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Low-carbon Energy Transition from the Lens of Feminist Theories

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ABSTRACT

Climate change mitigation pledges require decarbonization of the economy and the creation of a carbon-neutral society. Men and women contribute differently to climate change and have different roles in low-carbon energy transition. Gender roles influence career choices, abilities to invest in low-carbon solutions, power of decision-making, dissimilar mobility and energy consumption demands, and different values and consumption profiles, shaping the individual carbon footprint and behavior. A feminist methodology in gender- just low-carbon energy transformation goes beyond the introduction of certain gender-equal redistribution measures and aims to deal with the core roots of the different unequal practices in all fields of society life. It seeks to rebalance prevailing power arrangements, centering the most marginalized individuals and groups. There are various frameworks developed for the analysis of linkages between climate change and women following the feminist theory, like gender impact assessment (GIA); gender equality training (GET) model, and so on. The paper applies the feminist theory approach to the analysis of low-carbon energy transitions. The main purpose of using a feminist lens in this study is to enable the discovery of how people interact within energy systems and to offer solutions to confront and eradicate oppressive structures for just low-carbon energy transition in the EU.

KEY WORDS: low-carbon energy transition, climate change mitigation, feminist theory, gender equality.

JEL Classification: H30, P18, Q20, Q30.

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1. Introduction

Feminist theory is concerned with the disruption of structures of oppression or barriers imposed by these structures to bring about change. (Burton, 2014; Egbert & Roe, 2020; Hooks, 2000). While feminist theory considers all people, not just women, the emphasis is on disrupting oppression, which is a core tenet of feminist theory (Bierema & Cseh, 2003). As equality and equity can be considered as key issues of just low-carbon energy transformation and determining climate change mitigation actions and policies (Pearse, 2017), the study framework is based on the feminist theory model that begins with the belief that systems exist and operate against some individuals or their groups (Bee et al., 2015). The feminist model then shows that oppression is based on specific social and power structures that can create discrimination and exclusion for some individuals and their groups (Egbert & Roe, 2020). In the end, the feminist model provides that, through knowledge and well-targeted actions, these defined oppressive structures can be disrupted to support understanding and social change (Bierema & Cseh, 2003).

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There are several frameworks established for the consideration of low-carbon energy transition based on the feminist theory, ranging from gender-adjusted environmental impact assessment and strategic impact assessment (Transport Innovation Gender Observatory, 2020) to the 4R method, which evolved from the 3R Method and includes the gender appraisal of an action or behavior considering Representation, Resources, and Realia (Atmadia et al., 2020), and other frameworks; however, there is a clear gap in this area as most frameworks for a low-carbon energy transition based on feminist approach were developed for the transport sector. A more universal and wide-ranging framework is necessary for the analysis of the gender-just low-carbon energy transformation from the lens of feminist theory.

The main objective of this article is to develop a theoretical framework for the study of the interconnection between gender equality and climate action in the EU based on feminist theory.

The main tasks are to collect and systematize the relevant extant data sources covering gender inequality studies in low-carbon transition, to systematize frameworks, used in studies on low-carbon energy transformation, to develop a comprehensive research framework including ways of identifying and systematizing oppressive structures based on established criteria, linking defined oppressive structures to the social groups, defining their outcomes (discrimination, exclusion, inequality, etc.) and measurement indicators, outlining targeted actions of oppression disruption.

2. Literature Review

It is important to recognize that climate change affects women, men, and gender-diverse individuals differently. Moreover, intersectionality plays a significant role in shaping these experiences within these categories. Roles of genders and their relationships are not static, but rather, they fluctuate across time, cultures, societies, and nations. Therefore, planners must take these factors into account when planning actions, policies, and measures.

When implementing policies fostering transition towards a low-carbon economy, it is essential to take into account their potential gender implications. If gender dynamics are not considered, existing inequalities may be reinforced. For instance, men tend to occupy most of the formal jobs in carbon-intensive branches that are expected to experience workplace growth, such as energy and transportation, which may require specialized skills or specific education. This could result in women lacking their chances of developing a new carbon-free energy sector. On the other hand, women play a crucial role in sectors such as agriculture, forest economies, textile, and services. Therefore, it is important to consider the impact of these policies on all mentioned sectors and branches of industries. (Environment for Development, 2023).

