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Identifying Key strategies to Promote use of Renewable Energy in Urban Communities with an Emphasis on Social Sustainability Indicators

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Abstract
In recent decades, rapid urbanization and increasing demands for energy created serious challenges in energy supply and environmental conservation. Based on this fact that 71% to 86 % greenhouse gas emissions are from energy consumption in urban areas, the importance of using renewable energy sources becomes increasingly evident. In this regard, the main objective of this research is to identify social sustainability indicators and strategies for developing the use of renewable energy in cities based on identified indicators. This research attempts to respond to the raised questions by conducting a narrative review of existing studies based on the scoping review methodology. The findings of this study examine the challenges in using renewable energy resources and emphasize that to increase the use of renewable energy sources, special attention must be paid to various indicators that affect social sustainability in urban communities. The findings of this study demonstrate that social sustainability indicators play a key role in increasing the use of renewable energy in urban communities, and that attention to these indicators can contribute to the sustainable development of energy in cities. Consequently, recommendations to promote the use of renewable energy in urban communities with an emphasis on social sustainability indicators have been presented.

Keywords: *Social sustainable, renewable energy, urban communities, influential indicators and solutions, scoping review method.*

1. Introduction

In the final decades of the 19th century and throughout the 20th century, the industrial revolution brought about environmental, social and economic changes at the global level. During this period, cities acted as centers of attraction and platforms for economic growth, social exchange, and scientific and technological developments [1]. These conditions led to uncontrolled urban growth and population which typically creates challenges in environmental, social, cultural, and economic dimensions at the global level. Whit increased awareness of the interconnections between mentioned dimensions and concerns about social justice, economic vitality and environmental conservation, the concept of sustainable development emerged and has become an important perspective across various disciplines [1, 2]. Unfortunately, in the urban areas, 71% to 86% of greenhouse gases emissions stem from energy demand. Predictions indicate that by mid-21st century, over 80% of the population will reside in urban areas, and the need for energy resources will increase [3]. A significant portion of global energy consumption is provided by fossil fuel sources. However, the continued use of fossil fuel reserves has drawn attention to the future energy situation in the face of potential fossil fuel shortages. The rapid depletion of these resources may lead to significant disruptions in energy supply throughout the world [4]. Energy supply disruptions are a significant part of financial systems across various levels of economic activity, which can cost countries up to 12% of their annual growth potential and cause serious damage to effective economic performance. Nonetheless, urban infrastructures are facing fundamental challenges in meeting the growing demand for energy services, and the lack of renewable energy integration could lead to increased greenhouse gas emissions and pollutants. Furthermore, environmental concerns and the risk of rapid global warming have also directed global attention towards environmentally friendly and renewable energy sources [4].

Therefore, the use of renewable energy sources will be beneficial due to their availability and cleanliness [5]. Additionally, these sources are supplied by natural processes that are continuously replenished. Moreover, these sources are supplied by natural processes that are continuously replenished. In this context, the main objective of the research is to identify social sustainability indicators and provide strategies for developing the use of renewable energy in urban communities based on identify indicators. Considering the determined goal, the following questions are also raised to be answered in this research:

1. What are the social sustainability indicators for promoting renewable energy use in cities?
2. What are the key strategies for developing the use of renewable energies based on social sustainability indicators in urban communities?

2. Theoretical foundations of research work

A good city is defined as a concept that directs citizens towards the highest efficiency and satisfaction with minimal time and cost. This concept should be achieved with justice, internal efficiency, and a continuous place, consistent and free space that facilitates development [6]. Developing sustainable urban planning strategies based on the correct selections and implementation of urban sustainability indicators, should be a priority for all countries. Implementation and development in correct time and suitable framework have very positive effects towards achieving sustainable urbanization [7]. Therefore, a set of effective urbanization indicators should be selected and implemented based on goals of energy sustainability. A sustainable and efficient city with resources can be defined as an urban area that is significantly decoupled from resource exploitation and environmental impacts, while being socially, economically, and environmentally sustainable in the long term [8-10]. To achieve sustainability, cities faced challenges such as: reduce carbon dioxide emissions, improving energy efficiency and utilizing renewable energy sources, creating and maintaining green spaces in urban areas, encouraging urban mobility and public transportation among citizens. The main aim is presenting new advances in renewable energy and energy-saving systems that allow cities to evolve in a sustainable way [11, 12].

From a linguistic perspective, the term "development" has similar meanings like social change, social growth, social evolution, modernization and progress. In the other words, development is a set of interconnected changes aimed at responding to the needs of society, and it is a process that transforms unfavorable living conditions into desirable conditions [13].

Sustainable social development refers to the creation of conditions in which the current social and economic needs are met compromising the ability of future generations to meet their own needs. This concept encompasses various dimensions related to improving quality of life, social justice, and social cohesion. The primary reason for the increasing attention to sustainable development policies is the limitation of resources and the unlimited nature of human needs and desires. The components of sustainable development are presented in figure 1.

Figure 1. Components of sustainable development [6].

