across a range of social categories and are influenced by personal and contextual factors in choices they make. To frame the correct policy responses, it is therefore needed to use three categories for data analysis to link causal or consequential factors to the gender dimension of energy poverty: economic, biological/physiological and socio-cultural as visualised in figure 2 (Clancy et al., 2017). The economic factor explains that the macro-economy influences household income, which affects housing affordability and, consequently, energy efficiency (Feenstra & Clancy, 2020). Energy costs can in turn dominate household expenses, leading to energy poverty at the micro level, resulting in negative health outcomes. Women, especially older women or single-person households headed by women, face higher energy expenses, impacting their energy affordability (Feenstra & Clancy, 2020). The biological/physiological factor addresses the consequences of extreme weather temperatures, causing cold or heat stress with young children, women and the elderly being particularly vulnerable (Feenstra & Clancy, 2020). Older women are more likely to live in inefficient homes and gender differences in excess winter mortality (EWD) are partly due to age and women's greater sensitivity in temperature (Feenstra & Clancy, 2020). The social factor

dives deeper into household care tasks. Cooking, washing clothes and cleaning are energy-intensive and predominantly performed by women, demanding significant time and energy or exposing women to household air pollution (Feenstra & Clancy, 2020). Gender differences in energy consumption exist. Women often manage household energy and energy-saving measures can lead to intergenerational tensions (Feenstra & Clancy, 2020).

In this context, it is crucial to understand that there is an inequitable distribution of energy resources and a gendered division of labor within households and communities, shaping women's experiences. We need to be aware that women are in many households the managers of the energy system, both in the Global South and the Global North (Clancy et al., 2020). As primary users and providers of household energy, they play an essential role in ensuring the functioning of daily activities. As energy systems play a vital role in shaping various aspects of human life, reproductive health outcomes should not be neglected when researching the gendered dimensions of energy consumption and distribution. Access to clean and sustainable energy sources is critical for ensuring safe and healthy living environments.

2.2 Gender and SRHR

Sexual and reproductive health and rights (SRHR) encompass a broad spectrum of issues, including access to contraception, maternal health services and sexual health education. Gender equality and SRHR are closely interconnected, as achieving SRHR means that individuals must have the right and ability to make decisions about their sexual and reproductive lives without facing violence, coercion or discrimination- an outcome that is only possible with gender equality (IPPF, 2023). Conversely, true gender equality can only exist when individuals can fully exercise their sexual and reproductive rights.

Many women frequently lack control over decisions related to sexual activity, contraceptive use and family planning, due to gender inequality. Discriminatory systems and norms deny women and girls access to crucial SRHR information and services. They contribute to social expectations of women that lead to the control of sexuality and reproductive behavior for certain groups (Ouahid et al., 2023). Examples are cultural norms in a society, community or country specific stigma or taboos and the lack of education (UNFPA, 2023). Women, in particular in patriarchal and gender-unequal societies, often have lower status, fewer opportunities and less access to power compared to men and boys (IPPF, 2023). This is problematic as it can lead to negative health outcomes, such as higher fertility rates and/or decreased contraceptive use (Lorist, 2018). An example is a study showing that unmet needs for contraception increase when there is spousal disapproval or a lack of direct communication between partners about reproductive intentions (Wolff et al., 2000).

Moreover, access to SRHR services not only improves health outcomes but also enhances women's participation in economic and social activities (UNFPA, 2023). Women's ability to make

informed decisions about their sexual and reproductive health is closely tied to their overall empowerment and socioeconomic status. An example is that the ability of women to family planning enables them to make decisions about if and when to have children. They know how to time and space their pregnancies, allowing them to pursue their education first before child-rearing responsibilities can interrupt or even end educational pursuits. Moreover, by choosing when to have children, women can establish themselves in the workforce, gain financial stability and advance their careers, which can lead to higher incomes and greater economic independence, contributing to a broader economic development. Empowered women are also more likely to engage in social and community activities, including leadership roles and decision-making processes within their communities, with which they can challenge traditional gender norms (UNFPA, 2023). Lastly, gender inequalities and harmful masculinities also contribute to high rates of gender-based violence (GBV). About 30% of women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence in their lifetime (WHO, 2014). This violence in turn can reduce the use of contraceptives among female survivors, leading to additional sexual health issues (IFPP, 2004).

This shows that gender significantly influences health inequalities, both independently and through its intersection with other social determinants such as socioeconomic status, age, ethnicity, disability and sexual orientation (Ouahid et al., 2023). This intersectionality amplifies health disparities experienced by various groups. Therefore, addressing gender norms and SRHR inequalities requires a comprehensive approach, considering various stages of a person's life, shaped by a range of factors including gender norms, social determinants of health and access to healthcare services (Ouahid et al., 2023). This approach leads to engendering policy, defined as "the process that creates a gender just policy in which the needs of both women and men are addressed and universal human rights are acknowledged leading to a gender just policy impact" (Feenstra & Özerol, 2021).

To address the underlying causes of gender inequality related to SRHR, including structural inequalities embedded in social structures, gender gaps, unequal policies and discrimination, to ultimately implement an engendering policy, a gender-transformative approach is needed (IPPF, 2023). A gender-transformative approach actively "strives to examine, question and change harmful gender norms and imbalances of power in order to fulfill SRHR and realize gender equality" (IPPF, 2023) . The gender-transformative approach stems from the conceptual framework known as the Gender Integration Continuum, which guides programs from gender blind/discriminatory to gender aware programs, aiming towards the goal of equality and better development outcomes (IGWG, 2017). A gender-neutral or blind policy makes no distinction between women and men, using general terms such as 'households', 'citizens' or 'consumers', assuming that it is equally impacting men and women (Feenstra & Özerol, 2021).

Engendering policy counteracts this approach and reaches towards a gender-equal policy impact. The next stage identified for this is reaching for gender aware policies and programs, which aims to "address the set of economic, social and political roles, responsibilities, rights,

entitlements, obligations and power relations associated with being female and male and the dynamics between and among men and women, boys and girls" (Marcus et al., 2023). Reaching further than this are gender transformative policies. Gender transformative explicitly seeks to redress gender inequalities and remove structural barriers.

