ECONOMIC RESEARCH FORUM

The Role of MSMEs in Fostering Inclusive & Equitable Sustainable Economic Growth

in the Context of the Clean Energy Transition in MENA

Tunisia Qualitative Report

Perceptions of Energy Transition by Tunisian MSMEs:

What is Going Wrong?

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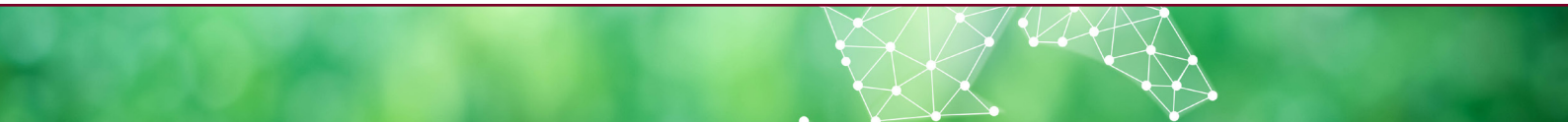
Country Qualitative Reports provide a deeper look into qualitative analysis and narrative of the qualitative survey conducted under the project. To complement the quantitative findings, the project team conducted qualitative surveys, including in-depth interviews with experts and relevant stakeholders, alongside focus group discussions specifically with MSMEs. These qualitative reports offer insights into local challenges, sustainable practices, and employment opportunities, emphasizing inclusivity and gender equity. The qualitative data reports for Egypt, Jordan, Tunisia and Sudan provide a focused perspective on the contributions of MSMEs to an equitable clean energy transition across the MENA region.



Perceptions of energy transition by Tunisian MSMEs: What is Going Wrong?

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Abstract

This study provides an in-depth qualitative examination of the perspectives and experiences of micro, small, and medium enterprises (MSMEs) regarding the energy transition in Tunisia. Through in-depth interviews, this study explores the diverse perceptions and challenges faced by MSMEs amidst Tunisia's progressive shift towards sustainable energy practices. The country's strategic goals of reducing primary energy consumption by 30% and achieving 35% renewable electricity generation by 2030 serve as a backdrop for analyzing MSMEs' responses and adaptations to these ambitious targets. The research reveals a spectrum of awareness of energy sustainability issues among MSMEs, their diverse engagement with renewable energy sources, and the complex balance of economic and environmental considerations influencing their transition processes. The research identifies significant barriers, such as bureaucratic complexity, the need for sector-specific strategies, and limitations related to financing and technology. A key aspect of the study is the recognition of the critical influence of government policy and strategic planning in supporting this transition. The findings highlight the critical role of refined administrative procedures and improved education and awareness initiatives in encouraging MSMEs to adopt renewable energy practices. Strategically, the analysis argues for greater involvement of MSMEs in the energy transition, suggesting a proactive stance in policy formulation and adoption of renewable technologies. For policymakers, the study advises a tailored approach to address the unique challenges faced by MSMEs and promote policies that not only facilitate the energy transition, but also address the specific needs of MSMEs. The study provides a comprehensive qualitative insight into the complex dynamics of Tunisia's energy transition from the perspective of MSMEs. It provides a set of actionable recommendations aimed at refining the transition process, emphasizing the formulation of clear, supportive government policies, the implementation of sector-specific strategies, the provision of financial incentives, the simplification of administrative procedures, and the establishment of comprehensive awareness and education campaigns. These recommendations aim to create an enabling environment for MSMEs to become key actors in Tunisia's quest for a sustainable energy future.

Keywords: energy transition, renewables, Tunisia, sustainability, qualitative analysis

JEL Classification: O13, P28, Q42, Q43

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Terms of references:

Under the ERF NPIO project on: The Role of MSMEs in Fostering Inclusive and Equitable Sustainable Economic Growth in the Context of the Clean Energy Transition in MENA, funded by the IDRC, the Grantee will write a case study on Tunisia. The case study will aim to understand what factors would affect energy transition in Tunisia the most; access to finance, demand for skills and regulatory frameworks, and how they affect the performance of MSMEs that account for the bigger share of the private sector and job creation in the country.

In addition, the grantee will be offering intellectual and technical guidance and support in designing the survey for the quantitative data collection as well as in developing the interviews and focus group discussions guides for the qualitative data collection. This includes taking part in developing the common module of the survey as well as working with the ERF team in developing the country specific modules.

Outline

1. Introduction

Tunisia has embarked on a strategic energy transition to mitigate the effects of climate change and promote sustainable growth. The country's commitment to reduce primary energy demand by 30% and generate 35% of its electricity from renewable sources by 2030 reflects a proactive stance on environmental protection. In addition, the goal of reducing greenhouse gas emissions by 45% from 2010 levels by 2050, with the goal of achieving climate neutrality, demonstrates Tunisia's commitment to a sustainable future.

However, this transition is not just a change in energy sources, but represents a broader paradigm shift in the country's economic and socio-political landscape. At this critical juncture, Tunisia's energy sector faces the challenge of balancing two dominant narratives: one rooted in neoliberal green extractivism that emphasizes resource exploitation for export, and the other that advocates a just, democratic, and community-centered approach to energy projects. This dichotomy requires careful navigation through complex, often competing stakeholder interests, making decision-making a delicate endeavor.

The concept of "just transition" is integral to this process, envisioning a transformative path toward economies that are not only environmentally sustainable, but also socially just. This approach goes beyond traditional environmental concerns to address historical and contemporary issues of gender, race, class, and other forms of social inequality. It emphasizes a multidimensional form of justice - procedural, redistributive, and restorative - and encompasses interactions at local, national, and international levels.

As part of the IDRC-funded ERF NPIO project, this case study of Tunisia seeks to unravel the complex dynamics affecting the energy transition, with a particular focus on MSMEs. These businesses are central to the Tunisian economy, accounting for a significant share of the private sector and job creation. The study aims to identify the impact of factors such as access to finance, demand for skills, and the regulatory framework on these businesses and their role in the energy transition.

In the broader economic context, Tunisia has experienced fluctuating growth rates, with a slowdown after 2010, exacerbated by the COVID-19 pandemic. These challenges are particularly exacerbated in the energy sector, where, despite declining economic growth, energy consumption patterns have not met expectations, indicating inefficiencies and a disconnect between economic activity and energy use. This scenario is particularly pronounced in the MSMEs sector, where limited investment in energy efficiency and scale-up challenges hinder progress towards more sustainable practices.

Politically, Tunisia has shown a proactive approach to energy management since the mid-1980s, with policies and legal frameworks supporting investments in energy efficiency and renewable energy. However, despite these efforts, the path to a truly sustainable energy landscape remains fraught with challenges, including bureaucratic inertia, limited public and private investment, and a complex international context.

This report, based on qualitative research, explores these dimensions, using advanced data analysis tools and methodologies to provide a comprehensive understanding of the MSMEs perspective on Tunisia's energy transition. It delves into the nuances of awareness, perceptions, challenges and opportunities as experienced by different stakeholders, offering a multifaceted view of the complexities of the transition process and potential pathways forward.

2. The Context of Tunisia

In the first half of 2023, Tunisia experienced a further slowdown in its modest economic recovery, exacerbated by the impact of a severe drought, unpredictable financing conditions, and the gradual implementation of the reforms planned by the government. It is pertinent to note that this period was also marked by political challenges that exacerbated the situation. The country's agricultural sector suffered from the persistence of below-average rainfall for the sixth consecutive year; in the first half of 2023, the sector's value added contracted by 9% in real terms compared to the corresponding period in 2022 (World Bank, 2023). This adverse event has added to the complexity of an already arduous recovery process. The momentum of the recovery has been hampered by uncertainties in external financing and persistent regulatory barriers to growth. These include restrictive entry requirements in various sectors, arbitrary and strict foreign exchange controls, and the entrenchment of incumbents, all of which have not been addressed by reforms.

As a result, the Tunisian economy grew by only 1.2 percent in real terms in the first half of 2023, half the growth rate in 2022 and nearly a quarter of the growth rate in 2021 (4.4 percent) (World Bank, 2023). Tunisia's real GDP remains below pre-pandemic levels, and the country's economic recovery has been much more modest than in other MENA countries. The worsening effects of the drought led to a particularly pronounced economic slowdown in the second quarter of 2023. Real GDP contracted by 1.3% from the first to the last quarter, the largest quarterly decline since the pandemic. Nevertheless, this contraction was still smaller than those experienced in the second quarter of 2018 (by 0.6%) and the second quarter of 2019 (by 2.3%) (World Bank, 2023).

The Tunisian economy is predominantly characterized by very small enterprises (VSEs), also known as microenterprises. These businesses make minimal investments in energy efficiency and rarely achieve significant economies of scale. Despite these challenges, VSEs serve as a critical economic engine for the country, contributing significantly to both job and value creation. They account for 50 percent of Tunisia's GDP and provide nearly 70 percent of private sector employment (Arouri et al., 2018). The structural configuration of the economy leads to inefficiencies, as firms targeting a limited market produce in small quantities, which hinders their ability to achieve economies of scale. In addition, the implementation of energy efficiency measures in VSEs is limited, due to their relatively high operating costs and the low responsiveness of firms to these issues.

Statistics show that by the end of November 2023, primary energy resources stood at 4.1 million tons of oil equivalent (Mtoe), a 5% decrease compared to the same period of the previous year, as documented by the Ministry of Industry, Mines and Energy (2023). This decline is primarily due to a decrease in domestic production of crude oil and natural gas. Despite this decline, domestic oil and gas production still represents a significant majority of Tunisia's primary energy resources, accounting for 73% of the total. On the other hand, the share of renewable energy, specifically from the production of the Tunisian Electricity and Gas Company (STEG), in the total primary energy resources remains significantly low, contributing only 1%. It's also worth noting that the royalties generated by the transit of Algerian gas through Tunisia decreased by 3% at the end of November 2023 compared to the same period in 2022, according to the Ministry of Industry, Mines and Energy (2023).