Among the various dimensions defined for the concept of sustainability globally, attention to social sustainable and its positive impacts on societies has been less studied. Given the current challenges facing humanity, the importance of addressing this dimension in scientific studies has been strongly emphasized [14]. In this research, special attention has been paid to social sustainability as a fundamental component of the sustainability approach in human societies.

Social sustainability is defined within the framework of broader concepts such as enhancing quality of life, social equality, preventing deprivation, and providing access for all citizens to essential needs. This is done to enable active and full participation in social, economic, and political dimensions [15-17]. Additionally, creating suitable conditions for the emergence of creativity and engaging all individuals in line with sustainable development goals, emphasizing the well-being of local communities and their vital role in environmental management and future

developments, is another definition of social sustainability [4]. Social sustainable development has various dimensions, including environmental responsibility: utilizing natural resources without weakening ecosystems, social cohesion: equality of opportunities and enhancing quality of life, and economic efficiency: strengthening investment and economic productivity. These dimensions not only contribute to social sustainability but also play a fundamental role in achieving general goals of sustainable development [18, 19].

In the contemporary period, energy is recognized as one of the main pillars of economic and social development. Based on the increasing population growth and rising demand for energy, the proper and sustainable management of energy resources has become one of humanity's fundamental challenges. This issue not only affects the quality of human life but also impacts the health of the environment and the future of the planet [20, 21]. In general, energy in the world is divided into four groups, each with its own characteristics and specific impacts [5]:

- Polluting and non-renewable energies typically include fossil fuels such as oil, coal, and natural gas, which have limited resources and generate pollution during their use.
- Polluting and renewable energies, such as biomass and biofuels, are derived from renewable natural resources but generate pollution during their production or consumption.
- Non-polluting and non-renewable energies usually refer to nuclear energy, which does not produce air pollution during generation, but its source (uranium) is limited and non-renewable.
- Non-polluting, renewable, and unlimited energies include solar, wind, hydro, and geothermal energy, which not only produce no pollution but also have naturally and endlessly renewable sources.

In this research, non-polluting, renewable, and unlimited energies have been examined. By definition, renewable energies originate from continuous or intermittent flows that can be returned to the environment or alternative energy flows [22, 21, 24-26]. These energies do not necessarily mean new energies and have been used by humans for centuries; for example, creating fire using biomass or heating with sunlight may be among the earliest examples of renewable energies [22, 23, 27]. The term "new" in this context means renewable or innovative, which translates to "Renewable" in English, and includes new technologies that have recently been developed in this field [22, 23, 28]. Five types of renewable energy include wind energy, solar energy, hydroelectric energy derived from water flow, geothermal energy generated from the Earth's heat, waste and biomass. These are renewable and cost-effective energies that are becoming increasingly popular due to their growing importance [29]. The goals of using renewable energy are reducing dependence on fossil resources, decreasing pollutant emissions from energy production and consumption sectors, and also reducing greenhouse gas emissions, which have a significant impact on global warming [25, 30]. The following is an introduction to the types of renewable energy:

Solar energy is one of the sources of renewable energy and one of the most important of them. According to an estimate, if all fossil fuels are burned at once, the energy obtained from it is equivalent to 4 days of sunlight on the earth. The amount of solar energy radiation varies in different parts of the world and is the highest in the solar belt of the earth. Also, solar energy is classified into active and passive [5, 27, 31].

Wind energy refers, to the energy harnessed from the kinetic energy of moving air. The use of wind energy gained significant importance worldwide with the construction of the first modern and fast wind turbines in the early twentieth century. In recent years, the average annual growth of wind energy globally has increased by about 30%, which is the highest growth rate among other renewable energies. Additionally, small turbines can be used to expand the use of rechargeable battery-powered vehicles [5, 32, 33]. In general, there are two main types of wind turbines [34, 35]:

- Horizontal Axis Wind Turbines: These turbines are typically used in wind farms and can generate between 2 to 3 watts per meter.
- Vertical Axis Wind Turbines: These turbines can generate up to 30 watts per meter and have advantages due to their higher power density and better performance in urban environments. The benefits of vertical axis wind turbines include less reliance on wind direction, the ability to handle variations in wind speed, and lower construction costs. However, challenges such as space limitations, variability in wind direction and speed, safety issues related to vibration and noise, and aesthetic

considerations may hinder the widespread adoption of wind energy in cities.

Biomass energy, derived from forestry and agricultural residues, urban waste, and biogas is considered one of the forms of renewable energy. These resources can be burned in solid or gas form and are utilized in thermal and combined power units for electricity and heat production. In large-scale energy production, the power density of biomass can vary depending on the climatic characteristics of the region and the types of plants present in that location. It is important to note that proper management of biomass consumption is essential to prevent the release of greenhouse gases [34-36].

Geothermal energy, is a renewable energy source that is low in carbon emissions. This heat is derived from the Earth's internal thermal energy. It can be harnessed for electricity generation and heating or cooling applications. Heat can be extracted from the ground using wells or other systems designed to transfer heat to the surface. This demonstrates significant potential worldwide for providing renewable energy [2, 35].