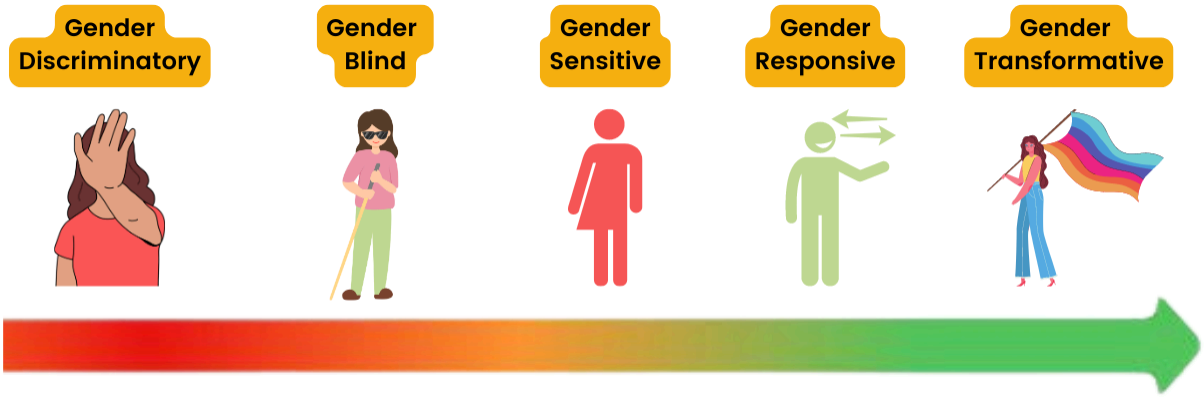

Figure 3 - the Gender Integration Continuum

The underlying causes addressed by a gender-transformative approach include discriminatory legislation, policies, institutions, norms and stereotypes about gender roles, harmful masculinities and insufficient support for women's agency and rights (UNFPA, 2023). Restrictive sexual and gender norms are motivated by religious, social and cultural beliefs, impact the sexuality of young people, women, those with diverse sexual orientations and individuals with different gender identities (Lorist, 2018). As a result, many people's sexual and reproductive rights are violated globally. By addressing root causes of gender inequalities, gender-transformative approaches ultimately contribute to the equal distribution of power. This means that when the main objective of a program is to improve women's access to SRHR information and services, a gender-transformative approach may help in parallel communities recognize and challenge norms and stereotypes that perpetuate gender inequalities and limit access to services in the first place (UNFPA, 2023).

Furthermore, gender-transformative approaches place women and girls at the center of policies and programming. The ability of women and girls to exercise their rights hinges on their agency. Agency is defined as the "capacity to act independently and make their own choices, free from violence, coercion and retribution" (UNFPA, 2023). Agency is intertwined with empowerment, bodily autonomy and decision-making, making it key to SRHR. Many women are not free to make their own choices regarding health care, contraception and the ability to give consent to sex. Inadequate agency and ability to exercise their rights further increases gender-based violence, including genital mutilation and child marriage (UNFPA, 2023). Choice and agency is empowering when women and girls have freedom to choose from a range of choices regarding contraceptive use or when and whom to marry. Empowered choice challenges social inequalities, when translated into actions and outcomes (Kabeer, 1999).

Despite that many donors and implementing agencies have endorsed gender transformative programming as a tool to advance gender equality, tensions and critiques have also emerged about the implementation of it (Alvarez et al., 2021). A lack of tools, resources, time and skills limit their ability to implement these approaches and measure their outcomes. Furthermore, the definitions vary across institutions (Alvarez et al., 2021). The gender transformative approach also encounters resistance in global policy-making due to differences in cultural norms between countries and traditions that are conflicting with the changes this approach advocates for, experiencing them as too radical or unnecessary. This makes it more difficult to use the language of gender-transformative approaches in policy and international reports.

To conclude, gender equality and SRHR are deeply interconnected. Gender norms and inequalities significantly influence access to SRHR services, impacting women's ability to make informed decisions regarding their SRHR. Striving towards a gender-transformative approach, which seeks to challenge and change harmful gender norms and power balances, is therefore essential for achieving both SRHR and gender equality.

3. The Implications of Energy Poverty on SRHR

In the previous sections, the link between gender and energy access and the link between gender and SRHR has been identified. This identification contributes to examining the intersection of energy access and SRHR using a gender lens. Women bear the greatest burden of energy poverty as they are often the primary consumers and producers of energy within households and it is their unpaid labor that is expended to gather biomass fuels for cooking, collecting water or process foods (UNDESA, 2018). Consequently, their decisions and access resonates across multiple dimensions of well-being, including health, SRHR, education and economic empowerment. There is a complex interplay of challenges that intersect with women's SRHR, as they take on diverse roles and have to navigate through systemic barriers, socio-cultural norms and structural inequalities, intersecting with their SRHR (UNDESA, 2018). Therefore, it is crucial to understand the interplay between women's roles in the energy system and their SRHR. This paper addresses multiple dimensions of energy poverty which influence women's SRHR. The issues will be classified in two areas; household energy access (section 3) and energy access for public services (section 4).

Key Gender SRHR Issues Across the Energy Sector

Household Energy Access *Household Energy*	Health impacts due to lack of modern energy for cooking methods; physical strain and maternal complications due to fuel collection; time poverty due to fuel collection and cooking; gender-based violence related to fuel collection;
Energy Access for Public Services *Rural Electrification*	No or little access to electricity for healthcare facilities leading to SRHR complications; gender-based violence related to traffic patterns and street lighting

Figure 4 - SRHR issues divided across energy sectors

3.1 Household Energy Access

Firstly, the link between household energy access and women's SRHR is addressed. This intersection spans multiple disciplines and requires a comprehensive approach considering the diverse needs and challenges faced by women and girls in energy-poor households [Fig. 5]. The lack of modern cooking methods, reliance on biomass fuels and the associated indoor air pollution (IAP) disproportionately affects women's health and maternal outcomes. Additionally, physical strain and risks related to fuel collection and the impact of energy poverty on women's domestic responsibilities and how it limits their autonomy is addressed. Lastly, the heightened

risks of gender-based violence women face during fuel collection and the broader implications it has on women's SRHR is examined.