The demand for primary energy decreased by 4% from the end of November 2022 to the end of November 2023: the demand for natural gas decreased by 4%, while the demand for petroleum products decreased by 3%. The 4% reduction in the demand for natural gas is directly attributable to the reduction in the procurement of Algerian gas, which is due to regulatory adjustments and not to unilateral actions by either Algeria or Tunisia. STEG has resorted to electricity imports to meet all of the country's electricity needs. The distribution of primary energy demand has remained unchanged, with the share of oil products remaining stable at 48% between the end of November 2023 and the end of November 2022. Similarly, the share of natural gas remained constant at 52% during the same period (Ministère de l'Industrie, des Mines et de l'Energie, 2023).

Throughout the period from 2011 to 2021, energy subsidies represented 2.14 percent of GDP and accounted for an average of 6.4 percent of public spending in Tunisia. These subsidies represented a significant fiscal burden. In 2022, there was a notable increase in energy subsidies, which accounted for 5.3 percent of GDP and 15 percent of public expenditure. This increase was largely driven by the escalation in global commodity prices, underscoring the strong correlation between subsidies and the international price of oil, the exchange rate, and Tunisia's increasing dependence on imported energy. In contrast to the situation in 2010, when imports accounted for only 7% of the country's energy consumption, the figure escalated to 50% of demand in 2022 (World Bank, 2023).

The green transition is also harmed by risks related to STEG's financial viability; artificially low energy prices financed by subsidies. When it comes to private investments in renewable energy, STEG is in charge of integrating renewable energy sources into the transportation network in addition to purchasing electricity. As a result, its ability to purchase electricity from independent producers of renewable energies is compromised by its financial crisis. Furthermore, low electricity costs linked to energy subsidies directly lessen private incentives for renewable energy investment. In fact, the savings from producing renewable energy are commensurate with the current cost for self-producers.

The modest growth of Tunisian renewable production was partly due to these deterrent factors. Tunisia, which has had relatively little progress over the past ten years in comparison to countries like Morocco, Jordan, Turkey, or Kenya with similar geo-climatic conditions, was among those with the lowest shares of renewable energies in the production of electricity in 2021. Similar to this, cheap fuel has hindered investments in green and energy-efficient technologies, particularly in the transportation, building, and industrial sectors, undermining Tunisia's overall green transition.

3. Literature review and theoretical framework

3.1. Global and regional context of energy transition

The global energy transition marks a significant shift in energy production, consumption, and management strategies, driven primarily by the urgent need to address climate change and achieve sustainable development goals. This transition involves a comprehensive movement away from traditional fossil fuel-based energy systems to more sustainable alternatives, including solar, wind, hydro, geothermal, and bioenergy sources. The drivers for this transformative change are complex and multifaceted, including the need to reduce global greenhouse gas emissions, as set out in

international frameworks such as the Paris Agreement, and to mitigate the environmental impacts associated with energy production and consumption. Thank you for your feedback. We've revised our report to include bioenergy as a key sustainable energy source and expanded our discussion to include the broader socioeconomic benefits of energy transition, such as job creation, energy diversification, reduced import dependence, and improved social welfare.

Furthermore, the energy transition is recognized for its potential to generate multiple benefits beyond environmental sustainability. These include the creation of employment opportunities, the diversification of energy sources that enhances energy security, the reduction of dependence on energy imports that improves national trade balances, and the provision of significant social benefits. These social benefits are manifested in improved air quality and public health, increased access to energy in remote and underserved communities, and the strengthening of economic resilience and sustainability.

The Paris Agreement, a landmark international treaty adopted in 2015, plays a pivotal role in shaping global energy policy. It aims to limit global warming to well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 degrees Celsius. Achieving these goals will require significant reductions in global greenhouse gas emissions, with the deployment of renewable energy as a key strategy. The agreement's emphasis on Nationally Determined Contributions (NDCs) encourages countries to define and pursue national emission reduction targets, which invariably include energy transition strategies.

In the MENA region, with its significant fossil fuel reserves, the energy transition is influenced by both global climate commitments and regional dynamics. The region faces the dual challenge of sustaining economic growth that has traditionally relied on fossil fuel exports, while transitioning to more sustainable energy sources. The region's abundant solar and wind resources present significant opportunities for renewable energy development, which could potentially reshape the region's energy landscape and contribute to global efforts to combat climate change.

Focusing on Tunisia, its energy transition strategy is integral to the country's broader economic and environmental goals. Tunisia's commitment to reducing greenhouse gas emissions and transitioning to renewable energy is evident in its national policies and strategic plans. The Tunisian government has set ambitious targets to reduce primary energy demand by 30% and generate 35% of its electricity from renewable sources by 2030. In addition, Tunisia aims to reduce greenhouse gas emissions by 45% from 2010 levels, with the ultimate goal of achieving climate neutrality by 2050.

Tunisia's proactive engagement in energy management since the mid-1980s has provided a solid foundation for its ongoing energy transition efforts. The evolution of the country's policies to include a wide range of renewable energy initiatives is highlighted by the adoption of significant legislation, including the Energy Management Law of 2004 and the Renewable Energy Law of 2015. These legislative measures reflect Tunisia's commitment to reducing energy intensity, reducing reliance on imported fossil fuels, and asserting its position as a renewable energy leader in the region.

Despite this progress, the Tunisian economy faces unique challenges that affect its energy transition trajectory. One major hurdle is the significant role of MSMEs, including Very Small Enterprises (VSEs), in its economic fabric. These entities are instrumental in generating employment and contributing to gross domestic product (GDP). However, their limited operational capacity often limits significant investment in energy efficiency and renewable energy technologies. The market dynamics prevalent

among MSMEs also often do not support the economies of scale needed for effective energy conservation and efficiency improvements.

In terms of economic indicators, Tunisia's GDP growth rate has fluctuated from an average annual growth of about 4.2% between 2000 and 2010 to a slower pace of 1.7% between 2011 and 2019. The COVID-19 pandemic exacerbated the economic challenges, leading to a GDP contraction of 8.8% in 2020. The trajectory of GDP per capita reflects these economic changes, with an overall increase until 2011, followed by a period of stability and then a decline since 2016 due to factors such as political instability, lack of public and private investment, and unfavorable international conditions.

The contribution of the energy sector to the Tunisian economy and its evolving energy balance also reflect these challenges. In 2020, the oil and gas extraction sector accounted for 2.5% of GDP, with national hydrocarbon production covering 43% of national energy consumption. The energy balance showed a slight improvement in the deficit in 2020 compared to 2019, from a deficit of 54.8% to 53.6%, mainly due to lower consumption. However, in 2021, despite an increase in consumption, the deficit improved to 51.3% due to an increase in production.

Tunisia's energy transition journey is embedded in a multifaceted global and regional scenario characterized by its specific socio-economic characteristics, a forward-looking energy policy framework and ambitious sustainability goals. This positioning places Tunisia at a pivotal point in the global transition towards sustainable energy systems. By addressing the specific challenges faced by its MSMEs, and capitalizing on its comprehensive policy and regulatory structures, Tunisia is poised to make a significant contribution to both regional and global efforts to transition to a more sustainable and resilient energy paradigm. This approach underscores the importance of aligning national energy strategies with broader sustainable development goals, thereby enhancing Tunisia's potential impact on global sustainability outcomes. MSMEs

3.2. Theoretical perspectives on energy transitions and MSMEs

The study of energy transitions, with a special focus on MSMEs, draws on a variety of theoretical perspectives. Among these, Ecological Modernization Theory (EMT) stands out for its advocacy of reconciling environmental sustainability with economic growth. It posits that technological innovation is critical to eco-efficiency and provides an important lens through which to examine the potential of MSMEs to achieve both environmental goals and economic benefits (Mol, 2002; Jaffe et al., 2002).

Transition Management Theory (TMT) adds another dimension by emphasizing the governance of sustainable transitions. It introduces a multilevel perspective and identifies MSMEs as niche actors that can drive innovation in sustainable practices (Kemp et al., 2007). This theory underscores the central role of MSMEs in pioneering and scaling up new energy solutions, thereby marking them as key contributors to the transition to sustainable energy systems.

The Resource-Based View (RBV) of the firm also provides important insights, focusing on internal resources and capabilities as the basis for competitive advantage (Barney, 1991). In the context of energy transitions, the agility, adaptability, and innovative capacity of MSMEs are seen as strategic assets that enable them to navigate and exploit the evolving energy landscape (Hart, 1995). The institutional theory also sheds light on how regulatory frameworks, societal norms, and cognitive structures shape organizational strategies. It examines how MSMEs adapt to and interact with energy

transition policies, highlighting the influence of the institutional environment on their strategic responses to energy transition challenges and opportunities (Scott, 1995).

3.3. The role of MSMEs in the energy transition

MSMEs play an important and diverse role in the energy transition, often leading the way in the innovation and adoption of renewable energy technologies. Their inherent flexibility and market responsiveness position them as integral agents of change (Cohen and Winn, 2007). MSMEs' strong ties to local communities and markets provide them with unique insights into specific energy needs, facilitating the development of tailored and innovative energy solutions (Pinkse and Groot, 2015). Nonetheless, MSMEs face specific hurdles in the energy transition, particularly limited access to finance, which hampers their ability to invest in new technologies and sustainable practices (Ayyagari et al., 2011). In addition, the complicated regulatory landscape they navigate often presents significant barriers that affect their active engagement in the energy transition (Beck et al., 2005).

Academic literature highlights the need for policy interventions specifically designed to support MSMEs in the energy transition. This includes financial incentives, technical assistance, and regulatory adjustments that consider the specific characteristics and needs of MSMEs (Blok et al., 2015). Such targeted policies are critical to enabling MSMEs to overcome existing barriers and fully participate in the energy transition.

These theoretical frameworks, taken together, shed light on the complex role that MSMEs play in the energy transition. They highlight the need for a holistic approach that includes technological innovation, strategic resource management, and adaptive policymaking. As the global energy paradigm continues to evolve, the importance of MSMEs in this transformative process is increasingly recognized, necessitating comprehensive strategies to strengthen and harness their contribution to a sustainable energy future.