Hydropower is, generated by harnessing the kinetic energy of flowing water. It is typically used in hydropower plants, where the force of falling water is utilized to turn turbines and produce electricity. Hydropower can be applied in large-scale applications, such as powering cities, as well as in smaller-scale applications, like supplying electricity to [36, 37].

3. Research method

Based on the studies conducted, if various studies and research have been published on a particular topic, it is possible to review and investigate them again, comparing them in a comparative manner or summarizing their results and combining them. It will be an endeavor to constitute independent research [38, 39]. In this study, the scoping review method has been employed, which is generally recognized as a qualitative research approach aimed at creating and extracting a shared reference framework based on the results of previous research [40]. This method is used to identify, examine, and summarize a wide range of studies related to social sustainable development and renewable energy. The scoping review enables researchers to define research questions and then, through searching, selecting, evaluating, summarizing, and synthesizing evidence, develop a comprehensive framework to address the posed questions [40]. The statistical population of this research consists of articles that have been jointly conducted in the fields of social sustainable development and renewable energy in urban communities. The stages of the research are as follows.

Defining research questions: The main research questions were initially identified to determine the scope of the search and the review of studies.

A systematic search was conducted in selected databases, including Web of Science and ScienceDirect, covering the period from 2010 to 2025.

Study selection: Based on inclusion and exclusion criteria, studies related to social sustainable development and renewable energy were selected.

Quality assessment: The quality and relevance of the studies were evaluated, and irrelevant or low-quality studies were excluded.

Summarizing and synthesizing evidence: The data and findings of the selected studies were qualitatively analyzed and synthesized to develop a comprehensive reference framework.

3.1. Setting research questions

The formulation of research questions is considered the first step in the Scoping review method. In line with the objectives of the present study, it is essential to address the following questions: what, who, when, and how, in order to navigate the principles of the Scoping review method. The parameters and research questions are specified in Table 1.

Table 1. Research parameters and questions.

Parameters	Research questions
What	Influential indicators on social sustainability in the context of developing renewable energy usage in urban communities.
Who	Articles published in international scientific journals regarding influential social sustainability indicators in the context of renewable energy development in urban communities.
When	Searches have been conducted in selected databases from 2010 to 2025.
How	Method and criteria for selecting resources, thematic review of sources, note-taking, analysis, classification, and categorization of concepts.

3.2. Literature review in a systematic way

At this stage, a search for studies was conducted in selected databases from 2010 to 2025. These databases include Web of Science and ScienceDirect, which are well-known for searching studies published in internationally indexed journals. In this research, the main

keywords "social sustainable development" and "renewable energy" were searched in combination within the mentioned databases to review and analyze studies published at the international level. Additionally, all research conducted in the field of sustainability from a social perspective and renewable energy was also explored.

In figure 2, the total number of studies over time shows that approximately 15% of the studies were published in 2021, about 13% in 2016, and around 6% of the sources were published in the years 2019, 2017, 2015, 2014, and 2013. Additionally, about 2% of the sources were published in 2025, 2024, and 2018. Furthermore, approximately 9% of the sources were published in 2023, 2020, and 2011, while around 4% were published in 2010 and 2022.

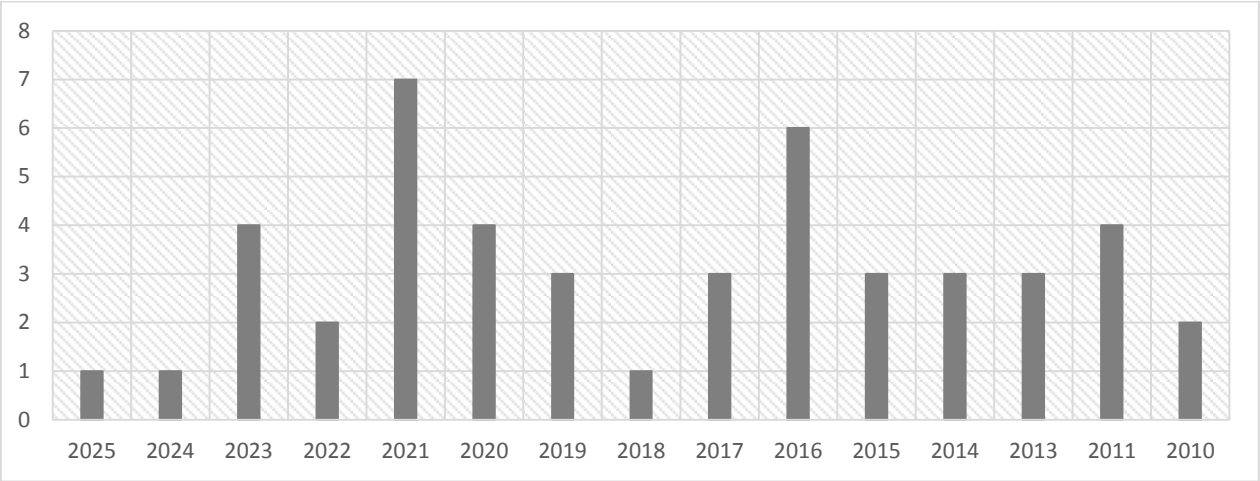

Figure 2. Bare of studies based on the published year in the selected time frame

3.3. Searching and choosing appropriates

The inclusion criteria for studies consisted of ten main aspects, including research objectives, research methods, research design, sampling methods, data collection, ethical considerations, accuracy and data analysis, clear presentation of he value of the research. findings, and t Additionally, studies published between 2010 and 2025 related to the topic of social , sustainable development and renewable energy in urban communities, published in reputable -ljournals with international indexing, and with ful .text access available were included in this review