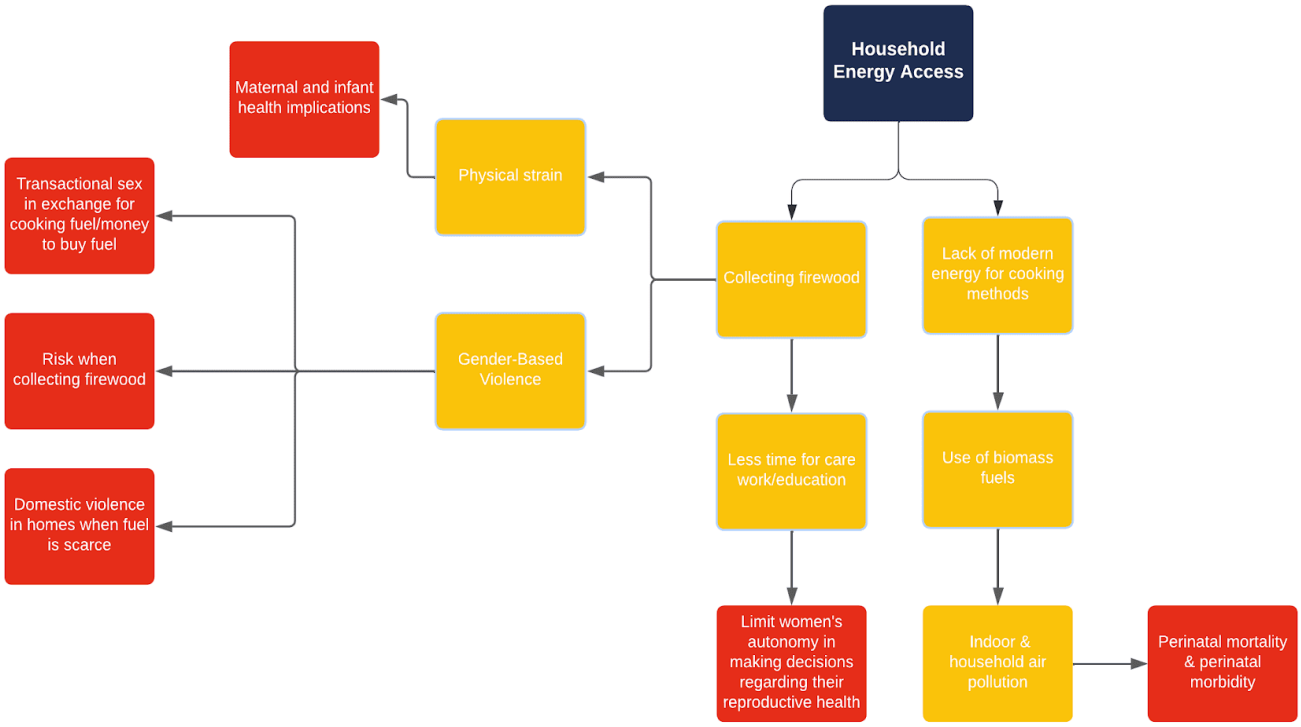

Figure 5 - Implications on women's SRHR related to household energy access

3.1.1 Lack of modern energy for cooking methods

The most common intersection scholars have made between energy access and SRHR is the implications on women's SRHR due to the lack of modern energy for cooking methods. Mainly in rural areas, people still lack access to clean energy sources for cooking. Globally, the number is set at 2.8 billion people who still do not have access to clean fuels and technologies for cooking (International Energy Agency (IEA) & World Bank, 2015). Biomass, including firewood, charcoal, dung and agricultural residues, serves as a primary source of cooking fuel for approximately three billion people globally (International Energy Agency (IEA) & World Bank, 2015). Since women are active agents, shaping consumption practices, particularly in the domain of cooking technologies, the prevalent use of biomass underscores the reliance of millions of women on this traditional cooking method. Smoke released from fires using these fuels emits numerous noxious pollutants, including carbon monoxide, nitrogen dioxide and carcinogenic organic air pollutants in concentrations that are significantly higher than those associated with air pollution in polluted cities (Ezzati et al., 2000). Estimates suggest that household air pollution from solid fuel use accounts for 3.5 million premature deaths in children and adults from pneumonia, lung cancer, cardiovascular disease of chronic obstructive

pulmonary disease (Lim et al., 2012) In addition to cardiorespiratory effects, there is growing concern about potential perinatal risks associated with biomass burning. This underscores the importance of addressing the effects on women's SRHR due to the use of biomass. For this paper, there are two types of air pollution examined; household air pollution (HAP) and indoor air pollution (IAP) from inefficient combustion.

The use of biomass, leading to harmful indoor and household air pollution, poses significant health risks. The deaths annually attributed to IAP from solid fuels is estimated between 1.5 and 2 million (Ezzati & Kammen, 2002). These deaths disproportionately affect women and children in poorer households and rural populations, due to their predominant role in cooking activities. Using fuelwood as an energy source is driven by multiple factors. In the Global South, fuelwood plays a big role as a domestic energy source, especially for cooking, and is deeply embedded in domestic cultural practices and beliefs. The effects fuelwood can have on women's health are often accepted as a cultural phenomenon or lived reality (Clancy et al., 2020). However, this does not mean that it is only an issue of the Global South. Indoor air pollution is a forgotten policy issue in the Global North such as in Central and Eastern Europe. The use of fuelwood as a solid fuel has been overlooked by the European energy transition policy, while in reality, fuelwood and other primary solid biofuels take up 17% of the average household's final energy consumption in the European Union (EU) (Stojilovska et al., 2023). The reason is that fuelwood is used as a tool for coping with households' inability to attain a necessary level of domestic energy services. Households need to adjust their energy needs to cope with energy poverty and primarily due to its low price, fuelwood is the alternative that is well suited (Stojilovska et al., 2023). Another reason why fuelwood is used is a cultural practice and socio-cultural norms. Fuelwood unifies multiple energy vulnerabilities, such as vulnerable people living in vulnerable spaces being dependent on old technologies and polluting fuels, without adequate policy support and thus amplifying the problem (Stojilovska et al., 2023).