Transitioning to low-carbon energy will affect gender equality and justice due to the differing vulnerabilities of genders (Fisher & Mohun 2015; Sadiqa et al., 2023). The main categorization of vulnerabilities in low-carbon transition is identified by Sadiq et al., (2023); inequalities in the policymaking, access to various resources, gender partition of labor, land endowment, and resettlements due to penetration of renewables, gendered green practices and jobs, increase in work for women due to low-carbon transition, gender invisibility in policies, different impact of energy efficiency on women, and so on.

Although the literature on vulnerability assessment of low-carbon energy transformation is expanding, it fails to consider gender as a component of the vulnerability element. The vulnerability scoping diagram (Carley et al., 2018; Coletti et al., 2013; Sadiqa et al., 2023) is widely used in literature to examine the vulnerability of energy sector transformations across established three dimensions of vulnerability- sensitivity, adaptive capacity, and exposure, as well as diverse constituents of these extents in distinct geographical backgrounds (Kortetmäki & Järvelä, 2021; Raimi et al., 2022; Sadiqa et al., 2023).

European Union (EU) has a long-term strategy for achieving carbon-free energy and economy and a carbon-neutral society by 2050. Scholars agree that the low-carbon energy transition raises important questions of justice and equality. Low-carbon energy transformations include a gender

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dimension as these processes have different impacts on women and men (Walk et al., 2021). These transitions can have an adverse impact on women as they have lower access to power in decision-making and financial means and limited ability to pay for their GHG emissions or to buy carbon-free energy technologies (Lieu et al., 2020; Pigot et al., 2019).

The energy sector is one of the least gender-diverse branches, notwithstanding all attempts to ensure women's and men's equal participation. It is necessary to address the existing and potential of citizens low-carbon transformation engagement in terms of socio-demographic, socio-economic, gender, class, socio-cultural aspects and to look at the ethics of contribution in the energy sector, which will reveal the injustices in participation in the energy transformation including the inequality between women and men to access carbon-free energy services as well as their capacity to influence the energy transition (Geels, 2011; Geels & Schot, 2007; Rotmans & Loorbach, 2009).

According to Gambhir et al. (2018), Piggot et al. (2019), Mohr et al. (2020), Heffernan et al. (2021), and Walk et al. (2021), gender equality should be incorporated into all sectors, such as renewable energy, construction, transport, and agriculture which play important role in achieving long-term sustainability. This can be achieved by integrating gender equality and diversity into every aspect of these sectors and raising awareness of the diverse roles that women and men can play in the low-carbon transition, challenging established cultural values and norms, and supporting the building of competencies and providing equal opportunities for women. Perace (2017), Bell et al. (2019), Mang-Benza (2021), and Krosnell (2013) highlighted the importance of these measures for gender mainstreaming in gender-just low-carbon energy transition.

Studies showed that gender aspects in low-carbon transition need a deeper than the binary divide of women and men to provide an examination that reflects the complexity of the lives of people in terms of a range of social characteristics such as their economic status, stage in the life cycle, ethnicity, and so on – as well as household composition. Such an approach contributes to a more inclusive participation of individuals in low-carbon transition processes (Johnson et al., 2020).

The scholars focused on how actors' agency and capacity drive socio-technical transitions. This applies to gender studies as well (Davies, 1991). Actors' ability to act is capacity and willingness to act is agency and they are distinct categories (Kern & Rogge, 2016). The likelihood that an actor (woman) will modify their behavior or take an action is related to their agency and also capacity. Several empirical studies showed that in the case of high agency and capacity, the likelihood of accomplishment is significantly higher than if they both are low. Up until now, the concepts of agency and capacity have been applied in several studies to define the tools through which women employ their participation and input in low-carbon transition processes by applying an intersectional analysis approach (Christensen & Jensen, 2012; Walk et al., 2021).

While studies on intersectionality, gender, and energy are expanding, understanding how gender inequalities intersect with other inequalities like origin, social class, race, and age remains a serious under-investigated topic in low-carbon energy transformation literature (Sadiqa et al., 2023; Sahrakorpi & Bandi, 2021).

Therefore, scholars agree that it is essential to consider the gender dimension in the low-carbon transition research transversally, both taking into account the roles played by the two genders and ensuring that all our inputs and outputs, can capture the behavioral and social issues related to gender. With a participatory action research approach, it can be possible to ensure gender balance throughout all engagement activities during the policy process. It is crucial to acknowledge the significant role that women can often play in various aspects of life by bringing novel insights and acting as the main engines of pioneering and inclusive solutions. The active participation of underrepresented social groups, including gender, particularly in terms of the participation of female citizens, professionals, developers, policy-makers, and researchers in co-creation processes, supporting equity, social justice, and gender balance in the proposed low-carbon

energy transformation solutions on all levels.