4. Methodology

4.1. Research design and approach

This research is grounded in a qualitative paradigm, specifically tailored to explore the intricate perspectives and lived experiences of MSMEs, in Tunisia as they navigate the complexities of the energy transition. The study's qualitative design is instrumental in unraveling the nuanced layers of participants' perceptions, attitudes, and understandings that are often embedded in their narratives and not readily accessible through quantitative methods.

The core of our qualitative research is the use of NVIVO version 14, an advanced qualitative data analysis software. This tool facilitates a comprehensive and systematic examination of the interview data. The research methodology includes lexical and frequency analyses of the interview transcripts, techniques that are integral to identifying and quantifying the prevalence of key terms, phrases, and concepts. This analytical approach allows for an informed understanding of the recurring themes and patterns that emerge from the participants' discussions.

Lexical analysis allows for the dissection of the complex language and terminology used by respondents, shedding light on their cognitive frameworks and the semantic contexts within which they discuss the energy transition. This method proves invaluable in uncovering the subtle and intricate meanings that participants associate with their experiences and viewpoints.

Frequency analysis also adds a quantifiable layer to the study, providing the means to measure the importance and prevalence of certain themes and ideas within the collected data. This aspect of the analysis is essential for distinguishing between the most important issues and concerns expressed by MSMEs, and those insights that are less frequently mentioned but may be of significant importance.

The comprehensive research design and methodological approach are carefully crafted to ensure a deep, detailed and authentic examination of MSMEs' experiences with the energy transition in Tunisia. By combining qualitative methods with advanced analytical tools, the study aims to make a significant contribution to the body of knowledge and enrich our understanding of the myriad challenges and opportunities that characterize the energy transition landscape.

4.2. Participant selection and profiles

In this study, the selection of participants was strategically carried out through purposive sampling to ensure a comprehensive representation of different sectors relevant to the energy transition in Tunisia. The sample consisted of 34 individuals, with a gender distribution of 26 men and 8 women, providing a wide range of perspectives that enriched the research findings.

The participant profiles include:

- **Researchers and experts (23.53%):** This group consists of academics and consultants who offer insights from a theoretical and practical standpoint on sustainable finance, energy strategy and environmental policy, contributing significantly to the understanding of the dynamics of the energy transition.
- **Banking and Finance (14.71%):** Banking and finance professionals provide essential perspectives on the economics of the energy transition. Their views are critical to understanding the financial challenges and opportunities of renewable energy adoption, especially for MSMEs.
- **Non-governmental organizations (NGOs) (5.88%):** NGOs representatives offer a perspective that emphasizes the societal and environmental impacts of energy policies. Their perspectives are critical to understanding the broader implications of the energy transition beyond the business sector.
- **Government officials (8.82%):** The participants from government departments provide insight into policy-making processes, strategies and regulatory aspects. They play a key role in understanding how government actions facilitate or hinder the energy transition.
- **MSMEs, including VSEs (47.06%):** As the main focus of the study, these small to very small business participants provide practical insights into the direct impact of the energy transition on businesses. Their experiences and challenges are critical to understanding the realities and practicalities of implementing renewable energy solutions in a business context.

The diversity of participants' profiles, including different ages, genders, and professional backgrounds, ensures a well-rounded and in-depth exploration of the energy transition in Tunisia. This approach allows the study to capture a wide range of experiences and viewpoints, providing a rich and nuanced understanding of the challenges, opportunities, and dynamics of the energy transition as it relates to MSMEs in the Tunisian context.

4.3. Data collection methods and analysis

The methodological framework for data collection in this study was carefully designed to capture a holistic view of MSMEs' perceptions of the energy transition in Tunisia. This methodology included several steps:

- **Interview preparation:** Through extensive brainstorming sessions with domain experts, a comprehensive interview guide was formulated. This guide was aligned with the academic literature and previous studies to ensure the relevance and thoroughness of the questions posed. It covered a wide range of topics, including participants' awareness of key energy and environmental sustainability indicators, their perceptions and understanding of renewable energy, their assessment of the progress of energy transition within Tunisian MSMEs, and their opinions on government energy policies. In addition, it explored the identification of opportunities and challenges faced by MSMEs during the energy transition and gathered recommendations for accelerating this transition in Tunisia. Questions also aimed to assess the involvement of institutions in the energy transition, its impact on employment and gender disparities, and the current use of renewable energy sources.
- **Interview process:** Semi-structured interviews were the primary method of data collection. This approach allowed for a flexible dialogue that allowed participants to freely articulate their thoughts while ensuring a consistent structure across all interviews. The semi-structured format facilitated a deep dive into participants' views, providing nuanced and detailed perspectives.
- **Data analysis techniques:**
    - *NVIVO analysis*: Transcribed interviews were methodically coded using NVIVO software, which facilitated the identification and classification of emerging key themes and patterns, allowing for a structured and comprehensive analysis of the qualitative data.
    - *Lexical analysis*: This analysis examined the frequency and context of specific terms and concepts related to the energy transition within the interviews. It highlighted the dominant themes and terminologies articulated by the participants, providing insights into the most critical aspects of the energy transition for MSMEs.
    - *Thematic analysis*: This analysis distilled the commonalities and differences in the perceptions and experiences of different participant groups. It was instrumental in uncovering overarching themes and unique insights from the diverse cohort of participants.
    - *Literature cross-reference*: Findings were validated and contextualized through cross-referencing with existing academic literature, situating the study's findings within the broader discourse on energy transition and the specific challenges and opportunities for MSMEs in Tunisia.

This methodological strategy proved crucial in elucidating the complex, multifaceted perspectives of Tunisian MSMEs on the energy transition. Through the use of qualitative data analysis tools and thematic exploration, the study provides valuable insights that contribute to a comprehensive understanding of how MSMEs in Tunisia are maneuvering through the complexities of the energy transition.

5. Main Findings

5.1. Awareness and perceptions of energy transition

5.1.1. Knowledge of energy and sustainability entities

When considering the familiarity with different energy and sustainability entities among different respondent groups, a detailed analysis reveals certain patterns, presented in percentages. The National Agency for Energy Management (ANME) is recognized by 94.12% of all respondents, underscoring its significant role in various sectors. This notable recognition likely reflects ANME's pivotal position in Tunisia's energy landscape, highlighting its broad influence and possibly its extensive operational impact across the country.

The focus then shifts to the National Energy Management Fund (FNME), which is known to 44.12% of respondents. There is a marked difference in familiarity among researchers and experts, with 62.5%, compared to 31.25% among micro, small and medium enterprises (MSMEs), including very small enterprises (VSEs). This gap suggests a stronger engagement of FNMEs with segments more directly involved in energy management, and a lower degree of interaction or visibility within the MSME sector.

Regarding the Energy Transition Fund (ETF), 47.06% of respondents are aware of its initiatives and objectives in promoting energy transition. This entity receives notable recognition among researchers, experts, and NGOs, with awareness rates of 75% and 100%, respectively, compared to a significantly lower 18.75% among MSMEs. Such figures may reflect the alignment of FTE's activities with the specific interests of these groups, particularly with regard to energy transition efforts.

The Program for Energy Efficiency and Substitution (PEESE) registers an awareness level of 35.29% among respondents, with a pronounced awareness level of 75% among researchers and experts and 50% among NGOs. This level of awareness may speak to the engagement or interest of these groups in projects related to energy efficiency and sustainability, suggesting a need to increase the visibility and impact of PEESE in other sectors.

Finally, the Energy Audit Program (PAE) is recognized by only 14.71% of respondents, which is the lowest level of awareness among the entities surveyed. Its particularly low recognition among government officials and NGOs suggests either limited exposure or a relatively new role in the energy and sustainability discourse. MSMEs MSMEs MSMEs

The analysis reveals varying degrees of familiarity with energy and sustainability agencies among different categories of respondents. A particularly high level of awareness of the National Agency for Energy Management (ANME) among various groups, including unanimous recognition from NGOs, government officials, and MSMEs, highlights the significant reach of ANME and its central role in Tunisia's energy sector. This widespread recognition suggests that ANME has successfully engaged in a wide range of energy-related activities, from policy development to implementation, and has

effectively reached a diverse audience. ANME's pervasive impact likely benefits from its collaborative efforts with various sectors, increasing its visibility and importance in the national energy conversation.

Conversely, the National Energy Management Fund (FNME) and the Energy Transition Fund (FTE) exhibit more variable levels of awareness, with significantly higher awareness among researchers, experts, and NGOs. This variance may reflect the specialized focus of these entities, which are more aligned with the professional and research interests of those involved in energy research, sustainability initiatives, and policy advocacy. The relatively lower level of awareness among MSMEs suggests a potential gap in information dissemination to the broader business sector, particularly smaller businesses that may not be directly engaged in energy management practices.

The limited awareness of the Program for Energy Efficiency and Substitution (PEESE), and especially the Energy Audit Program (PAE), among all groups except researchers, experts, and NGOs prompts reflection on the outreach and communication strategies of these initiatives. This suggests an imperative for these programs to increase their visibility and interaction, especially with MSMEs, which play an essential role in widespread energy efficiency and sustainability efforts. The lack of awareness of PAE, despite its critical role in facilitating energy audits to increase efficiency and cost savings for businesses, represents an overlooked opportunity.

These disparities in entity awareness point to the need for tailored communication and engagement tactics that address the different needs and interests of different groups. It is clear that more concerted efforts are needed to increase awareness and understanding of the functions and offerings of these entities, particularly among MSMEs and government officials. Increasing such awareness is critical to fostering a more inclusive, well-informed discourse on energy and sustainability issues, which could potentially stimulate greater participation and cross-sector collaboration in Tunisia's energy transition efforts. MSMEs MSMEs MSMEs MSMEs

5.1.2. Understanding of renewable energy properties

An analysis of the understanding of the properties of renewable energy among different professional groups shows that while familiarity with clean energies is widespread, the depth of knowledge of their specific properties varies considerably.