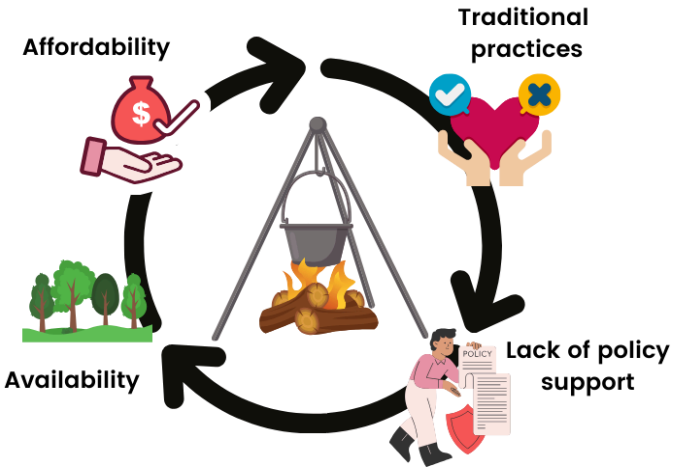

Figure 6 - Factors of using fuelwood as energy source

The relationship between biomass and SRHR outcomes becomes clear due to multiple different implications it can have on pregnancy outcomes. Antenatal exposure to household air pollution has been mostly addressed with the adverse pregnancy outcomes perinatal morbidity and perinatal mortality (Wylie et al., 2014). Perinatal morbidity refers to non-fatal health complications affecting the mother, fetus or newborn during the perinatal period - around the time of birth - and perinatal mortality refers to the death of the fetus or newborn during the perinatal period, including stillbirths and deaths within the first week of life (Wylie et al., 2014).

The studies that have been done on the influence of HAP and IAP on specifically the reproductive health of women have consistently shown a correlation between the maternal exposure to IAP and perinatal mortality (Boy et al., 2002; Misra et al., 2012). In countries that rely heavily on solid biomass and coal for cooking, household air pollution is responsible for 2.8 million premature deaths every year, linked to the fumes from biomass fuels (IEA, 2017). Findings suggest a higher risk of stillbirths and deaths in the first week of life among infants born in these households (Mavalankar et al., 1991). Moreover, there are many studies that have associated urban outdoor pollution and environmental tobacco smoke - which has a much lower concentration of pollutants than cooking with biomass stoves - with low birth weight and early death (Windham et al., 1999). This gives more evidence that the effects of biomass air pollution are extremely sincere.

Besides perinatal mortality, there is also evidence of a correlation between maternal exposure to IAP and perinatal morbidity. A study done in Guatemala revealed that babies born in households using wood for cooking had significantly lower birth weights and thus in turn a higher rate of prematurity, compared to those using cleaner fuels, highlighting the detrimental impact of biomass cooking on neonatal health (Mishra et al., 2004). A study done in Bangladesh associated the use of crop residues and fuelwood for cooking with an increased risk for low birth weight, a decrease in birth length and head circumference, implying the detrimental effects fuelwood has on fetal growth (Lee et al., 2022). The results of the studies in Guatemala and Bangladesh illustrate how exposure to IAP from biomass fuels can adversely affect fetal development and neonatal health, highlighting the significant health risks associated with the use of biomass fuels for cooking.

To combat the negative health effects biomass fuels have on women's SRHR, a collaborative approach needs to be taken if implementation is to be effective and sustainable. However, literature showing evidence of the negative influence of HAP and IAP on prematurity, including perinatal mortality and morbidity, addresses the need for a specific focus in research and policy on implications on women's SRHR. There is too little attention to these consequences on women's SRHR in policy, international conventions and treaties. In addition, if prematurity is confirmed as an adverse effect of exposure to household air pollution during pregnancy, the actual rates of perinatal morbidity and perinatal mortality due to household air pollution may be higher than is currently recognized and may be underestimated in the literature. This is especially concerning in resource-limited settings, such as areas with fewer healthcare

resources and lower socio-economic status, where preterm infants are particularly vulnerable. The impact of IAP and HAP in these remote areas is difficult to measure accurately, despite being where the majority of biomass fuels are being used. Therefore, there is an urgent need for more research and to take these implications into account when writing policy. Further, there needs to be trials that evaluate whether advanced stoves and access to modern energy for cooking methods can lower household air pollution exposure and enhance health outcomes, particularly during pregnancy (Wylie et al., 2014).

3.1.2 Physical Strain and Maternal Health

Women play not only a central role in using biomass fuels to cook with, but also in collecting biomass fuels, as they are often the ones that undertake this task, due to a combination of cultural, social and economic factors. Women's roles as primary caregivers and homemakers mean that they spend most of their time in and around the household and thus making them responsible for ensuring that there is an adequate supply of fuel for cooking and the cooking process itself. However, there are a range of health impacts, both physical and psychological, emerging from the way women for example collect firewood and its carrying of the wood (Matinga & Clancy, 2020). These physical demands can pose risks to women's reproductive health, particularly during pregnancy and childbirth.

Negative infant and maternal outcomes linked to carrying heavy loads in general during pregnancy have been reported in a few studies (Bonzini et al., 2007; Spinillo et al., 1995). Women's heavy workloads during pregnancy exacerbate the risk of pregnancy complications, such as obstruction of the birth canal and incidences of back injury, highlighting the detrimental impact carrying heavy loads of firewood can have on maternal health (Knight-Agarwal et al., 2023; G. M. Shaw, 2003). Thereby, other studies have documented instances of lower uterine pain experienced by pregnant women while specifically collecting firewood, indicating again the potential risks to maternal well-being (Matinga & Clancy, 2020). Moreover, increased physical strain during pregnancy can lead to complications during labor, such as obstruction of the birth canal, increasing the risk of maternal and neonatal mortality (G. M. Shaw, 2003). Excessive workload during pregnancy also contributes to maternal exhaustion and fatigue, potentially leading to negative maternal and neonatal health outcomes (Del Rocío Corchero-Falcón et al., 2023). This in combination with inadequate rest can be dangerous for the reproductive health of pregnant women.