The EU has policies expanding gender equality solutions in the labor market produced several important regulations aiming at gender diversity and equality in the workforce marketplace (Jacquot, 2017). This has been achieved by a combination of hard measures, such as equality legislation and law, and soft measures, which are not legally obligatory but which Member States are stimulated to adopt, such as 'gender mainstreaming', checking all policies to ensure they do not have an adverse impact on women. EU DG EMPLOYMENT is responsible for gender equality monitoring which includes tracking the gender pay gap of occupations, gender composition of occupations, new entrants, and representation on corporate boards. Particular attention in EU policies is given to professions where women are not adequately represented like Science, technology, engineering, and mathematics. Scholars acknowledge that hard law is more effective than soft measures which tend to be disregarded by business in the case of financial crisis or other turbulence.

Therefore, scholars see gender mainstreaming as a failed policy with limited commitment at the EU level and in the majority of member countries (Botta, 2019; Brown, Spiegel, 2019; Mohr et al., 2020). The studies advocated many soft policies like training, gender impact assessments, consultation with women, and gender budgeting which are not very popular in the majority of EU Member States. It is common for studies to neglect the reality of the double oppression experienced by women, which stems from the naturalized domination resulting from the unequal power dynamics between men and women, as well as certain policies and practices. This issue has been highlighted in various sources including the UN (2018), Carley and Konisky (2020), Garcia-Garcia et al. (2020), and Johnson et al. (2020).

Effective public financial management is a crucial component of a comprehensive government strategy to address issues such as gender inequality, climate change, and the transition to low-carbon energy. Such strategies require public investments through well-planned budgets, as well as regulatory frameworks and incentives that promote private investments and funding (Colenbrander et al., 2018; CIFOR, 2020).

Cultivating gender equality and realizing a low-carbon energy transformation can complement each other. Gendered perspectives play a crucial role in policy-making, ranging from household decisions to government policies. For instance, when making policy decisions, a government official's emphasis on environmental values and household welfare can reflect their gendered perspective. In a gender-just transition, all genders should have equal opportunities to participate in decision-making and occupations linked to low-carbon energy transformations. Therefore, it is essential to anticipate and provide the necessary equal opportunities for training, education, and support for both genders.

The assessment frameworks' failure to incorporate gender dimensions limits analysis and obscures gender in low-carbon transition discussions by making gender invisible in scientific research of challenges of just low-carbon energy transition.

3. Theoretical Frameworks for Gender Mainstreaming in Transition Studies

Analyzing gender-just low-carbon energy transformation requires a solid theoretical framework for understanding gender discrimination systems and sources, targeted indicators of gender inequality, and linking to these indicators and policies and actions to promote gender-just and gender-equal low-carbon energy transformation in the EU and other countries.

As gender inequality is one of the main issues of just low-carbon energy transition, various frameworks were developed for assessing gender aspects in climate change mitigation policies and low-carbon transition for various economic sectors. Gender mainstreaming involves integrating a gender perspective across all areas and levels to achieve equality. Several frameworks were developed for gender streaming: GIA, GET, Staircase model, 4R, Green budgeting, Norm criticism approach briefly described below.

A Gender Impact Assessment – GIA model was developed in transport planning and is based on

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environmental impact assessment (EIA), social impact assessment (SIA), and strategic environmental assessment (SEA) frameworks adjusted to gender equality issues (Therivel, 2010). The GIA model was considered for transport systems that have to deliver mobility that permits people to get access to their workplaces, education, social facilities, and so on (Levin & Faith-Ell, 2019). The main driver for incorporating gender dimension in transport was the set gender equality and diversity targets in land and infrastructure planning. Therefore, GEI involves a strategic, target-oriented methodology and focuses on consequences for gender equality. The actions and policies for reaching targets are usually set by public bodies like land-use or energy-planning organizations. Thus, the consequence of the implementation of various activities on gender equality is the key issue in GIA. The significance of the consequences depends on the level of gender equality in the area being examined. Thus, it is crucial to include an analysis of gender equality in the baseline description. The quality of baseline scenario analysis defines the overall excellence of the conducted Gender Impact Assessment (GIA). The consequences of the activities on the issues linked to gender equality can be assessed by evaluating whether the consequences are positive or negative; the extent of consequences (number of