Among the total population, solar energy is the most recognized, with 52.94% of respondents mentioning it, underscoring its importance in the renewable energy sector. Wind energy follows with 41.18%, reflecting its importance as a key renewable resource. However, other renewable sources such as water, geothermal and biomass are mentioned less frequently, with 11.76%, 8.82% and 5.88% respectively. This disparity suggests a more concentrated focus on mainstream renewables in public and professional discourse.

There's a remarkable depth of understanding among researchers and experts, as evidenced by 62.5% mentioning solar and 50% mentioning wind. This indicates a high level of engagement with these technologies. The banking and finance sector shows a similar trend, with high recognition of solar (60%) and wind (40%) energy, likely driven by the economic and investment potential in these sources.

For NGO representatives, solar energy is unanimously recognized (100%), indicating its practicality and applicability in their field of work. Government officials also show broad awareness, with 66.67%

mentioning solar and 33.33% mentioning wind, reflecting their need for a broad understanding for policy formulation.

MSMEs focus primarily on solar (50%) and wind (43.75%). This indicates the increasing accessibility and feasibility of these technologies for smaller businesses, driven by economic considerations and market dynamics.

Digging deeper into the implications of these findings, it's clear that the widespread familiarity with solar and wind energy across different professional groups reflects the current global emphasis on these sources. Solar energy, mentioned by more than half of respondents, and wind energy, recognized by a significant proportion, are clearly at the forefront of the renewable energy conversation. This trend is consistent with the global push toward more sustainable and cleaner energy sources, where solar and wind have become synonymous with renewable energy due to their increasing viability and decreasing costs.

The less frequent mentions of hydropower, geothermal, and biomass, despite their potential as sustainable energy sources, suggest a gap in awareness or focus within the broader renewable energy discourse. This gap suggests an opportunity to increase the visibility and understanding of these alternative renewable energy sources, which could be critical in diversifying the energy mix and addressing specific regional or situational energy needs.

For professionals in fields such as research, banking, and NGOs, the emphasis on solar and wind energy may be driven by the priorities of their respective fields. Researchers and experts who show a deeper engagement with solar and wind technologies may be influenced by the current academic and scientific focus on these areas. In contrast, the recognition of these energies by the banking and financial sector is likely to be driven by their growing role as profitable investment areas due to favorable government policies and market trends.

The unanimous recognition of solar energy by NGO representatives is indicative of its practicality for grassroots and community projects, where ease of implementation and immediate benefits are key factors. For government officials, the balanced recognition of different energy sources reflects the need for a comprehensive policy perspective that considers different energy options.

The focus of MSMEs primarily on solar and, to a lesser extent, wind energy highlights the scalability and practicality of these sources for small and medium-sized enterprises. This trend is likely driven by economic considerations, such as the cost-effectiveness and ease of integrating these technologies into existing business models.

The varying degrees of familiarity with different renewable energy sources across professional groups underscore the need to broaden the scope of renewable energy education and discourse. Expanding this focus beyond solar and wind to other viable sources such as hydropower, geothermal, and biomass can contribute to a more inclusive and comprehensive approach to the energy transition that addresses diverse energy needs and contexts.

5.2. Advantages and challenges in adopting renewable energies

5.2.1. Economic and environmental considerations

Examining the economic and environmental aspects of renewable energy deployment in Tunisia reveals a variety of professional perspectives, each offering unique insights into the benefits and challenges. This analysis is based on the views of respondents from different sectors.

Recognizing the economic benefits of renewable energy, 58.82% of the total respondents consider financial incentives to be crucial. A striking example comes from a 37-year-old consultant in the field of sustainable development, who sees renewable energy as an opportunity to "*master energy costs, decarbonize industry, gain autonomy and create commercial assets*". This perspective underscores the potential economic growth associated with the adoption of renewable energy.

In addition to the economic benefits, 44.12% of respondents recognize the environmental impact of renewable energy. This environmental awareness is aptly illustrated by a young climate change negotiator who emphasizes the "*dual benefit of sustainability in creating green wealth and addressing environmental concerns*", highlighting an acute awareness of renewable energy's role in environmental stewardship.

Despite these benefits, there are concerns about the practicality of integrating renewable energy into existing systems, as noted by 14.71% of respondents. This indicates concerns about seamlessly integrating new energy solutions into traditional frameworks. In addition, 17.65% of respondents expressed concern about the upfront costs of transitioning to renewable energy sources, revealing the perceived financial burden of initial investments. In addition, 11.76% see the need for strategic planning in the implementation of renewable energy, emphasizing particularly the need for careful, long-term planning.

Recognition of these benefits and challenges varies within specific professional groups. Researchers and experts, for example, show a deep understanding of both economic and environmental aspects. A senior government official and a consultant point to benefits in terms of "*cost control and improved competitiveness*", indicating a nuanced understanding of the potential of renewable energy.

In the banking and financial sector, the focus is also balanced, with a representative of a Tunisian public bank emphasizing the need for renewable energy to stimulate economic growth. Both the economic (60%) and environmental (40%) benefits are recognized, along with the practical challenges.

NGOs representatives, demonstrating a broad understanding, unanimously recognize both economic and environmental benefits. This is exemplified by an NGO leader who speaks of "*reduced energy expenditures and improved competitiveness*", providing an applied perspective on the benefits of renewable energy.

Government officials charged with policy formulation and strategic planning recognize the cleanliness, energy efficiency, and economic benefits of renewable energy, balancing economic (66.67%) and environmental (33.33%) considerations. Their insights into the challenges of integration and investment reflect an awareness of policy and implementation hurdles.

Finally, in the MSMEs sector, a commercial director expresses concern about bureaucratic barriers to the adoption of renewable energy, reflecting a practical attitude towards these new energy solutions.

This group recognizes the economic (50%) and environmental (37.5%) benefits but is also aware of the operational and financial challenges.

The in-depth examination of the perspectives of different professional groups in Tunisia provides a comprehensive understanding of the multifaceted nature of renewable energy adoption. While there is widespread recognition of the economic and environmental benefits of renewable energy, the specific challenges highlighted by each group are indicative of their unique operational realities and needs. In this context, the emphasis on economic benefits across sectors underscores a broad consensus on the financial viability of renewable energy. However, this economic perspective is nuanced by environmental considerations, revealing a balanced approach to sustainability and profitability. In particular, concerns expressed about the integration challenges and up-front costs associated with renewable energy point to a shared concern about the transition from traditional energy frameworks to more sustainable models.

This diversity of perspectives is particularly revealing when considering the different priorities and constraints each group faces. For example, researchers and experts tend to have a broader understanding of both the benefits and the practical challenges, given their in-depth engagement with the topic. Similarly, representatives from the banking and finance sector show a strong awareness of the economic implications, likely influenced by the sector's focus on investment and market dynamics.

NGO representatives, with their on-the-ground experience in implementing renewable energy solutions, offer insights into the practical application of these technologies and emphasize the importance of accessibility and community engagement in the adoption process. Meanwhile, government officials, balancing policy considerations with practical implementation, emphasize the need for strategic vision and funding in mainstreaming renewable energy.

MSMEs operating with more limited resources and facing direct market pressures, express more pragmatic concerns such as bureaucratic barriers and operational costs. This reflects the sector's focus on immediate economic impact and the challenges of integrating new technologies into existing business models.

This diverse landscape of perspectives and concerns highlights the need for tailored approaches to promoting renewable energy adoption in Tunisia. Recognizing the different circumstances and priorities of each stakeholder group is critical to developing effective strategies that address both the common and unique challenges faced by these sectors. Such a nuanced approach not only promotes a more inclusive and sustainable energy transition, but also ensures that the benefits of renewable energy are realized across the diverse spectrum of Tunisian society and industry.

5.2.2. Barriers to implementation

Delving into the multifaceted challenges of renewable energy implementation in Tunisia, based on extensive feedback from interviewed professionals across different sectors, provides a nuanced understanding of the barriers faced by each group. This in-depth analysis, which reflects the complexities and particularities of each sector, paints a complex picture of the barriers to renewable energy deployment.

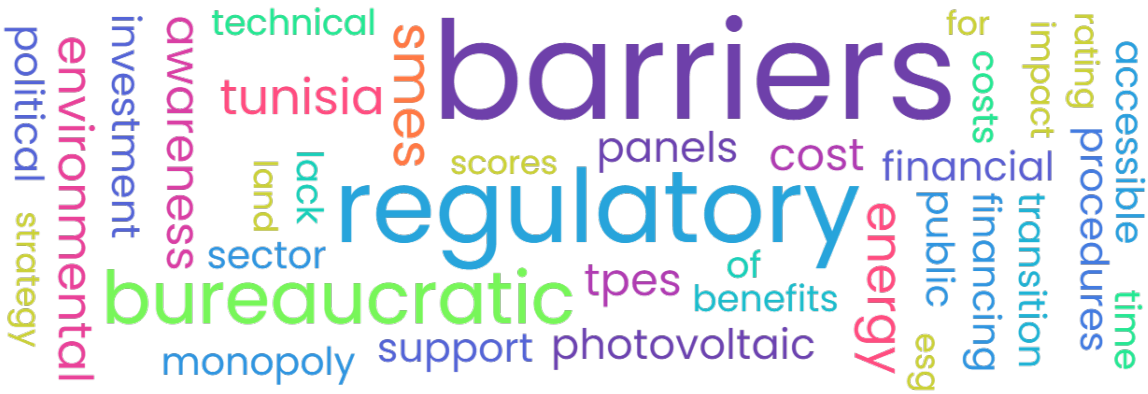

Figure 1: Key aspects and challenges of renewable energy deployment in Tunisia

- **Regulatory barriers:** A dominant concern, cited by 76.47% of respondents, underscores the widespread problem with existing regulations. A 28-year-old climate change negotiator elaborates on the intricate nature of these barriers, stating, "*The barriers are predominantly regulatory, institutional, technological, and financial".*

- **Financial barriers:** Recognized by 61.76% of respondents, these barriers highlight the economic challenges of transitioning to renewable energy. A 29-year-old Ph.D. in finance, with a focus on sustainable finance and energy transition, underscores the financial burden, mentioning, "*The main opportunity lies in having a supportive, non-corrupt government with a clear energy transition strategy*".