The exclusion criteria include factors that remove a study from the scope of the review, such as studies whose topics are related to other fields or fall outside the specified time frame, as well as text access or having low -icles lacking fullart .scientific quality

Given the large number of articles related to the keywords "social sustainability" and "renewable energy" in the Web of Science database, the study and selection process was carried out carefully step by step. In this process, the authors independently reviewed the titles first, then the abstracts, and finally the full text of each article to decide which articles should be included in the study and which should be excluded. This method to increase the accuracy and reliability of helps .the research results

After applying these filters and conducting a -relevant and high ٤٧thorough review, a total of quality studies were selected for the final analysis. ch are The various stages related to this approa Table presented in2.

Table 2. The number of selected studies from each database

Science Direct 2010-2025
=Total number of resources found: N39
=Number of resources used: N28
Web of Science 2010-2025
Total number of resources found: N=47
Number of resources used: N=19

tudiess istribution ofd Geographical

The selected studies were gathered from various countries around the world, reflecting a wide geographical coverage of the topic. The highest ed number of studies originated from the Unit States, China, the United Kingdom, Spain, and Italy. Additionally, studies from Iran, Turkey, Indonesia, South Africa, Denmark, Australia, India, Malaysia, Egypt, Poland, the Netherlands, Sweden, and Hungary were also included in this Additionally, some of the sources are .review international in nature and are not limited to any specific country. This distribution reflects a relatively broad geographical coverage of the selected studies. Table3shows the geographical .dies based on countriesdistribution of these stu

Table3. Geographical distribution of studies.

Region/Country	Number of Studies	References
United State (USA)	7	6,9,35,38,40,44,45
China	5	25,18,29,33,43
United Kingdom (UK)	4	10,15,19,28
Germany	2	17,30
Spain	2	3,11
Italy	2	24, 34
Iran	1	5
Turkey	1	14
Indonesia	1	12
South Africa	1	20
Denmark	1	27
Australia	1	7
India	2	2, 36
Malaysia	1	23
Egypt	1	47
Poland	1	39
Netherlands	1	42
Sweden	1	19
Hungary	1	39
Multinational/International	6	13 ,16,21,22,26,45

3.4. Extracting indicators from selected studies

In this study, sustainability indicators from the social perspective were extracted through a systematic literature review. First, relevant studies on the topic were comprehensively searched and collected. Then, these studies were carefully examined, and the key indicators presented in each source were identified and extracted. The indicators were subsequently categorized based on common themes and criteria.

The method of extracting indicators is based on approaches similar to those used in previous studies. These approaches allowed us to comprehensively and coherently identify the key indicators relevant to the topic. The list of extracted indicators is presented in table 4.

Table 4. Social sustainability indicators for the evelopment of denepable energy use in urban communities based on Selected Studies.

REFERENCES	INDICATORS
[1]	Increasing social equality, creating social capital, increasing positive social norms, improving the well-being and health of society, increasing safety
[2]	Public education and awareness, access to energy, reduction of greenhouse gas emissions, ensuring energy security
[3]	Social justice, reducing pollution and improving quality of life, managing resources and reducing waste, developing sustainable infrastructure, increasing energy self-sufficiency
[4]	Social indicators, economic indicators (economic prosperity, economic well-being)
[5]	Social indicators (social welfare, safety and security, social justice), environmental indicators (pollution, energy efficiency, environmental impacts), economic indicators (economic prosperity, economic well-being)
[6]	Social participation, sustainable transportation, healthy environment, development of supportive policies, security and safety, flexibility in urban design
[7]	Awareness and education, empowerment of local communities, development of green infrastructure, social justice, sustainable economic development
[8]	Education, public participation, culture and citizen perception, crime prevention through environmental design
[9]	Social indicators, economic indicators (economic prosperity, economic well-being)
[10]	Social participation and cooperation, education and awareness, social justice, research and innovation, sustainable infrastructure development, healthy environment
[11]	Social indicators, economic indicators (economic prosperity, economic well-being)
[12]	Social indicators, economic indicators (economic prosperity, economic well-being)
[13]	Poverty and inequality, access to education, employment opportunities, social inclusion, quality of life, health and sanitation
[14]	Social indicators, economic indicators (economic prosperity, economic well-being)
[15]	Interactive and participatory, social justice and equality, education and awareness, development of new technologies, sustainable infrastructure, healthy environment
[16]	Social indicators, economic indicators (economic prosperity, economic well-being)
[17]	Public awareness and education, accessibility and equality, environmental protection
[18]	Population growth, environmental quality and sustainable development, reduction of greenhouse gas emissions, labor efficiency
[19]	Social solidarity and inclusion, education, social justice, local environmental quality, safety and security
[20]	Community participation, energy access, innovation and research
[21]	Social indicators, economic indicators (economic prosperity, economic well-being)
[22]	Social justice, education and public awareness, community participation, sustainable development and technology, social infrastructure
[23]	Poverty and inequality, access to education, employment opportunities, social inclusion, quality of life, health and sanitation