Table 1

Targets, Questions, Indicators, and Sources for Goal: Equal Opportunities and Conditions for Education and Work Goals in GIA in the Transport Sector

Targets	Questions	Indicators	Sources
Both men and women should have equal access to education and job opportunities, including salaries enabling them to achieve financial independence.	What is the status of the job market and where are educational institutions located in the city? Where are workplaces situated taking into account the location of residential areas?	The number of workplace/education institutions that can be accessed within 15-30- 45-60 minutes traveling from a residential location.	Municipal and regional statistics on the dominance of men and women in local workplaces.
It should be possible for both genders to reach educational institutions and job places with similar standards and during similar time intervals.	Which means of mobility are used to reach the job places or education institutions?	The number of traveling women and men; The share of men and women working in dissimilar workplaces or going to educational institutions.	Municipal and regional statistics on schools and universities.
It should be possible for men and women to use similar modes of travel, taking into account time and budget constraints.	Is it possible to use a bicycle or public transport means to reach the workplace or educational institution? Is it necessary to have a driver's license or car to reach the destination? Are there any unmet transport demands? Is it possible to stop on the way to bring kids to school and/or kindergarten?	Are there available travel opportunities for each mode of travel? Comparison of travel time for men and women.	Regional public transport authorities. Analysis of targets Travel surveys Workplace surveys Surveys on schools and universities. Mental maps Interviews and focus groups.

Source: created by authors based on (EIGE 2018; Ihlström et al. 2019; Transport Innovation Gender Observatory, 2020)

individuals affected and spatial distribution), duration, permanency, likelihood, and monitoring results achieved moving towards equality goals.

The GIA model combines the SDGs and gender equality goals with established assessment tools using clear criteria and stages like other impact assessment methods, EIA, SIA, and so on (Transport Innovation Gender Observatory, 2020). Smyth and Vanclay (2017) proposed five criteria for evaluating, forecasting, and managing the social impacts of various programs: rely on main concepts and current frameworks; safeguard human rights compatibility, bring into line with central global standards and best practices, ensure meeting widely desired social goals and ensure high participation, engagement, and practicality. Sweden has conducted numerous gender impact assessments in recent years. Though the interest in gender mainstreaming was high for all stakeholders, the realization process was quite deliberate. Other European nations exhibit similar trends in gender equality and transportation mobility (European Institute for Gender Equality [EIGE] 2018; Ihlström et al. 2019).

Targets, questions, indicators, and sources for specific goals (Equal opportunities and conditions for paid work) in the GIA process for the transport sector are illustrated in Table 1.

Gender Equality Training (GET) framework delivers the relevant information, skills, and values for individuals allowing the successful accomplishment of the gender-mainstreaming approach in various fields. Especially for civil servants is important to have the capacity and competencies to define gender-equality objectives in order to effectively mainstream gender equality to consider gender equality during policy planning and implementation, to monitor progress achieved towards goals, and to evaluate all programs from a gender equality viewpoint these activities require plenty of theoretical knowledge and practical competencies and have an impact on the attitude and individual behavioral changes. First of all, it is necessary to acknowledge that all political activities are gender-neutral. Gender equality training is one tool among many to achieve gender mainstreaming. Incorporating gender equality training into a continuous process of lifelong learning would be highly beneficial (EIGE 2020).

There is another popular tool for gender mainstreaming – the staircase model. It has many variations, but the same approach consisting of several stages is applied. It recommends starting by presenting principles to be followed for organizations wishing to project knowledge development processes. All versions of the staircase model have similar aims - to systematize the process and increase knowledge on gender equality. Therefore, the staircase model proposes an overall outlook of the stages required to create sustainability in knowledge development. Using this stages-wise method allows the division of quite complex problems or duties into lesser parts, and by following the approach stage by stage, there is an opportunity to look both backward and forward. The Swedish toolkit on gender mainstreaming is a good illustration of the staircase model. This toolkit has eight stages of progression, with suggested activities at every stage of progression (Transport Innovation Gender Observatory, 2020). Figure 1 shows the Swedish gender mainstreaming toolkit, which consists of 8 stages.