- **Institutional barriers:** Identified by 47.06% of respondents, these point to deep-rooted organizational and systemic problems in the transition to renewable energy in Tunisia. This is exemplified by the perspective of a 38-year-old director of studies at CAMI ENGINEERING, who highlights the significant challenges posed by installation costs and the role of the Tunisian Electricity and Gas Company (STEG) in the transition process. She emphasizes that "*installation costs and the role of the STEG are major challenges in the transition process"*, underscoring the need for institutional reforms and support to facilitate a smoother transition to renewable energy solutions.

- **Technological barriers:** Cited by 47.06% of respondents, suggesting a gap in the technology and expertise required for effective implementation of renewable energy solutions in Tunisia. This challenge is elaborated by a 63-year-old energy consultant specializing in energy strategy and transition. Reflecting on the global context, he says: "*With the introduction of ESG ratings by BlackRock, Tunisian companies are now forced to embark on an energy transition"*. This is an opportunity to align with global environmental standards. His observation implies that despite the technical hurdles, there is an opportunity for Tunisian companies to meet international standards and gain a competitive edge in the global market.

- **Bureaucratic barriers:** Experienced by 61.76% of respondents, point to the inefficiency and complexity of administrative processes. This problem is acutely felt by the 48-year-old co-manager of CUISINA, a company involved in the design, manufacture and marketing of kitchen furniture, bathrooms and dressings. Pointing to the challenges of navigating the bureaucratic landscape, he emphasizes, "*The positive effects of the energy transition for Tunisian companies include reduced energy costs and improved brand image. However, lack of investment funds, regulations, and*

bureaucratic processes are major challenges". His statement highlights the dichotomy between the potential benefits of renewable energy and the practical hurdles, particularly for entities such as ANME and STEG, in realizing these benefits.

- Lack of awareness: Mentioned by 26.47% of the total respondents, highlights a significant gap in understanding and communication within the renewable energy sector. This barrier underscores the necessity for enhanced education and information dissemination to bridge the knowledge gap. A 56-year-old leader of an NGO, "Ksar Hlal 2050", accentuates this need, stating, "*Tunisian companies face numerous opportunities in the energy transition field, particularly in solar and wind energy, thanks to the favorable climate. However, barriers like access to funding for energy transition projects are major. High initial installation costs necessitate accessible financing. Additionally, the lack of a binding legal framework mandating cleaner energy sources in companies or specific sectors is a significant barrier. Such a framework could stimulate sustainable energy practices by creating clear incentives and obligations".* This statement not only addresses the awareness issue but also highlights the interconnected challenges of financing and regulatory frameworks, which are pivotal in fostering a conducive environment for renewable energy adoption in Tunisia.

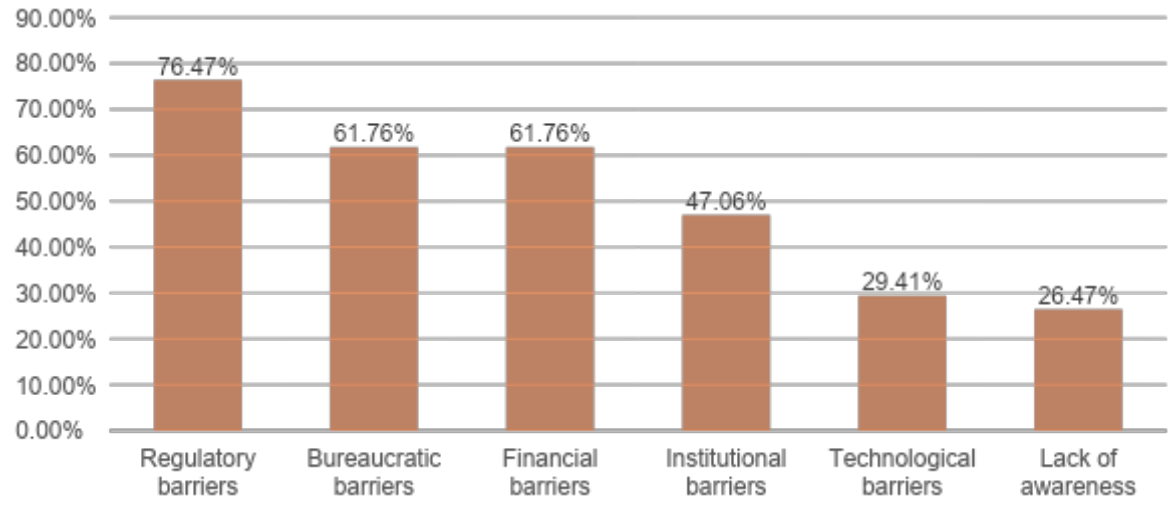

Figure 2: Proportion of identified barriers to renewable energy implementation (% of total occurrences) among all respondents in Tunisia

These collective insights from the entire population set the stage for delving into the unique perspectives of each professional group, shedding light on their specific challenges in implementing renewable energy solutions.

- Researchers and Experts: These professionals face a wide range of challenges, from regulatory to technological, as well as financial and awareness barriers. A 37-year-old consultant at UTS-Palma outlines the multifaceted nature of these challenges: "*The barriers are mainly regulatory, institutional, technological and financial".*

- Banks and Financials: This group, primarily concerned with regulatory and financial barriers, raises questions about the economics of renewable energy projects. A representative of a Tunisian public bank, a 34-year-old woman, highlights land availability as a major challenge: "*Renewable energy projects require a lot of land".*

- NGOs: Focusing on bureaucratic barriers and the need to raise awareness, NGO representatives underscore the practical challenges of implementation. A 65-year-old CEO of an energy and climate consulting firm points to financial barriers, stating, "*The barriers are largely financial, with challenges in accessing funds".*

- Government officials: These respondents highlight strategic and financial challenges and point to the need for clear policy direction. A 54-year-old government official involved in research and innovation mentions the strategic barriers: "*Opportunities are hampered by the lack of a clear strategy and vision".*

- MSMEs: Respondents in this group express concerns about regulatory, financial and bureaucratic barriers. The commercial director of a company in the metallurgical sector, aged 55, discusses the cost of electricity as a major barrier: "*A key opportunity lies in finding sustainable, low-cost energy sources".*

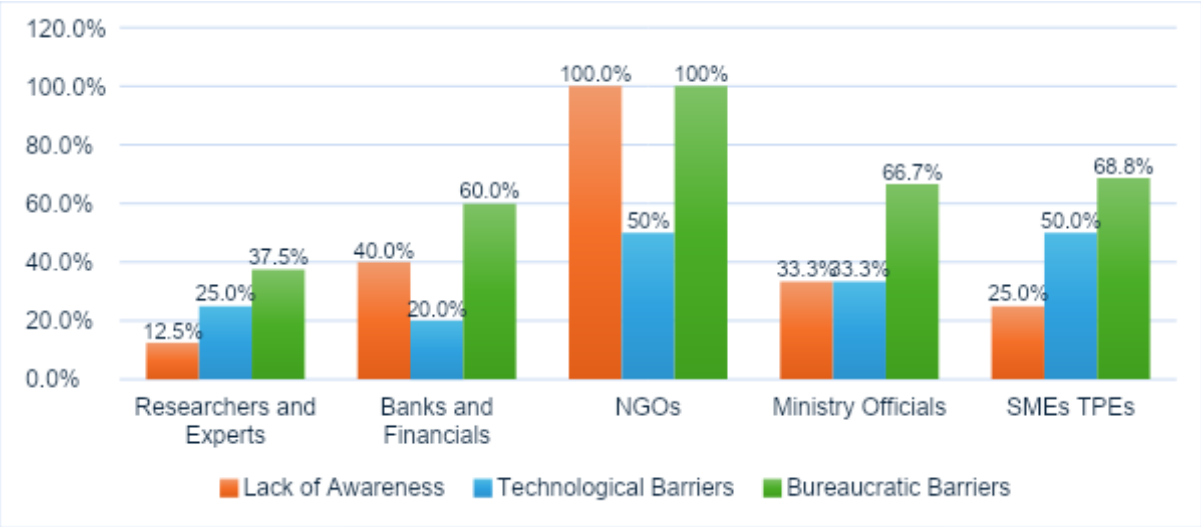

Figure 3a: Awareness, Technological, and bureaucratic barriers to renewable energy (% of group-specific occurrences) among different professional groups in Tunisia

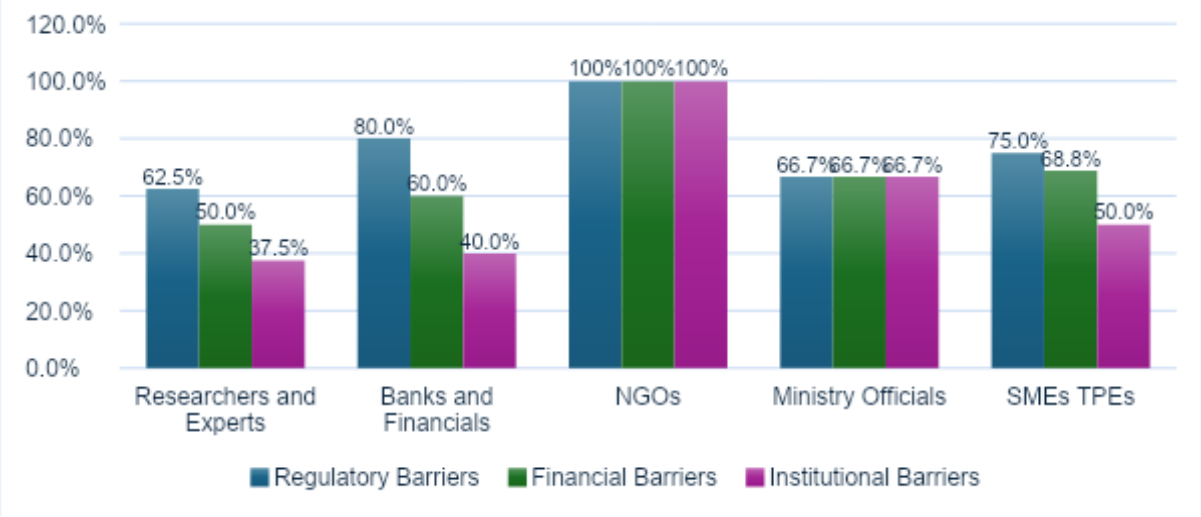

Figure 3b: Regulatory, financial, and institutional barriers to renewable energy (% of group-specific occurrences) among different professional groups in Tunisia

Exploring the barriers to renewable energy deployment in Tunisia across different professional spectrums reveals a complex set of challenges that defy oversimplified solutions. This complexity reflects the diverse nature of the barriers encountered across sectors and underscores the complexity of navigating Tunisia's energy transition landscape. The range of challenges, including regulatory constraints, technological limitations, financial hurdles, lack of awareness, and bureaucratic inefficiencies, represents a deep-rooted set of problems that require a comprehensive and multifaceted response. Each sector, including researchers, experts, MSMEs, and government officials, faces different barriers that reflect their specific operational contexts and priorities.