[24]	Community engagement, education and accountability, access to sustainable energy, support for innovation, economic sustainability, infrastructure development, environmental quality improvement, sustainable mobility
[25]	Social participation and cooperation, education and awareness, social justice, research and innovation, sustainable infrastructure development
[26]	Economically vulnerable population, education and learning, health benefits, financial mechanisms
[27]	Reducing energy poverty, awareness and education, social justice, strengthening social solidarity, improving public health
[28]	Environmental factors (safety and accessibility, road surface quality), social strategies
[29]	Social participation, social justice, awareness and education, strengthening social solidarity
[30]	Economically vulnerable population, education and learning, health benefits, financial mechanisms
[31]	Education and awareness, sustainable business models, environmental standards
[32]	Poverty reduction, awareness and education, improved public health, energy security
[33]	Public education and awareness, access to energy, reduction of greenhouse gas emissions, ensuring energy security
[34]	Social participation, reducing energy poverty, awareness and education, social justice, strengthening social solidarity, improving public health
[35]	Public education and awareness, access to energy, reduction of greenhouse gas emissions, ensuring energy security
[36]	Awareness and education, reducing environmental impacts, waste management, government policies
[37]	Social solidarity, education, social justice, safety and security
[38]	Environmental factors (safety and accessibility, road surface quality), social strategies (education and awareness)
[39]	Education and awareness, sustainable business models, environmental standards, green energy consumption, safety and efficiency of energy systems
[40]	Social indicators, economic indicators (economic prosperity, economic well-being)
[41]	Environmental factors (safety and accessibility, road surface quality), social strategies (education and awareness)
[42]	Social inclusion, strengthening trust and social solidarity, awareness and education, social justice
[43]	Social participation, social justice, awareness and education, strengthening social solidarity
[44]	Public education and awareness, access to energy, reduction of greenhouse gas emissions, ensuring energy security
[45]	Social indicators, economic indicators (economic prosperity, economic well-being)
[46]	Education, public participation, culture and citizen perception, crime prevention through environmental design
[47]	Poverty reduction, awareness and education, improved public health, energy security

3.5. Analysis and categorization of indicators

Based on the content presented in the theoretical foundations and the selected studies listed in table 4, an effort was made to examine and extract sustainability indicators from the social perspective aimed at increasing the use of renewable energy in urban communities. At this stage, after extracting and selecting the main indicators, they were analyzed. First, the relevant concepts were extracted, then each was grouped into corresponding categories, and finally, the main indicators were presented in table 5 to provide a basis for a unified and novel interpretation of the findings in subsequent stages. The main indicators were categorized into social, cultural, environmental, and economic factors. The difference in the impact of certain indicators compared to others is generally due to the following reasons: frequency and repetition in various studies; indicators mentioned in a larger number of studies usually have greater importance and impact because more researchers have identified them as key factors. The nature and scope of the indicators; some indicators, such as economic or environmental factors, may have a broader and more tangible influence on the development of renewable energy, for example, production costs or greenhouse gas reduction, which directly affect policies and decision-making. Different geographical and social contexts; the importance of indicators may vary depending on the specific conditions of each community or country; for instance, in some regions, political or cultural indicators play a more prominent role. The complexity of the energy system; the energy system is a multidimensional and complex system that includes various dimensions such as economic, social, environmental, technical, and institutional, and each dimension may gain more importance under certain conditions. Therefore, indicators with greater impact are usually highlighted due to their practical significance, recurrence in the scientific literature, and relevance to the specific conditions of the energy system and the studied community.

In figure 3 shows the frequency of each indicator in the existing studies, including social factors at 19%, economic factors at 29%, environmental factors at 21%, cultural factors at 14%, and political factors at 17%.

Based on the frequency of the indicators, the varying percentages show that in the existing studies, some dimensions such as economic factors (29%) and environmental factors (21%) have received more attention and are recognized as key factors in the development of renewable energy, while social (19%), political (17%), and cultural (14%) factors also play a significant role but are less prominent. This percentage distribution can guide decision-makers to focus resources and efforts more on the dimensions that have the greatest impact, such as economic and environmental policies. However, the considerable percentages for social, cultural, and political dimensions indicate that sustainable development of renewable energy requires a comprehensive and multidimensional approach

that takes all these factors into account. Additionally, these percentages may reflect the specific geographical, social, and economic conditions of the regions where the studies were conducted; therefore, the relative importance of the indicators may vary across different areas. Overall, these percentages reflect the focus and priorities present in the scientific literature regarding sustainability indicators in the field of renewable energy and can help improve policymaking and research.

Table 5. Explanation and classification of social sustainability indicators for development of renewable energy usage in drban Co mmunities.