Another model, EIGE, suggests twelve stages in gender-equality training: 1. Assessing the needs for gender knowledge and skills development; 2. Integrating gender skills development in the broad equality strategy; 3. Ensuring necessary resources for the implementation of gender competencies and following activities; 4. Writing appropriate terms of reference; 5. Assessing the gender competencies development needs; 6. Engaging in the assessment of gender competence development needs; 7. Participating actively in the creation of gender skills expansion initiatives; 8. Encouraging people to participate in all activities; 9. Planning and implementing monitoring framework; 10. Setting the assessment framework; 11. Assessing the long-term effects of the gender competencies training; 12. Supporting the participants to implement acquired competencies in their tasks.

The 4R approach evolved from the 3R approach and includes the gender examination of activities, considering Representation, Resources, and Realia criteria (CEMR, 2018). Later, the fourth element,

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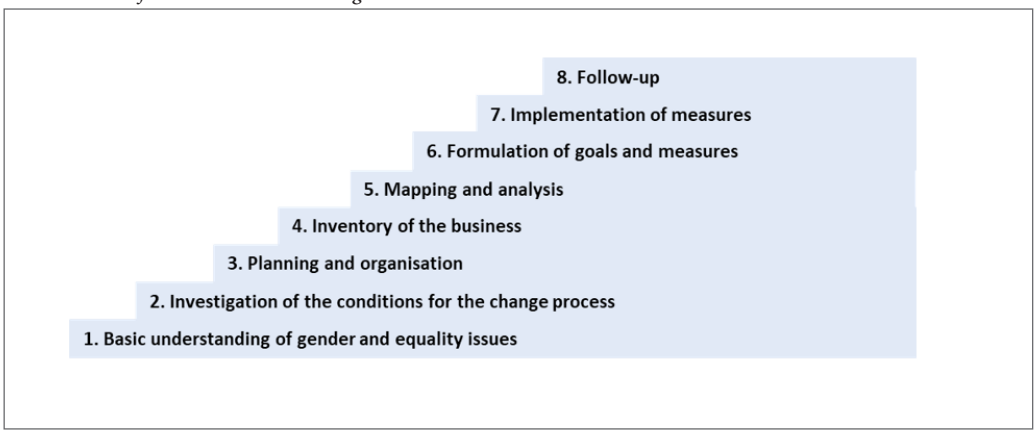
Figure 1
Swedish Toolkit for Gender Mainstreaming



Realisation criteria, was developed and added to the previous constituents. The 4R framework can be applied with the aim of surveying necessary activities and developing a summary of actions to be financed. It can be applied to comprehend how actions must be changed to encourage gender equality and diversity and analyze gender-relevant issues relevant to the actions. Therefore, the 4R method is based on representation, resources, realia, and realization. Representation provides a representation of genders in various processes at the organization. It is necessary to consider representation at all levels of decision-making processes. Resources indicate how equally are resources scattered between genders. It is necessary to evaluate the allocation of all types of resources, like expertise, management, and so on. Realia shows how the representation and resource allocations are related to gender norms in the institutions. It is necessary to show the reasons for the unequal distribution of resources. Realization indicates what measures should be developed to implement realization and how gender norms shape it. Answering all these problematic questions necessitates gender knowledge and competencies (Transport Innovation Gender Observatory, 2020).

Gender budgeting is a methodology that helps to identify the beneficiaries and disadvantaged groups in developing budgets. It aims to answer questions such as, how public budgets are distributed among different genders? Does the distribution of public resources address everyone's needs? Therefore, the primary objective of gender budgeting is to guarantee equitable and fair distribution of public funds and resources. The method has been predominantly used to examine the allocation of public resources concerning gender. Based on the definition provided by the Council of Europe, gender budgeting is a gender-based assessment of budgets incorporating a gender perspective at all levels of the budgetary process and restructuring revenues and expenditures to promote gender equality (EIGE 2017). Usual components in gender budgeting are an examination of public budgets and actions from a gender equality point of view; relating public budgeting to gender equality purposes, reshaping budgets, and adjusting actions in a more gender-equal way. It includes gender equality standpoints within the budget development cycle, checking and assessing achievements, ensuring transparency, and both genders' participation in the budget development process.