The significant emphasis on regulatory barriers by the majority of respondents points to systemic issues within the policy framework, suggesting that strategies to increase renewable energy uptake should include reforms or adaptations to existing regulations to facilitate the integration of renewable technologies. Financial barriers highlight the need for innovative financing models, such as public-private partnerships, incentives and subsidies, to lower the barriers to entry for renewable energy initiatives. However, these financial strategies need to be complemented by efforts to strengthen institutional capacity and streamline bureaucratic procedures, as highlighted by respondents. In addition, the technological barriers identified by respondents point to a deficiency in Tunisia's current renewable energy technology landscape, necessitating increased investment in research and development. This investment should be coupled with awareness-raising and capacity-building initiatives to equip the workforce with the skills and knowledge needed to effectively deploy and manage renewable energy technologies.

The diversity of these challenges underscores the need for a collaborative strategy that integrates the strengths and insights of different stakeholders, including experts, financial institutions, NGOs, government agencies, and MSMEs. This collective action could foster a shared understanding of the challenges and opportunities of the energy transition and pave the way for innovative and practical solutions. Tunisia's path to a successful energy transition therefore depends on a synergistic strategy that recognizes and addresses the complex nature of the barriers identified. This strategy must be flexible and responsive to the unique needs and barriers of each sector, ensuring the development of solutions that are not only effective, but also sustainable. By adopting this holistic and collaborative methodology, Tunisia can overcome the barriers to renewable energy adoption and establish a model for a sustainable and energy efficient future.

5.3. Assessment of energy transition progress

5.3.1. Current state and trends

The comprehensive assessment of the current state and trends of energy transition in Tunisian companies, as expressed by the professionals interviewed from different sectors, reveals a tapestry of opinions reflecting a complex and multidimensional reality. These perspectives collectively underscore a consensus on the overall slow pace of energy transition, albeit with nuanced differences in the experiences and observations of different professional groups.

Across the population as a whole, the recurring theme of "*weak progress*" resonates strongly, indicating a general sense of inadequacy in the pace and effectiveness of energy transition efforts. This is exemplified by two respondents who explicitly mention this assessment. Other perspectives

range from "*Needs significant improvement*" to "Slow progress", "*Lack of decisive political support*", "*Slow transition*", "No clear idea", "*Very weak progress*", and "*In a state of standby*". These varied assessments reflect the different experiences and levels of engagement with energy transition initiatives in Tunisian enterprises, and highlight the multifaceted nature of challenges and successes in this area.

Focusing on the feedback from the "Researchers and Experts" group, a variety of perspectives emerge. A 29-year-old financial researcher from ESCT cites the need for "*significant improvement*", pointing to the shortcomings of energy transition efforts, especially among non-multinational companies. A 37-year-old consultant from UTS-Palma notes "*tentative progress*", indicating a cautious, measured approach to the energy transition within Tunisian enterprises. A young 28-year-old climate change negotiator highlights the lack of "*decisive political support*", underscoring the essential role of political commitment in driving this transition. The variety of other responses, including observations of a "*slow transition*", "*no clear idea*", "*weak progress*", "*very weak progress*", and "*in a state of standby*", further illustrate the range of perceptions among this group of professionals. Each comment uniquely underscores the various challenges faced in advancing energy transition initiatives.

In the banking and finance group, the responses highlight operational aspects of the energy transition. The observation of "*underutilized energy audits*" by a 34-year-old public bank representative underscores the lack of technical expertise and awareness in energy efficiency. This is complemented by a 35-year-old Ph.D. student's comment about "*intangible government policies*", which points to a disconnect between policy formulation and its tangible impact. A representative of the National Agricultural Bank (BNA) notes the underutilization of energy audits in Tunisia, an observation that highlights the lack of technical expertise and awareness in this crucial area. Other observations in this group include limited investment prospects, legislative delays, and the perception that energy transition is not yet a priority, painting a picture of cautious engagement with renewable energy initiatives.

The "NGO" group expresses a more critical stance, with descriptions such as "*deeply worrying and frustrating*" and "*less than average progress*". These responses reflect a sense of urgency and the need for more proactive action in the area of energy transition.

Meanwhile, government officials offer a more balanced view, with assessments such as "*Very good, but relatively mediocre*", "*Maximum effort, but mediocre*", and "*Significant gap in performance*". These responses suggest recognition of the efforts made, but also acknowledge the challenges and the need for more robust strategies.

In the largest group, "MSMEs", there is a wide range of responses, from "*Unconvincing progress*" and "*Excessively slow progress*" to "*Disappointingly mediocre progress*" and "*Slow due to reliance on fossil fuels*". These responses reflect the diverse challenges that smaller companies face in adapting to the energy transition, including infrastructure challenges, lack of commitment, and slow progress due to existing dependencies on traditional energy sources.

These insights from professionals across sectors in Tunisia provide a rich and detailed perspective on the state of energy transition within businesses. They not only highlight the breadth of challenges faced, but also underscore the diversity of experiences and perceptions in this critical area of national and global importance. It highlights the need for a more coherent and strategic approach that

addresses the specific needs and challenges of different sectors. This approach would require a collaborative effort involving not only government policy and support, but also the active engagement of all stakeholders, including the private sector, NGOs and the wider community.

Figure 4: Perspectives on the progress of energy transition in Tunisian companies

5.3.2. Policy effectiveness and industry response

The evaluation of the state's energy policy for Tunisian enterprises, as perceived by a cross-section of professionals, reveals a comprehensive critique that reflects the complexity and inadequacies of the current policy framework. This analysis, which incorporates the views of our respondents, describes a landscape marked by a consensus on the need for substantial improvement in both the clarity and the effectiveness of these policies. This analysis is further illustrated in Figure 5, which shows the factors identified and their weights, providing a visual representation of the predominant concerns in the policy framework.

One major concern, cited by 23.53% of respondents, articulates a significant problem with the "l*ack of a clear strategy*" in the state's approach to energy transition. This concern, as stated by a Doctor of Finance from ESCT, reflects a fundamental gap in strategic direction: "*There is no clear strategy for energy transition in Tunisia*". This sentiment resonates across different professional groups, underscoring a widespread perception of strategic shortcomings in the government's energy policy.

Nearly half, 47.06%, of respondents express challenges related to "*policy clarity and implementation*". This significant figure underscores a widespread belief that while policies may be in place, their practical impact and implementation are lacking. Echoing this sentiment, a 37-year-old consultant at UTS-Palma highlights the "*apparent lack of involvement of industry stakeholders*", indicating a disconnect between policy formulation and industry needs. In particular, the MSMEs group expresses concern that policies are "*neither clear nor effective*", "*unclear*", and "*in place but not applied*", pointing to significant gaps in policy communication and implementation.

Specific challenges within the policy framework are identified by 11.76% of participants. For example, a 45-year-old management controller points to the problematic role of STEG, which has a critical impact on the effectiveness of state energy policy. Other respondents raise issues such as "challenges of energy dependency", "*cumbersome mechanisms*" and specific "problems with STEG policies", highlighting areas were targeted policy reforms are urgently needed.

Inadequate stakeholder involvement is highlighted by 5.88% of respondents, particularly from the "Researchers and Experts" and "Banks and Financials" sectors. They emphasize the need for "*accelerated administrative procedures*" and greater involvement of industry stakeholders, suggesting a significant gap between policy development and the practical realities of industry.

The "*role and example of government*", highlighted by 2.94% of respondents, including a 43-year-old engineer and head of strategy at the IMF, Enda Tamweel, advocates proactive government involvement in energy transition projects. His suggestion that "*all ministries, administrations, and public institutions should be equipped with solar systems*" reflects a desire for active government leadership in energy transition efforts.

Government officials, representing 8.82% of responses, offer a more tempered but still critical view. Some officials perceive the policies as "*somewhat acceptable but complicated*", acknowledging the efforts made but also recognizing the prevailing challenges.