3.1.3 Domestic Responsibilities and Access to Information and Resources

The heavy burden of household energy tasks also directly affects women's ability to exercise their reproductive rights. Extensive time and energy is devoted to activities like fuelwood and water collection, cooking, food processing and the engagement in income-earning activities. These tasks often result in long unpaid workdays, estimated at 11 to 14 hours, exacerbating

women's time poverty and limiting women's autonomy in making decisions regarding their reproductive health. This leaves women little time to access reproductive healthcare services, including family planning, maternal care and sexual health education (CRINGE, 2016; Asia Pacific Alliance, 2020). Moreover, the simultaneous nature of these household responsibilities means that child care is often integrated into women's daily routines, leading to challenges in providing adequate care (CRINGE, 2016).

The lack of access to modern energy sources further compounds these challenges, depriving women of connectivity with the outside world and access to information and resources vital for child care and education. This is problematic as access to information, education and services is crucial in the promotion of SRHR among, especially young people, as recognized in international rights and conferences (Ngilangwa et al., 2016). SRHR requires knowledge of normal physiology and development, healthy expressions of sexuality, an understanding of the consequences of sexual behavior and communication skills to assist people in making informed decisions (D. Shaw, 2009). With SRHR education and services, women and young girls are enabled to make informed choices on these matters, reducing unwanted pregnancies, STIs and maternal and child mortality. Youth-friendly services require confidentiality, privacy and non-judgemental attitudes (D. Shaw, 2009). It is crucial that there are adolescent-friendly health facilities established and accessibility of SRHR information in every household (Klu et al., 2023). Without adequate energy sources, women are forced to expend considerable effort and resources on gathering unsustainable and damaging means of alternate energy for household use and to get SRHR information and education. Misinformation and lack of knowledge about SRHR is disturbingly common among young people, globally, with negative consequences concerning unwanted pregnancies, STI's and healthy sexual behavior (D. Shaw, 2009). Energy access can increase the access of SRHR information and education by increasing its accessibility. It can help demographic transition to longer lives and informed decisions on family size, providing information about choices on health, reproductive rights and opportunities for women through communications methods that use modern energy carriers (Lambrou & Piana, 2006). An example is a study being done in Bangladesh, which mentioned the use of TV as an influential factor regarding family planning use in electrified households with 22.5% (Barkat, 2002). An IEG rural electrification impact evaluation has also argued that there is strong evidence that access to television increases knowledge of health and family planning (IEG, 2008).

Furthermore, the consequences of women's heavy workloads extend beyond child care to maternal and child health outcomes. Studies have shown associations between women's workload and neonatal mortality, as well as children's nutritional status and susceptibility to diarrheal diseases (Holmboe-Ottesen & Wandel, 1991; Rabiee & Geissler, 1992). Research indicates that overwork among women negatively impacts child feeding practices, with only a small percentage of children being exclusively breastfed and a significant proportion of women resuming their normal workload shortly after childbirth (Tefft & Kelly, 2002). This lack of support for women in accomplishing household tasks and caring for children contributes to suboptimal

child feeding practices and increased workload for women. Additionally, women's own health and well-being are compromised due to the physical and mental toll of their extensive responsibilities. An example is that they may face increased stress and fatigue due to their household responsibilities.

3.1.4 Gender-Based Violence when Collecting Firewood

Another serious factor concerning significant risks for women due to the collection of firewood, besides the physical risks for the women's body on their reproductive health, is the one related to physical and sexual violence. Gender-based violence can be defined as "any form of violence used to establish, enforce or perpetuate gender inequalities and keep in place unequal gender-power relations" (Fulu et al., 2013). Violence specifically targeted at women and girls is one form of gendered violence, but it can also take on many different forms and does not need to include physical aspects. In the literature it has been established that sexual and gender-based violence overwhelmingly impacts women and girls and intensifies in emergency settings (Hughes et al., 2016; Fisher, 2010).

It is important to note that collecting data on gender-based violence is challenging, due to social sanctioning, stigma, the impunity of perpetrators, weak data protection systems and limitations in the capacity to ensure privacy (Listo, 2018). Despite these challenges, studies have highlighted the prevalence of violence against women during firewood collection, particularly in displaced persons camps and other vulnerable settings (Kasirye et al., 2009; Tønnessen, 2012). Communities in development settings have minimal access to energy for lighting, cooking and heating which increases the risk of sexual abuse and domestic violence. This violence has been mostly associated during firewood collection, as this activity is principally conducted by women and girls. There are three scenarios related to firewood collection in which women are at risk to being exposed to various forms of violence, including physical assault and sexual harassment. The first one is the risk of gender-based violence during firewood collection itself. The reason is that without electricity or gas for cooking, women often have to travel long distances to gather biomass fuel, leaving them vulnerable to gender-based violence, as they are on their own and in a vulnerable setting (CRINGE, 2006; UN Women, 2014). The second scenario has to do with domestic violence due to scarcity of firewood. Domestic violence tends to rise in homes where fuel is scarce, as financial strain and resource scarcity increase the likelihood of intimate partner violence (Benson & Fox, 2001). Communities in development settings are likely to experience scarcity in resources, including firewood. In this case, domestic violence may be a serious threat to women. Lastly, in some cases, scarcity may drive women desperate for survival. In this case, women and girls may engage in transactional sex in exchange for cooking fuel or money to buy fuel (Braaf, 2016).