Norm criticism is an idea that is usually applied when debating on gender equality, diversity, and non-discrimination. A mutual misunderstanding is that norm criticism is against norms, but this is untrue. The norms are necessary for societies to be able to operate successfully together. Like, the norm to come on time to a meeting is a good and rational one. Norm criticism is linked to the questioning of specific norms. Ovesson (2019) recommends considering norm criticism in the same way as literature criticism, as both work not against some

phenomenon it just examine it. The norm criticism approach raises such questions: what kind of norms do citizens want? Is a specific norm essential? What happens if the norm is broken? Who is involved, and what are the consequences of breaking the norm? etc. (Ovesson , 2019). Therefore, the norm criticism approach allows actors or organizations to reveal and transform their structures and modify behavior. The transformation happens if the linkages between power and the specific norm are recognized, regulations are scrutinized, and understanding is shaped. Therefore, norm criticism is a valuable instrument in gender mainstreaming processes. It can be used in combination with other tools and methods and also can be applied in GIA. The norm criticism tool consists of problematizing present practices and critically assessing the activity. Thus, the norm criticism instrument can deal with such norms as age norms; white norms; hetero norms; homo norms; body size norms, and similar criticism. This method requires recognizing norms in everyday life situations, valuing norms by judging analytically about them, accepting intersectionality and norm criticism as valuable methods in decision-making, gaining awareness of norms and stereotypes, and critically discussing the stereotypes originating from specific norms

In Table 2, the main gender streaming models are described.

As one can see from Table 1, all gender mainstreaming tools and models address gender perspectives in the development of strategies, policies, and programs; however, the qualitative assessment and descriptive approach dominate in these frameworks. They all lack a universal approach to addressing gender issues and formulating gender-just policies. In the next section, the feminist theory will be developed to provide a better, more general, and universal understanding and approach to gender mainstreaming in low-carbon energy transition studies.

5. Theoretical Framework for Addressing Gender Perspectives in Low-carbon Energy Transition

Feminist theory is a critical theory having the aim of destabilizing systems of power and oppression (Hooks, 2000). As gender equality continues to be an issue today, the current research into gender equality is moving feminist theory forward (Egbert & Roe, 2020).

Feminist theory was chosen for investigation of how people interact within energy systems and to offer solutions to confront and eradicate oppressive structures for just low-carbon energy transition as this theory reflects all people, not just women, with an emphasis on oppression and, the disruption of oppression is a core tenant of feminist theory (Bierema & Cseh, 2003).

As equality and equity can be considered as key issues of just low-carbon energy transformation and shaping of greenhouse gas emission reduction policies (Pearse, 2017), the new framework is developed based on the feminist theory model that begins with the belief that systems exist and operate against some individuals or their groups (Bee et al., 2015).

The feminist model then shows that oppression is based on specific social and power structures that can create discrimination and exclusion for some individuals and their groups (Egbert & Roe, 2020). In the end, the feminist model provides that, through knowledge and well-targeted actions, these defined oppressive structures can be disrupted to support understanding and social change (Bierema & Cseh, 2003). In Figure 2 the framework for addressing gender perspectives in low-carbon energy transition is provided.

This proposed framework consists of oppressive structures that can be various in low-carbon energy transition like (norms, social systems, social and health protection systems, education systems, institutions, laws, regulations, etc.) the measures of their outcomes, which can be measured by various indicators of gender inequality manifested in low-carbon energy transition process and policy actions linked to targeted indicators showing gender inequalities to disrupt oppression and increase understanding, advocacy, and change of situation in terms of gender inequality which can also be monitored by positive changes in gender inequality indicators.

It is necessary to define the criteria for identifying and systematizing oppressive structures for gender-just low-carbon energy transition. It should be the situation of unequal power and privilege be-

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Table 1

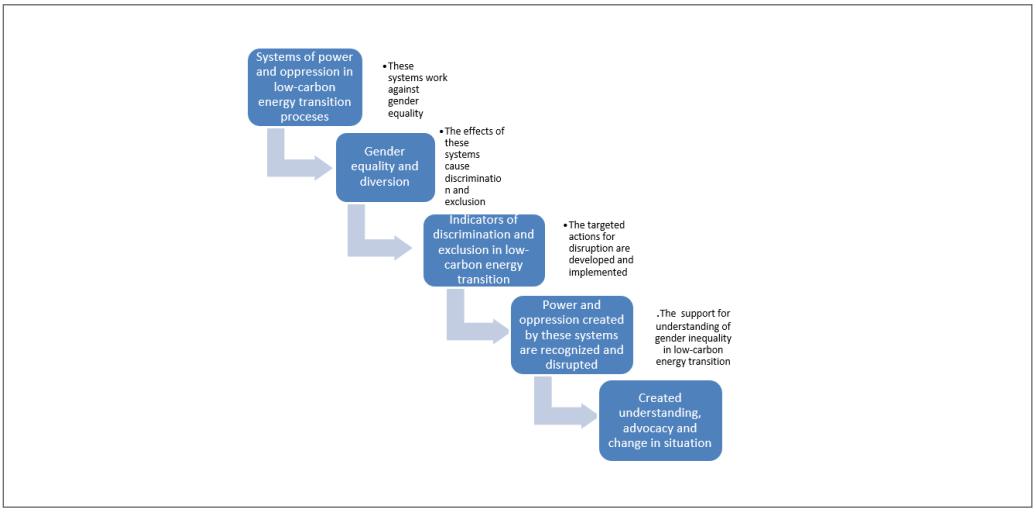
Targets, Questions, Indicators, and Sources for Goal: Equal Opportunities and Conditions for Education and Work Goals in GIA in the Transport Sector