Categories	INDICATORS	REFERENCES
Social factors	Social justice (participation in decision-making, fair distribution of resources, access to natural resources, equality in job opportunities, reduction of social inequality), education (environmental education, increasing social awareness (information campaigns, social media and their role, access to free education), strengthening social trust and solidarity (creating strong and reliable social networks among community members), social participation and interaction (the importance of the participation of individuals and different social groups, especially vulnerable groups, in social energy projects and energy transition), social acceptance, community and local participation, social welfare, social inclusion (emphasis on the importance of the participation of people with socioeconomic and demographic backgrounds)	[1-10, 12- 15, 17, 19-27, 29, 30-37, 41-47]
Environmental factors	Environmental indicators (energy efficiency, access to clean energy), improving public health and quality of life (using renewable energy and reducing pollution from fossil fuels, increasing the quality of life of individuals through improving environmental conditions, improving the well-being and health of society), reducing greenhouse gas emissions, reducing environmental impacts, waste management (using biomass and other renewable resources), reducing air pollution, managing resources and reducing waste, developing sustainable infrastructure, access to clean transportation, strengthening infrastructure, resilience to climate change	[1-6, 10-15, 17, 19, 21-25, 27-39, 42- 44, 46, 47]
Cultural factors	Well-being and happiness, sense of place (culture and identity), sense of community (attachment to place), culture and citizen perception, empowerment of local communities, preservation of local culture	[8,14, 16, 29, 37]
Economic factors	Economic prosperity, economic well-being, energy poverty reduction, economic development, access to sustainable energy, sustainable job creation, support for innovation and research, economic sustainability, development of new technologies, sustainable business models, vulnerable population economy	[5-15, 19, 20, 22-25, 27, 30, 31, 34, 35, 37, 39, 42, 44, 47]
Political factors	Ensuring energy security, government policies, increasing energy self-sufficiency, preventing crime through environmental design, safety and security, formulating supportive policies, safety and efficiency of energy systems	[1, 3, 6, 8, 19, 25, 26, 30, 32, 39]

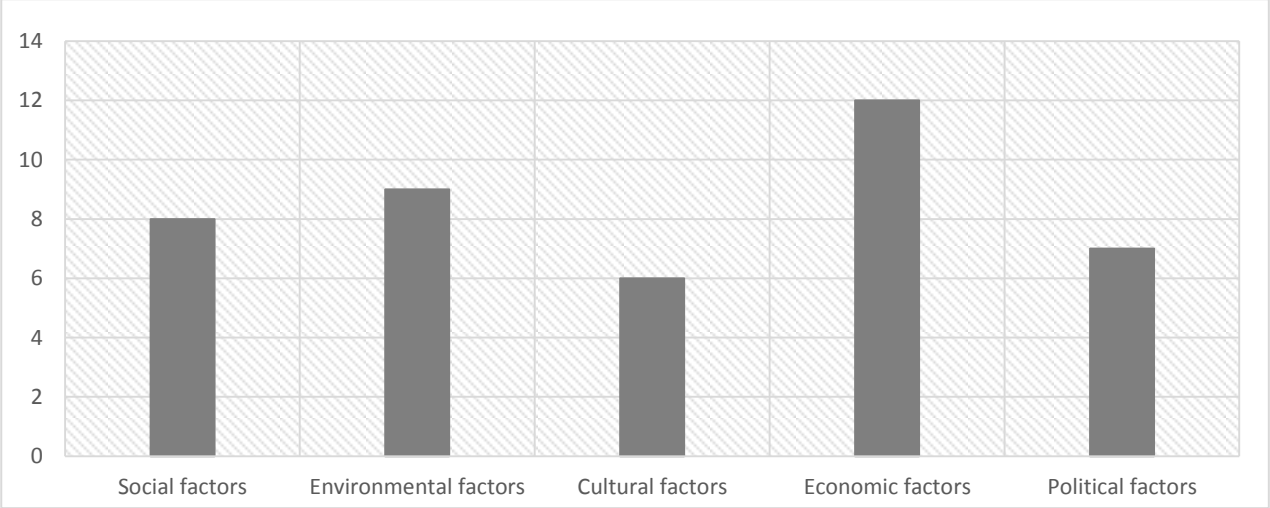

Figure 3. Abundance of the main indicators.

3.6 Presentation of findings

Ultimately, after achieving the obtained results and classifying the indicators, the influential indicators are including social factors, economic factors, environmental factors, cultural factors, and political factors. It is important to consider all components in parallel. In the following sections, each of these indicators will be explained in detail. The findings of this study indicate that environmental, economic, social, cultural, and political indicators each play an important role in promoting the use of renewable energy in urban communities. This result is consistent with

Social awareness and education energy in urban a signific, sustainable urban development is achieved when environmental, social, and economic dimensions are addressed in an integrated manner [10, 6, 8].