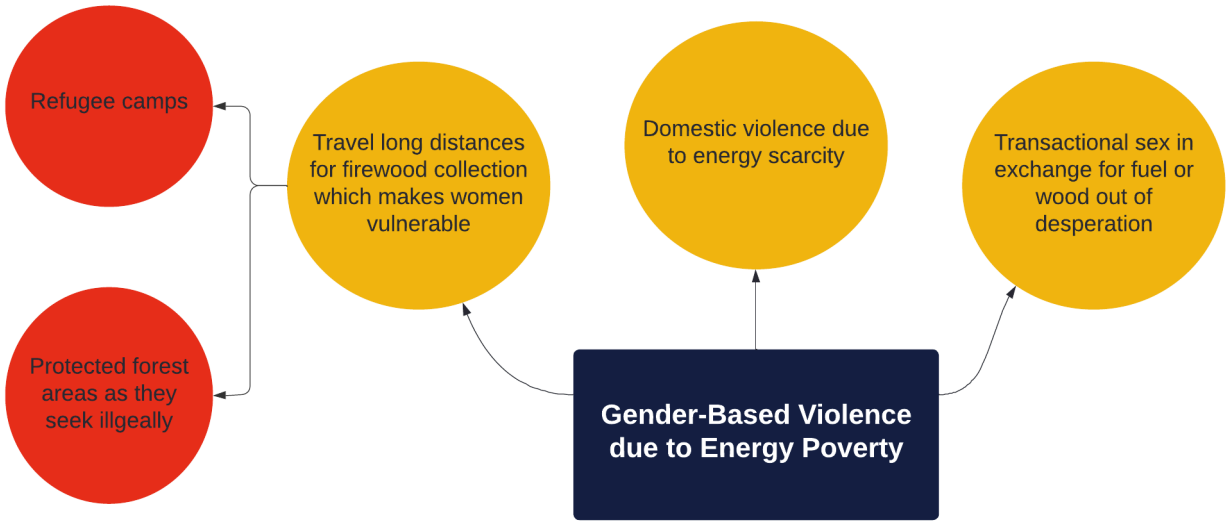

Figure 7 - Situations with a heigtened risk of experiencing gender-based violence due to energy poverty

The literature identifies two main situations where women collecting firewood are at heightened risk of violence. In protected forest areas, women may face harassment and sexual violence from forest guards as they seek fuel illegally. For example, women fuelwood carriers in Addis Ababa, Ethiopia, have been harassed and forced to pay bribes to be able to collect wood. They are at the same time at serious risk of sexual assault (Clean Cooking Alliance, 2015). Similarly, in refugee situations, militias may target women who venture out of camps to collect firewood, subjecting them to systematic violence and rape (Bradley & Liakos, 2019). Such situations have been reported in Somalia and also in Sudan. Women have reported there to be systematically beaten and raped when moving out of their villages looking for fuelwood, water and food (Bradley & Liakos, 2019). Most of the displaced communities living in camps are almost entirely dependent on humanitarian aid and there are minimal employment opportunities in the camps. This makes collecting firewood for cooking essential, both for family use, but also because selling these items is the only way to earn money for a family to supplement relief assistance and purchase necessary household items (HRW, 2005).The reason women are sent out their camps is due to the fact that men, who venture out, have a higher chance of being killed, while women and girls know they face rape, but not death (HRW, 2005). According to Médicins sans Frontieres (MSF), 82% of the rapes they treated in Sudan occurred when women left the towns and displaced persons camps in search of firewood, water or grass for animal fodder (MSF, 2005). Almost a third of the women and girls who were victims of these attacks were raped by multiple perpetrators (MSF, 2005).

The consequences of this violence extend beyond immediate physical harm, impacting women's reproductive health and overall well-being. Gender-based violence restricts choices and decision-making for those who experience it, limiting their rights to access critical SRH information and services (ARROW, 2011). Moreover, sexual violence experienced during

firewood collection is a risk factor for sexually transmitted infections (STI), including HIV/AIDS transmission, as sexual violence often involves unprotected sexual contact and injuries or open wounds facilitating the transmission of infections. Sexual violence can also result in unwanted pregnancies, contributing to unsafe abortions, especially among young girls. Unsafe methods to terminate the pregnancy pose serious health risks for girls and can lead to complications or even death (Haddad & Nour, 2009). In cases when the pregnancy reaches the point of childbirth, sexual violence poses the risk of maternal mortality, such as miscarriages and stillbirth. This risk is even higher when intimate partner violence (IPV) has occurred during the pregnancy period (ARROW, 2011). Research has further shown links between experiencing physical violence and a decreased likelihood of adopting contraception (Stephenson et al., 2006). This can be due to women facing control and coercion from their partners, resulting in a lack of autonomy in reproductive choices or experiencing fear of further violence.

In summary, the risks associated with firewood collection for women and girls extend far beyond the immediate physical dangers. Addressing these challenges requires comprehensive interventions, prioritizing both the prevention of violence and the provision of essential reproductive health services.

4. Energy Access for Public Services impacting women's SRHR

Energy access is not only crucial within households, but also in public spheres, significantly impacting women's SRHR. It is important that women can access SRHR services in a safe manner, such as in accessible and women-friendly healthcare facilities. Reliable energy ensures that healthcare facilities can provide essential SRHR services, including safe childbirth and comprehensive reproductive health services. Beyond healthcare settings, street lighting plays a significant role in women's safety and mobility, reducing the risk of gender-based violence (GBV) and enabling women to access SRHR services, education and employment opportunities, particularly during early morning or late evening hours. Thus, energy access in public spheres is essential for creating environments where women can safely exercise their SRHR, contributing to their overall well-being.

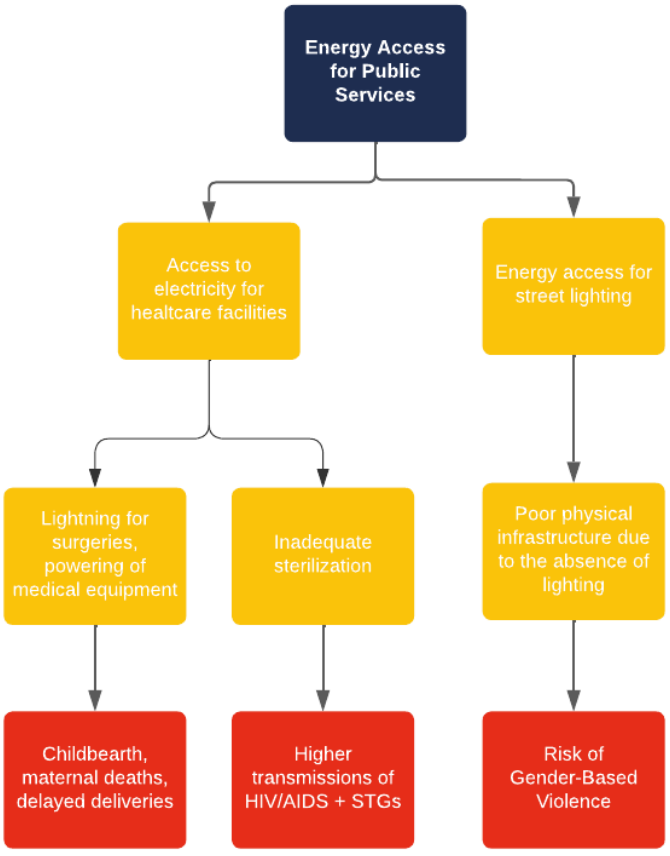

Figure 8 - Implications on women's SRHR related to energy access for public services