Model or tool	Description
GET (Gender Impact Assessment)	The process of Gender Equality Testing (GET) involves a preliminary evaluation, analysis, or assessment of a law, policy, or program. The aim is to proactively identify any potential negative impacts on gender equality that could arise from implementing a given decision. The purpose of the GET is to ensure gender equality by creating well-designed legislation and policies. Using GET can help to ensure that any discriminatory effects are eliminated or reduced during the policy-making process. Apart from preventing negative effects, gender impact assessments can also be used as a tool to define gender equality objectives and proactively promote gender equality by formulating policies.
GET (Gender Equality Training)	The Gender Equality Training (GET) is a comprehensive guide that aims to help public administration employees develop their gender equality competencies. The training program equips administration employees with the necessary knowledge, skills, and values to effectively implement gender equality strategies in their work field, organization, region, or even at a country level. It is a step-by-step guide that provides a clear roadmap to bring about gender equality in the workplace.
Staircase model	The staircase model involves implementing social changes step by step. Integration of gender equality principles in developing programs and policies can be achieved by implementing consequently necessary stages. As a result of breaking down complex issues into smaller parts, it is possible to reflect on past accomplishments and plan for future steps while integrating goals that promote gender equality and diversity into policies.
4 R (Representation, Resources, Realia and Realisation	The 4R method can be applied for collecting and analyzing data related to gender equality in institutions based on the so-called 4R: representation, resources, realia, and realization approach. It is useful for deepening of understanding of financing patterns and intersectionality aspects like gender, age, etc. in developing financial support strategies.
GB (Gender Budgeting)	Gender budgeting is a tool used to implement gender equality principles in the distribution of public resources. This allows for improved public resource spending when fiscal policies and administrative procedures are structured to address gender inequality.
NC (Norm Criticism)	Norm criticism is a tool that consists of questioning the norms in a particular society. Social norms are the ways of doing that are mutually believed to be "normal" ways of doing things in daily life. Norms by themselves are not a negative thing. However, norms can be also linked to subconscious things that are taken for granted and provide for some gender-related negative stereotyping about female or male jobs, etc.

Source: created by authors based on (Smyth, Vanclay, 2017; EIGE 2018, 2020; Ihlström et al. 2019; Equality Journey, 2019; Transport Innovation Gender Observatory, 2020)

Figure 2

A Theoretical Framework for Gender Mainstreaming in Low-carbon Energy Transition



tween groups for oppression to occur. Power and privilege inequalities must be seen and defined from a systems-level perspective. Oppression can be intentional or unintentional, and it can be overt or covert. For example, the laws and regulations can be an example of oppressive structures. It is necessary to amend all discriminatory laws against women and ensure their access to justice. The low quality of institutions can create discrimination and gender inequality. The accountable, inclusive, and effective public institutions having the capacity to deliver equitable, accountable, and effective services are necessary for ensuring gender equality. The decision-making and oversight systems must be strengthened to implement key functions for enhanced accountability and inclusivity.

The framework covers the methods and indicators of measurement of outcomes of oppressive structures like gender-disaggregated data on access to education, access to resources, green employment, energy poverty and energy inequality, health inequality, income inequality, and other gender-disaggregated data to recognize the effect of ecological stressors on women, female attitudes towards the environment and their inputs to reduction of negative environmental impacts. Some studies (Alsop, Heinsohn, 2005; Asian Development Bank, 2013) suggest gender inequality indicators are organized according to the four dimensions: human capital, economic empowerment, voice and rights, and capacity building. Every element is closely interlinked, and positive results achieved by one element can influence achievements in others. Also, the advancement in one area can be impeded if other dimensions are not implemented as well.