Studies have shown that the use of renewable energy not only reduces air pollution and greenhouse gas emissions but also improves quality of life, promotes social justice, and increases citizen participation in urban decision-making processes [4, 5, 14, 15-17]. Additionally, providing educational and education Social factors: have

- energy initiatives [41].
- Community participation**:** Community participation is essential for the success of renewable energy projects. Energy communities, which are local groups managing their own energy resources, can generate greater local income compared to projects managed externally. This platforms and raising public awareness about the benefits of renewable energy can enhance social acceptance and active community participation [15,17]. Ultimately, considering the geographical location and the social and economic conditions of different regions, the importance and priority of the indicators may vary. Therefore, policies and strategies need to be developed in accordance with the local conditions of each region to ensure their effectiveness. *and education*about renewable energy sources play a crucial role in their acceptance. Increasing knowledge about the benefits of renewable energy, such as cost savings, environmental protection, and energy independence, can foster community support and participation in renewable: Public awareness local ownership fosters a sense of responsibility and encourages participation in energy-saving initiatives [42].
- Social justice: This concept emphasizes equality and fairness in access to resources and opportunities, and it is particularly important in the context of renewable energy. It ensures that vulnerable populations benefit from renewable energy initiatives and that existing inequalities in energy access between different socio-economic groups are reduced [10, 12, 15, 16, 19, 22, 25, 34, 42, 43].

Strengthening trust and social Cohesion: Creating strong social previous studies that emphasize the multidimensional nature of urban sustainability and the necessity of simultaneously considering various dimensions in energy policymaking [1, 2, 6, 8-10, 18, 19]. Specifically, as highlighted in the theoretical framework

cohesion, and social inclusion, which will be discussed in detail below.

, community participation, social justice, strengthening trust and social ant and multifaceted impact on the usage of renewable areas. Various studies demonstrate how social dynamics influence the acceptance, implementation, and sustainability of renewable energy projects [41]. These factors include social awareness

- networks and trust among community members can significantly enhance social capital and collaboration in community energy projects. This is especially important in the context of utilizing distributed energy systems, as these systems require active participation and cooperation from community members [12, 19, 34, 35, 42, 43].
- Social Inclusion: This emphasizes the importance of involving individuals from diverse social, economic, and demographic backgrounds in community energy initiatives. This concept is particularly significant in the context of renewable energy and social projects, as it can help reduce inequalities and increase access to energy resources for all segments of society [26, 42].

Economic factors: The use of renewable energy as a key solution for sustainable development in cities is significantly influenced by economic factors. These factors

include the impact on employment, reduction of energy poverty, and the development of new technologies, which will be discussed in detail below [46, 47].

- Impact on employment: Renewable energy initiatives often lead to job creation and economic development in communities. Studies show that renewable energy can generate millions of jobs worldwide and create significant opportunities in local economies. For example, the integration of renewable energy technologies can provide substantial job opportunities, particularly in rural areas, thereby contributing to poverty reduction and economic stability [46, 47].
- Reduction of energy poverty**:** The establishment of energy communities as an innovative strategy to combat energy poverty and increase access to sustainable and affordable energy can have profound impacts on improving living conditions for individuals in various regions. Energy poverty refers to a situation where individuals or households are unable to meet their basic needs due to insufficient access to energy resources. This condition is often more prevalent in rural and low-income areas [34, 42, 47].
- Development of new technologies: The development of new technologies in the field of renewable energy can encourage innovation while addressing social and economic issues. Emphasizing the use of sustainable technologies as a tool for improving social and economic conditions and reducing negative environmental impacts is of particular importance. Furthermore, research and development in hydrogen production technologies and storage systems demonstrate scientific and technological advancements aimed at achieving sustainability goals [15, 22, 23].

Environmental factors: The use of renewable energy in cities is recognized as an effective strategy for reducing negative environmental impacts and addressing climate change. These types of energy sources are prioritized in environmental policies due to their ability to decrease dependence on fossil fuels and reduce air pollution. As such, they are considered one of the fundamental priorities in environmental policymaking [44, 46]. These factors include air pollution reduction, climate change, and access to clean transportation, which will be discussed in detail below.

- Air Pollution Reduction: One of the most significant positive impacts of development usage of renewable energy is the reduction of air pollution. Utilizing clean energy sources such as solar and wind power helps decrease the emissions of greenhouse gases and other pollutants. Studies indicate that as the share of renewable energy in the energy mix of cities increases, air quality improves, leading to a reduction in pollution levels [44, 46].
- Climate change: Climate change, recognized as a global challenge, has heightened the need for sustainable energy solutions. Cities, as centers of population and economic activity, must transition towards the use of renewable energy to achieve their greenhouse gas emission reduction targets. This shift not only contributes to environmental improvement but also enhances the resilience of cities against the impacts of climate change [3, 11].
- Access to clean transportation: Sustainable transportation encourages the use of public transit, cycling, and walking as solutions to reduce pollution and promote social activities. Additionally, the development of hydrogen-based transportation systems can enhance people's access to clean and sustainable vehicles. Accordingly, this can contribute to social justice and reduce inequality in access to sustainable energy resources. These approaches not only preserve the environment but also improve quality of life and promote public health [6, 31, 44].