4.1 Healthcare Facilities Energy Access

In healthcare settings, energy poverty further complicates the delivery of SRHR services. Access to electricity for healthcare facilities is a critical component of ensuring maternal and neonatal health, yet, an estimated 1 billion people globally are served by health facilities with no access to electricity (High-Level Coalition on Health and Energy, 2021). This poses significant challenges for delivering essential healthcare services related to reproductive health, from prenatal care and childbirth to family planning and emergency settings. This poses particular risks in rural areas.

Addressing maternal and neonatal deaths requires that every birth takes place with a skilled birth attendant in an integrated healthcare system equipped to handle emergencies (CRGGE, 2006). According to the World Health Organization (WHO), a functional health facility is defined as one that has access to electricity and running water. This definition and requirement show the vital role of electrification in supporting healthcare facilities with providing maternal and child care services (CRINGE, 2006). Electrification provides lighting for surgeries and examinations, powers medical equipment and enables the sterilization of instruments.

Thus, the unstable and unreliable energy access in healthcare facilities can have severe consequences, leading to delayed deliveries, stillbirths and maternal deaths in underdeveloped, mostly rural, areas. The maternal mortality ratio is strongly correlated with access to electricity (UN Women, 2014). Without electric lightning, healthcare providers may struggle to deliver essential services during nighttime hours, and thus further exacerbating the risks associated with childbirth and emergency obstetric care. Deliveries in absence of light are known to be a significant cause of infections and death. Women aged 15-34 die in disproportionately high numbers on account of maternal mortality (UN Women, 2014). In regions where healthcare facilities have access to electricity, there is compelling evidence of improved maternal and child health outcomes. For example, studies in Bangladesh have shown significantly lower rates of maternal and child mortality in households and villages with electricity. This improvement can be attributed to various factors, including better access to information, cleaner water, and improved nutrition, partly due to the economic opportunities created by electrification (Barkat, 2002). Higher proportions of electrified households were also reported in antenatal care, pregnancy check-ups by medically trained personnel, receipt of tetanus injections during pregnancy and post-natal check-ups after delivery (Barkat, 2002) .

Furthermore, electrified healthcare facilities can more efficiently provide emergency services and undertake safe surgical procedures and sterilization of equipment. Inadequate sterilization due to the lack of electricity poses significant risks, particularly for women accessing reproductive healthcare services such as family planning injections. The absence of proper sterilization protocols may contribute to iatrogenic transmissions of HIV/AIDS and other infections, further compromising maternal and neonatal health outcomes (Chawla et al., 2018).

Additionally, many vaccines and medications, including those related to maternal and child health, require refrigeration. Some even need to be stored at specific temperatures, such as the medicine oxytocin, which stimulates the muscles of the uterus to contract, initiating and sustaining labor (Gimpl & Fahrenholz, 2001). Shortages or insecurity in energy can lead to spoilage of these critical supplies, reducing their effectiveness and availability. Access to family planning services is also enhanced by reliable energy, supporting the operation of health facilities and outreach programs.

Overall, the access to electricity for healthcare facilities is essential for improving maternal and neonatal health outcomes. Addressing the energy needs of healthcare facilities must be prioritized as part of broader efforts to enhance healthcare infrastructure and promote maternal and child health globally.

4.2 Gender-Based Violence due to Street Lighting and Safety

The risks women face while collecting firewood are the consequence of and are intensified by the lack of access to energy for lighting and other labor-intensive tasks. However, it reaches beyond collecting firewood. The risk of physical or sexual violence does not only occur when collecting firewood for cooking activities. Safety issues in public services occur more frequently for women, especially in rural areas. Safety concerns include poor physical infrastructure such as the absence of street lighting, concern of sexual harassment on public transport services or walking down poorly lit streets (Uteng, 2011). Limited energy supply leading to poor or non-existent lighting can in turn increase the risk of sexual and other abuses for women and children in public spaces (Braaf, 2016). The UN Women's report on safe cities and public spaces indicated that investing in urban infrastructures like better public lighting is one of the keys to ensuring safer and more inclusive spaces for women (UN Women, 2017). Initiatives such as in India and Papua New Guinea demonstrated that improved public lighting systems raised the feeling of security, but also generated a decrease in violence against women (UN Women, 2017). In a city in Uganda, as of 2016, only eight percent of paved road and street networks were illuminated, 79% of young women reported feeling unsafe when walking in their city streets (Candiracci & Power, 2022).

Implementing public lighting systems should therefore be gender-sensitive. Cities are living cultural productions reflecting a society's values and principles. This means that cities have long reflected traditional gender roles and the gendered division of labor, marginalizing women and girls from public spaces (Matte et al., 2021). Cities have historically been planned and based on a dominant and whitewashed male experience and urban urban planning thinks and designs spaces from a masculinized perspective, without considering the plurality of bodies and existences that will experience them, thus having little knowledge or concern for how their decisions affect women (Belitardo, 2023; Matte et al., 2021). Gender-sensitive lighting systems

are designed with the awareness of how lighting can impact different genders differently, also concerning safety. They address the specific needs and concerns of various gender groups, especially women as they experience it differently from men. Gender-sensitive lighting systems aim to improve energy, increase economic and environmental efficiency, increase the use of technologies and are specifically focused on safety and security aiming for a decrease in gender-based violence (Matte et al., 2021). During the process of gender-sensitive lighting, should women be involved throughout the development, discussion, monitoring and evaluation of these projects.