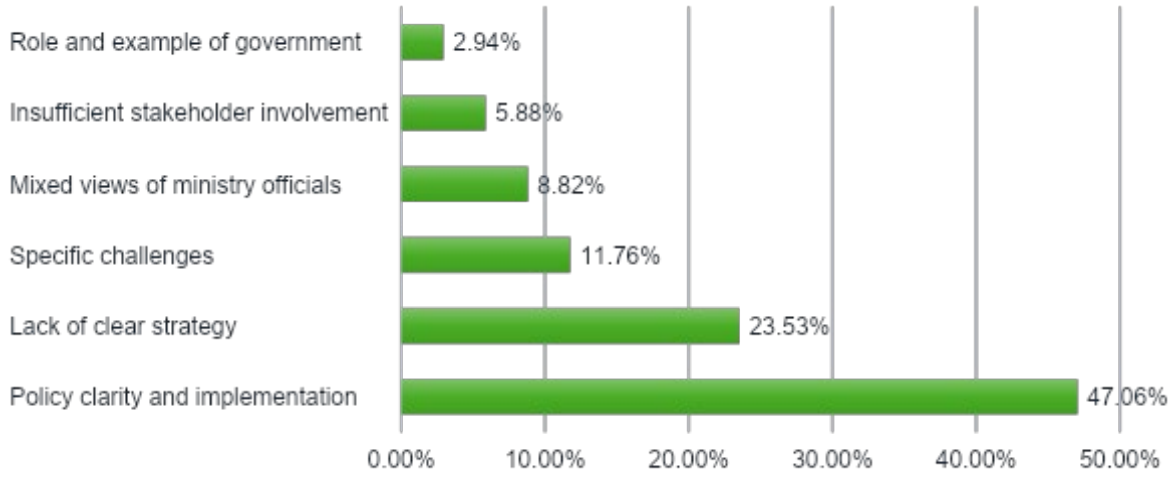

Figure 5: Identified factors and their weight in the effectiveness of the state energy policy in Tunisia

This cross-sectional analysis illustrates the urgent need for a more coherent, strategically focused and effectively implemented energy policy in Tunisia. The consensus across sectors, as illustrated in Figure 5, underscores the urgency of re-evaluating and improving these policies to effectively address energy and environmental needs. The findings highlight the complexity of the energy policy landscape and call for a collaborative and inclusive approach to policy design and implementation. The diversity of perspectives, from critiques of strategic gaps and specific operational challenges to calls for greater stakeholder involvement and government leadership, underscores the multifaceted nature of the challenges in designing effective energy policies. This broad understanding of policy shortcomings underscores the need for a nuanced approach that considers the unique needs and insights of different stakeholders to ensure that future policies are not only strategically sound, but also practically implementable and effective in advancing Tunisia's energy transition.

5.4. Impact and response to energy transition

5.4.1. Employment and economic impact

The analysis of the impact of the energy transition on employment and the economy in Tunisia, based on the perspectives of experts from different sectors, unfolds a nuanced and dynamic scenario.

Supported by the broad insights presented in Figures 6 and 7, this in-depth exploration examines the multiple expected impacts of the energy transition. These findings collectively illuminate the multifaceted influence of this transition on the labor market and overall economic development in Tunisia.

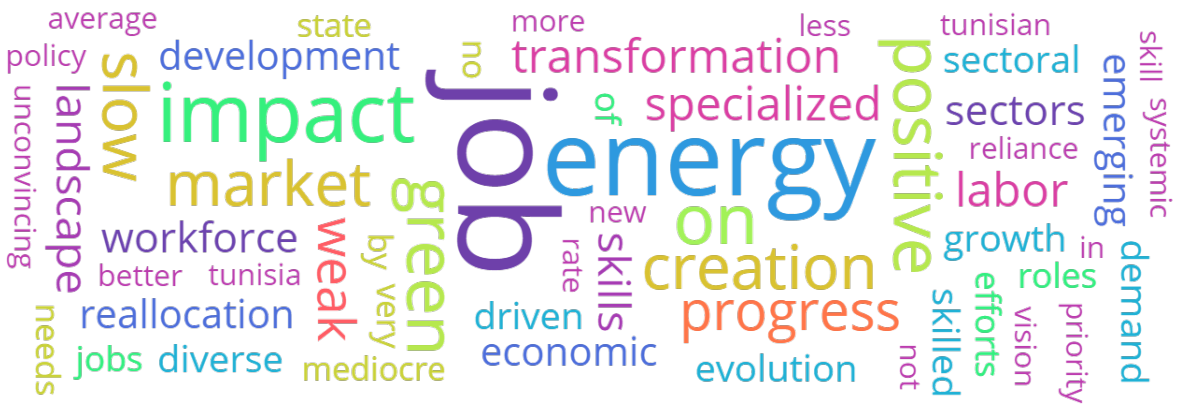

Figure 6: Impact of the energy transition on employment in Tunisia: key terms and perspectives

Some 47.06% of respondents emphasize the "*creation of new job opportunities*", reflecting a prevailing belief in the positive employment prospects brought about by the energy transition. This view is particularly evident in responses highlighting the potential for job creation in renewable energy, energy efficiency and related sectors. One notable example comes from a professional managing a solar photovoltaic project, who outlines the wide range of new jobs expected to emerge, ranging from technical roles in engineering to practical roles in installation and maintenance. This anticipation of diverse job opportunities point to a significant shift in the employment landscape driven by the burgeoning renewable energy sector.

The "*positive impact on employment*", cited by 41.18% of respondents, indicates a general optimism about the transformative effect of the energy transition on the job market. This sentiment is shared across professional groups, suggesting an overarching expectation of beneficial changes in employment patterns. One respondent from the banking sector discusses the reshaping of the employment landscape, highlighting both the opportunities and challenges associated with the transition to renewable energy. This perspective resonates with the broader view that the energy transition will not only create new job roles, but also contribute positively to employment conditions in Tunisia.

Diverse views, each representing 2.94% of the total responses, include "*uncertainty about impacts*", "*labor market development*", "*promotion of new occupations*", and "*role and example of government*" in leading the transition. These perspectives highlight different dimensions of the energy transition, from its unpredictable impact on jobs to the evolution of the labor market and the emergence of new professional roles. For example, a response from a senior engineering professional highlights the critical role of government in leading the energy transition, suggesting that an active government stance can significantly influence job creation and economic development.

The "*mixed views from government officials*", representing 8.82% of responses, provide a balanced perspective from within government. While acknowledging the potential employment benefits of the energy transition, these officials also point to the complexities and challenges involved. They recognize

the transition as an opportunity for job creation and skills development but stress the importance of strategic interventions to ensure smooth adaptation and minimize negative impacts.

Building on these insights, the analysis delves deeper into the specifics of the expected labor market transformation. The focus on "*green job creation*" (23.53%) and "*specialized skills*" (20.59%) highlights a growing demand for roles in renewable energy, energy efficiency, waste management and sustainable mobility. These sectors are expected to require a range of skills, from technical expertise to practical installation and maintenance skills. In addition, the transition is seen as a catalyst for "*sectoral growth*" (11.76%) and "*economic development*" (14.71%), suggesting a broader economic upturn as a result of increased investment and innovation in renewable energy.

The conversation also touches on "*workforce reallocation*" (8.82%) and "*labor market evolution*" (8.82%), indicating the need for training and retraining programs to facilitate the transition of workers from declining industries to emerging green sectors. This aspect underscores the importance of supportive policies and educational initiatives to prepare the workforce for the evolving employment landscape.

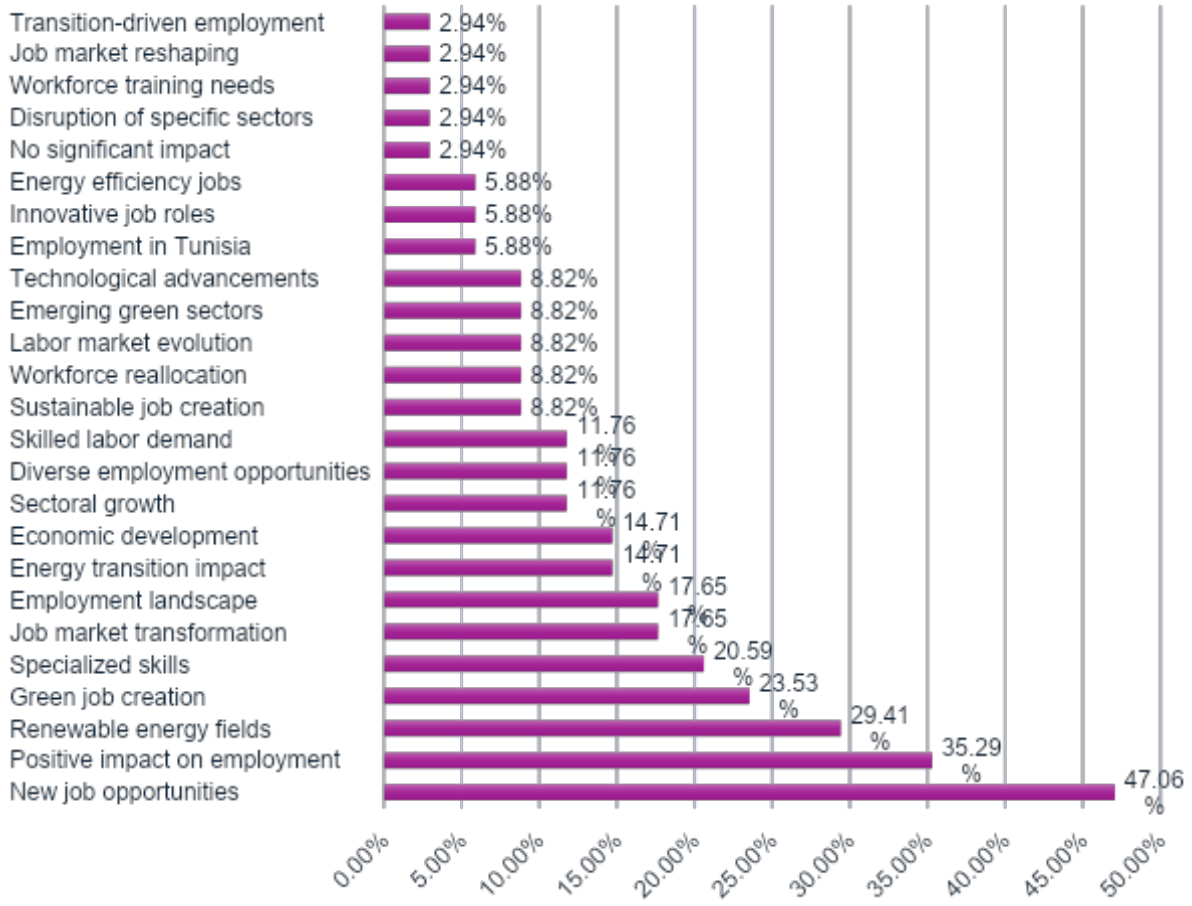

Figure 7: Multiple impacts and opportunities: employment and economic prospects in Tunisia's energy transition

The convergence of perspectives on the impact of the energy transition on employment in Tunisia, as revealed by the professional insights across sectors, underscores a dynamic scenario poised for significant shifts in the labor market. This collective assessment, detailed in Figure 5, sheds light on

the expected multifaceted changes and challenges that the energy transition is likely to bring. A prevailing sentiment among respondents is a strong belief in the emergence of new job opportunities, with a significant proportion predicting a positive impact on employment. This reflects an overarching optimism about the potential for job creation, particularly in renewable energy and related green sectors. However, this optimism is tempered by expressions of uncertainty and concern about the readiness of the current workforce to adapt to these new opportunities. Mention of the need for specialized skills and the potential disruption of certain sectors points to a labor market in transition, one that will require significant adaptation and strategic planning to navigate effectively.