Cultural factors: Sustainable social development requires attention to cultural factors, which can have profound impacts on how communities participate and interact in planning processes. These factors play a crucial role in sustainable social development. Effective public participation necessitates a deep understanding of local cultures and consideration of diverse needs and priorities. For success in this area, governments and organizations must respect cultural diversity and utilize it as a rich resource for sustainable development [7]. The following discussion will examine the impacts of culture and citizen perception on the preservation of local culture.

- Citizen culture and perception: Citizen's culture and perceptions of sustainable cities play a fundamental role in their behaviors and choices across various urban contexts. This topic highlights the relationship between cultural identity and sustainable development, which can contribute to the formation of balanced and sustainable communities. Understanding how cultural factors influence citizen engagement is essential for creating effective urban policies that resonate with the community's values and needs. By fostering a strong connection between cultural identity and urban development, cities can enhance their sustainability efforts and promote a sense of belonging among residents [8, 16, 29].
- Preservation of local culture: Hydropower projects, as a renewable energy source, can have profound impacts on local communities. These effects encompass not only economic and environmental changes but also significant cultural and social dimensions. Attention to these cultural impacts and efforts to protect the cultural and social heritage of local communities are considered a key component of sustainable social development. By recognizing the importance of cultural preservation in the context of hydropower development, stakeholders can ensure that the benefits of such projects are equitably distributed while safeguarding the unique identities and traditions of affected communities [37].

Political factors: Sustainable social development is significantly influenced by political factors. Appropriate policies can facilitate the adoption of renewable energy while simultaneously addressing existing challenges. Therefore, collaboration among governments, communities, and the private sector is essential to create a suitable political framework. This cooperation can lead to the development of effective strategies that promote sustainability, enhance public engagement, and ensure that the benefits of renewable energy initiatives are widely shared across society [2]. The following discussion will focus on energy security and safety.

- Ensuring energy security: Ensuring energy security through diversification of energy sources and reducing dependence on fossil fuels is considered another indicator of social sustainability. This approach not only helps provide sustainable and accessible energy for communities but can also lead to improved social and economic conditions, particularly in remote areas. As a result, diversifying energy sources and decreasing reliance on fossil fuels not only enhances energy security but also contributes to the improvement of quality of life and the sustainable development of communities [2, 47].
- Safety and Security: The design of urban spaces should be carried out in a way that ensures the safety and security of residents. This significantly impacts the quality of life and the sense of comfort in public spaces. Additionally, utilizing local and renewable energy sources can help reduce dependence on imported fossil fuels and enhance energy security. This aspect is particularly important in areas that require sustainable energy solutions. By prioritizing safety in urban design and-promoting the use of renewable energy, communities can foster a more secure and resilient environment for their inhabitants [6, 19, 32].

4. Conclusion and suggestions

This research focuses on identifying indicators of social sustainability and providing strategies for promoting the use of renewable energy in urban communities through a scoping review method. To this end, relevant studies on social sustainable development and renewable energy in urban areas were selected using the specified research method. After filtering these studies, a total of 48 articles were analyzed. The findings indicate that indicators related to environmental, social, economic, cultural, and political aspects play a significant role in the usage level of renewable energy, with an emphasis on social sustainable development. These indicators influence each other both directly and indirectly. According to the findings, it can be said that environmental factors rank first, which include (reducing air pollution, climate change, natural resource management, using renewable resources and reducing dependence on fossil fuels, access to clean transportation). Additionally, the results showed that economic indicators rank second and social indicators rank third.

Moreover, the indicators for social factors (social awareness and education, community participation, social justice, strengthening social

trust and cohesion, social inclusivity), economic factors (impact on employment, reduction of energy poverty, access to sustainable energy, development of new technologies), cultural factors (citizens' culture and perception, protection of local culture), and political factors (ensuring energy security, safety and security) play a crucial role in the development of renewable energy usage. The last two categories include political and cultural factors that have been considered important in developing the use of renewable energies. Therefore, based on the findings of this study, the following suggestions related to the identified indicators can be proposed for maximizing the use of renewable energy based on the social sustainability development in urban communities:

- Public education and awareness: Holding workshops and educational programs to raise citizens' awareness about the benefits of renewable energy and how to utilize them towards increasing social acceptance and active citizen participation in renewable energy projects.
- Local community participation: Encouraging local communities to participate in the management and implementation of renewable energy projects through the establishment of local energy cooperatives. Strengthening the sense of ownership and accountability among citizens and enhancing their satisfaction with the projects.
- Social justice and access to sustainable energy: Designing policies that ensure equitable access to renewable energy for all segments of society, especially vulnerable groups. In the way of reducing social and economic inequalities and improving the quality of life for all.
- Development of new technologies: Investing in research and development of innovative technologies such as hydrogen production from renewable sources. Reducing dependence on fossil fuels and creating sustainable and reliable energy systems.
- Developing supportive policies: Formulating and implementing government policies that support the development of renewable energy, such as tax incentives and subsidies. Facilitating the acceptance and expansion of renewable energy in urban communities.

The use of renewable energy in urban communities not only contributes to improving environmental conditions but can also serve as a powerful tool for achieving social sustainable development goals. By implementing the proposed strategies, it is possible to create more sustainable, equitable, and resilient communities in the face of climate change.

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