The focus of the human capital dimension is on the foundational elements that are necessary to achieve gender equality and empower women and girls. Improving human capital requires ensuring equal access to and outcomes from health and education. It is necessary to measure gaps in power relations affecting access to services, opportunities, gender-related stereotypes, and discrimination to boost human capital development in all genders.

Economic empowerment aims to reduce inequalities in access to and control over productive resources, services, and assets, such as land, property, employment, income, information, and financial services.

The voice and rights element of gender equality emphasizes women's ability to make decisions and assert their rights in both public and private domains, markets, and formal and informal organizations like NGOs, civil society organizations, government institutions, representative bodies, and so on. This dimension also includes women's partici-

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pation and leadership in institutions' planning and developing programs, strategies, and other actions.

The capacity-building element aims to enhance the capabilities of various actors in designing, implementing, and assessing policies and initiatives that guarantee equal participation and benefits for both genders. This necessitates the use of gender consideration and scheduling skills, incorporating the capability to define achievable targets and indicators and to create, implement, and supervise actions and strategies promoting gender equality.

Policies and targeted actions of oppression disruption linked to these indicators provided in the framework include the following: 1. Advancing gender equality and women's enablement in various sectors, with equal access to high-quality education, health, and other social benefits by eradicating legitimate barriers and supporting gender-just employment policies as well as gender parity all decision-making institutions; 2 Applying a gender lens to national policies on climate change, biodiversity, circular economy, and so on., and establishing environmental standards which can integrate a gender perspective into national environmental strategies, employing gender impact assessments (GIAs) policies development, adjusting environmental taxes, subsidies and budgetary tools according to gender equality principle and "genderizing" energy, transport and farming sectors, offering equal access to financial and other resources and technology that encourage women's empowerment; 3. Integrating gender equality dimension into transboundary policies like trade, foreign direct investment, corporate social responsibility business ethics, and so on. For businesses' investments in foreign markets, it should also be mandatory to consider the gender equality principles in investment decisions and requirements to include gender equality and in financing economic infrastructure, including transport and energy, to improve opportunities for women to participate in the green economy.

6. Conclusions

Transitioning to low-carbon energy has gender and justice implications due to differentiated vulnerability among genders, therefore the achievement of gender-just transition requires more research in this area to support policies and measures

Currently, the role of gender in the green energy transition is not thoroughly studied, which hinders our ability to comprehend vulnerability in the context of green policies and actions. It is crucial to investigate the gender aspects of low-carbon energy transitions, and scholars should devote significant effort in this direction. It is necessary to conduct more empirical research on the varying impacts and consequences of low-carbon energy transition practices on both genders.

It is crucial to conduct a thorough analysis of gender-disaggregated data related to time consumed, income generation opportunities, decision-making, and prevailing conditions. Empirical research and case studies should take into account not only gender aspects but also intersectionality, considering various factors such as age, marital status, geographical locality, and culture. These factors may affect the extent to which local communities will benefit from low-carbon energy transitions and whether certain individuals or groups will benefit more than others.

The following key questions need to be answered from a scientific point of view to accomplish a gender-just low-carbon transition: how interests of all social groups are better incorporated into low-carbon transition routes; how can employment situations be enhanced in woman-dominated sectors of the economy? What are the outcomes of low-carbon transition on different people, including gender, social status, health, age, and so on? How can local jobs be restructured to promote gender equity?

To solve these problems, it is necessary, first of all, to integrate gender-inclusive approaches in all phases of the energy policy cycle, starting from policy design to implementation. Enabling conditions and drivers of a more inclusive energy transition will be assessed to feed into the monitoring and evaluation of inclusion and social justice of energy transition policies. These insights would allow the design of a just energy policy for the EU.

For successful integration of gender dimensions and ensuring gender-just low-carbon transition, the theoretical framework was developed based on feminist theory and analysis of various theoretical frameworks for gender mainstreaming in various studies.

This proposed framework consists of oppressive structures and the measures of their outcomes, which can be measured by various indicators and policy actions linked to targeted indicators aimed

at the disruption of oppression and increase understanding, advocacy, and change, providing for gender-just low-carbon transition.

The conducted research has limitations. Further empirical studies are necessary for testing the created framework and applying it to solving concrete issues during low-carbon transition planning, like developing strategies and action plans for various economic sectors or regionalized decarbonization plans and strategies.

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