5. Discussion & Conclusion

This scoping review has examined the current grey and academic literature on the implications of energy access on sexual and reproductive health and rights (SRHR), with a specific focus on the intersection between energy poverty, gender and SRHR. The research question guiding this review was: **"How does the intersection of energy access and gender influences women's sexual and reproductive health and rights (SRHR), focusing on the Global South?".**

The findings highlight a clear intersection between energy access, gender and SRHR. There seems to be a growing awareness of the social dimension of energy poverty; however, recognizing that these concerns are not based on a homogeneous group and that it is impacting serious SRHR implications is still emerging in policy discussions. The experience of energy poverty is not uniform across genders - women face unique and more severe challenges. Current policy documents on energy access often use gender-neutral language, which fails to account for the different causes and implications of energy poverty for women and men. They have distinct energy needs due to their distinct roles and responsibilities, which means that the implications on their SRHR can also severely differ. Therefore, policy frameworks must be responsive to the different needs and realities of women.

In exploring the intersection of energy access, SRHR and gender, this paper has highlighted critical challenges that disproportionately affect women's SRHR due to energy poverty. Key findings include:

1. The increased risk of gender-based violence women face in collecting firewood,
2. increased vulnerability of women to physical and psychological health risks due to the weight of carrying firewood,
3. the health risks on maternal and neonatal health due to the use of biomass fuels,
4. energy available for SRHR education,
5. vulnerability to gender-based violence by poor lighting in public spaces
6. and the critical impact of energy access on healthcare facilities delivering maternal and neonatal services.

To effectively address these challenges, policies must integrate gender-transformative approaches, prioritizing women's SRHR in energy policies and energy poverty in SRHR policies. Therefore, while improving firewood provision can help address some aspects of sexual and gender-based violence, it should not be seen as a technical fix or 'the solution'. Instead, fostering community involvement, initiative and shared responsibility is crucial (CASA Consulting, 2001). Collaborative efforts involving governments, civil society and international organizations are essential to ensure sustainable solutions.

To implement policies that respond to women's SRHR needs, it is crucial that women themselves have influence over various aspects of the energy sector and policy management. Women are key agents of change and, as primary energy managers in households, they can play powerful roles in extending access to sustainable modern energy and adopting energy efficiency technologies, thereby reducing the negative implications on their SRHR (UNDESA, 2018). Each stage of energy planning and policymaking needs to factor in gender dimensions and actively advance women's leadership and increase their autonomy (UNDESA, 2018). By participating in policy formulation, women can advocate for the integration of gender-sensitive approaches that prioritize their needs, particularly in areas related to household energy tasks and their SRHR.

Further research is needed to create a deeper understanding of the gendered implications of SRHR due to energy access. Existing policy measures are too generic and do not reflect on the gendered implications energy access can have on women's SRHR. Further research could explore:

1. **Development of targeted interventions and policy programs:** Effective strategies to mitigate the negative impacts of energy poverty on women's SRHR require comprehensive research and innovative approaches. This paper addressed the multifaceted challenges women face due to energy poverty and further research is needed to identify and evaluate existing interventions. Long-term effectiveness and scalability in diverse socio-economic contexts should be explored.
2. **Sex-disaggregated data on the nature and scale of the problem:** One of the most important steps to cause greater awareness by policy makers is to have data on the nature and the scale of the problem. The unfamiliarity with the intersection of energy access and SRHR implications is partly caused by the lack of sex-disaggregated data. Good data are the basis of policy making and establish baselines for monitoring, enable comparison of policies and track progress of implementation (Feenstra & Clancy, 2020). Only with established data, informed policy decisions can be made. Therefore, it is necessary that sex-disaggregated data should be collected on the intersection of energy access and women's SRHR.
3. **Differences between the Global North and Global South:** In order to fully understand the problem energy access can have on women's SRHR, it is important to recognize that there may be a difference in experiencing the influence of energy poverty on SRHR between countries situated in the Global North and countries situated in the Global South. Even though the Global North generally enjoys higher levels of energy access than the Global South, energy poverty affects both under-developed/developing countries as well as a significant portion of the population in well-developed countries (Feenstra & Clancy, 2020). Indoor air pollution is a forgotten policy issue in the Global North and neglecting this issue means that energy-vulnerable households will continue to cope with fuelwood to deal with energy poverty, which in turn prevents them from participating in the low-carbon transition and will keep on impacting their SRHR in

negative ways (Stojilovska et al., 2023). Still, the extent and nature of the impact of this energy access on women's SRHR may vary between the Global North and the Global South. The problems concerning the Global North are more focused on affordability, while the problems concerning the Global South are more focused on accessibility, particularly in rural or developing regions (Chan & Delina, 2023). Research should address these differences and provide specific policy recommendations.

4. **Implications of energy poverty on women's workforce participation:** As this paper is mainly focused on the consumer side of energy access of women, further research could potentially address the implications of energy poverty on the producer side of women. Women are overrepresented as energy consumers, which is in contrast with women's structural underrepresentation as producers working in the energy sector (Murauskaite-Bull et al., 2024). Women play an emerging role as energy producers through their participation in local energy initiatives and renewable energy cooperatives. Still, there is little prioritization in the industry of the need for an inclusive energy workforce, as women lack representation in the energy sector workforce and in higher education in science, technology, engineering and mathematics (STEM) sub-fields (Murauskaite-Bull et al., 2024). The lack of inclusive workforces may also exacerbate the risk of gender-based violence, creating unsafe workplaces (Chun-Hoon & Frederick, 2024). Another issue related to women as producers of energy, is the possibility of women facing heightened risks of gender-based violence in industries or workplaces suffering from energy poverty, due to inadequate lighting or safety measures. This may ultimately create barriers for women in accessing workplaces or participating in the workforce, ultimately impacting their economic empowerment (Chun-Hoon & Frederick, 2024). This in turn can impact their decision-making autonomy related to SRHR choices. Further research should be done to assess these situations in the energy sector workforce globally.

In conclusion, this paper has shown that the dimensions of energy access on women's SRHR extend far beyond the current policy scope. There is a need for targeted interventions to address the nuanced dynamics between gender, SRHR and energy access. Problems experienced by women on their SRHR due to energy poverty should be an emerging concern for policy makers. Addressing these challenges requires multifaceted strategies, adopting a gender-transformative approach, and integrating energy access initiatives with efforts to advance women's SRHR and gender equality. Further research and policy development are essential to create effective and sustainable solutions.

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