The diversity of perspectives highlighted in the responses underscores the complex and multifaceted nature of the energy transition's impact on employment. It's not just about the creation of new jobs, but also about the transformation of existing roles, the development of new skills, and the redeployment of workers. This comprehensive understanding implies the need for a multi-dimensional approach to managing this transition.

The implications of these findings are profound. They suggest that while the energy transition offers promising opportunities for economic growth and job creation, it also poses significant challenges in terms of workforce development and sectoral adjustment. The transition should therefore be managed in a way that not only exploits its potential for job creation, but also addresses the associated challenges in a holistic manner. This includes focusing on skills development, supporting the evolution of existing sectors and fostering an environment conducive to the growth of new industries. In addition, the data suggest the need for collaboration among various stakeholders, including government agencies, educational institutions, industry leaders, and the workforce, to ensure a coherent and effective approach to the energy transition. By doing so, Tunisia can strategically navigate these changes to ensure that the benefits of the energy transition are maximized, and the challenges are skillfully managed to foster sustainable economic growth and employment opportunities.

5.4.2. Social and inequality aspects

The exploration of the impact of the energy transition on social inequalities and gender issues in Tunisia, as shown in Figure 8, reveals a diverse tapestry of opinions among the different perspectives of the actors interviewed. The responses indicate a complex interplay between the energy transition and broader societal issues, with varying degrees of optimism, skepticism, and uncertainty. In particular, almost a fifth of respondents, or 19.23%, expressed uncertainty about the impact of the energy transition on inequalities and gender issues. This ambiguity is reflected in the words of a 29-year-old PhD in finance from ESCT: "*I am not sure about the impact of the energy transition on inequalities of gender issues*". This statement highlights a widespread lack of clarity about how energy policies intersect with social dynamics.

In contrast, 3.85% of respondents, including a 37-year-old consultant at UTS-Palma, expect a positive impact on reducing inequalities, including those based on gender. They share the view that "*Yes, the energy transition is likely to have a positive impact on reducing inequalities, including gender inequalities*". This optimism suggests that the energy transition has the potential to contribute to improving social justice.

However, another 3.85% of participants, as highlighted by a 28-year-old climate change negotiator, believe that the impact on inequalities will depend on how inclusively and strategically the transition is managed: "*The impact will depend on how the transition is managed and how inclusive it is*".

The largest single group, representing 23.08% of respondents, does not see a significant impact on inequalities or gender issues as a result of the energy transition. This perspective reflects a belief that the transition is not inherently linked to addressing social inequalities. For example, a respondent from the banking sector states that "*the energy transition will not have an impact on inequalities, including gender inequalities*''. The transition itself does not directly address the systemic issues that underlie social inequalities.

At the same time, 15.38% of respondents highlight the persistence of systemic issues, indicating that the energy transition does not directly address the underlying causes of social inequalities. This view underscores the need for broader socio-political efforts beyond energy policy. A further 15.38% share the view that no direct link is expected between the energy transition and gender inequalities, suggesting that these social aspects may not be inherently affected by changes in the energy landscape.

Some 7.69% of professionals, including a 38-year-old department head at the Order of Tunisian Engineers, express uncertainty about the direct link between the energy transition and gender inequalities, suggesting the need for more comprehensive analysis.

Significantly, 3.85% observe an increase in access to jobs for both women and men, as noted by an executive from an international household appliance company: "*The energy transition has made some jobs accessible to both women and men*". Another 3.85% of respondents, such as a 43-year-old engineer at the IMF, Enda Tamweel, see the transition as an opportunity to improve energy inclusiveness for vulnerable groups, including women and rural populations, promoting democratized energy access. In addition, 3.85% emphasize the need for targeted action to address gender inequalities in the energy transition. An energy and climate expert from APEX Conseil emphasizes that the impact on gender equality depends on the inclusion of specific measures to mitigate these inequalities.

Taken together, these diverse insights underscore the multifaceted nature of the challenges and opportunities presented by the energy transition in terms of social inequalities. Opinions range from a sense of uncertainty and a belief in a lack of significant impact to views that highlight potential positive outcomes and the need for inclusive strategies. This wide range of perspectives highlights the complexity of the relationship between the energy transition and social inequalities in Tunisia, and suggests that a nuanced, multi-dimensional approach to both policy design and implementation is essential.

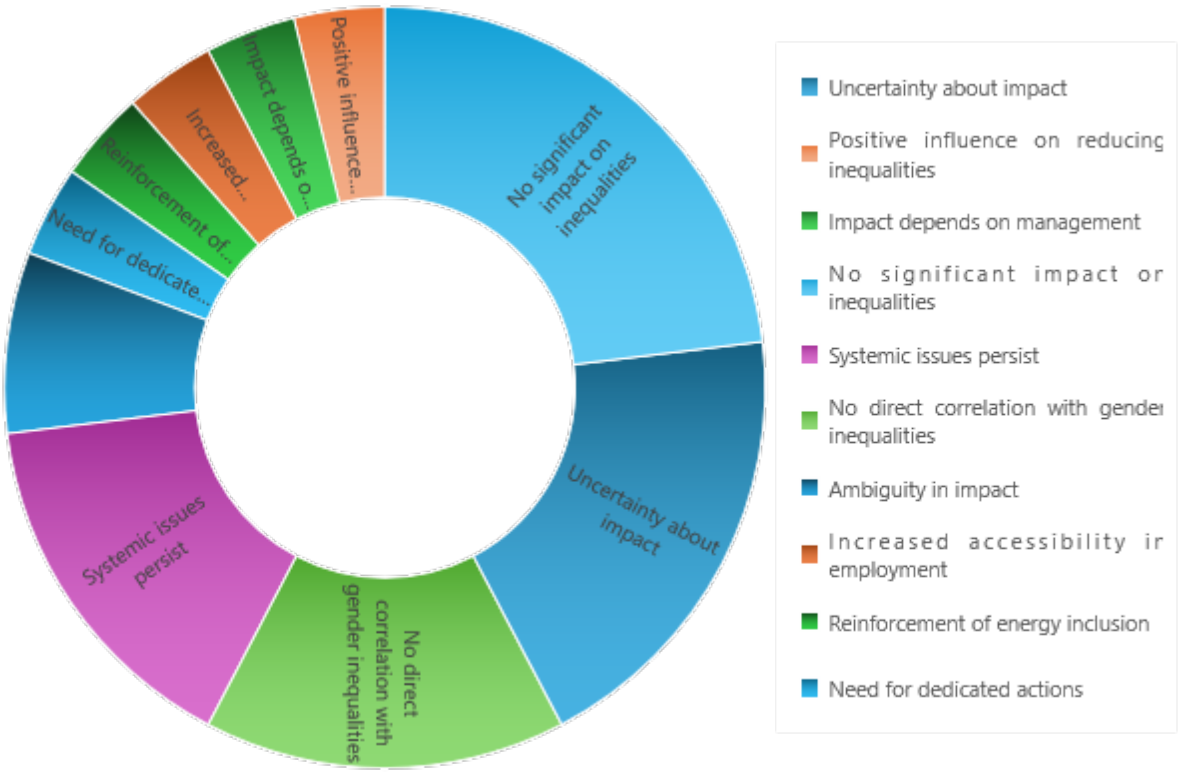

Figure 8: Social and inequality dimensions of Tunisia's energy transition

5.5. Strategies and engagement in energy transition

5.5.1. Institutional strategies and engagement

The assessment of institutional strategies and engagement in Tunisia's energy transition, informed by the perspectives of stakeholders from different sectors, reveals a diverse landscape of engagement and strategic focus. This complex scenario, characterized by a mix of proactive engagement and notable gaps in engagement, is visually depicted in Figure 9. This diversity underscores the varying degrees of readiness and commitment among institutions to adopt and integrate energy transition strategies into their operational frameworks.

A significant proportion of institutions, representing 47.06% of respondents, demonstrate active engagement in the energy transition. For example, a 37-year-old consultant at UTS-Palma highlights his institution's commitment: "*Yes, our focus is on electric energy research and its applications in the energy transition*". Similarly, a 28-year-old climate change negotiator mentions, "*Our institution specializes in photovoltaic energy research, which contributes to the energy transition*". These statements indicate a strategic and proactive approach to integrating energy transition into operational and research agendas.

In contrast, the remaining 52.94% of respondents show a lack of commitment or an initial stage in their approach to energy transition. This is exemplified by the admission of a 63-year-old energy consultant: "*No, there is no commitment to energy transition or specific energy research in our institution*". Such responses reflect a trend where energy transition has not been prioritized or integrated for a variety of reasons, including resource limitations or strategic oversight.

The response from the banking sector is mixed. A representative of the National Agricultural Bank (BNA) describes its involvement in investment activities related to renewable energy, indicating a strategic focus on energy transition. However, another professional from the household appliances industry criticizes the superficial commitment of his company, pointing to a discrepancy between marketing claims and actual implementation.

In the NGO sector, a 56-year-old representative of "Ksar Hlal 2050" discusses their commitment to climate change and sustainable practices: "*Our NGO is deeply committed to climate change, a major pillar of our activities*". This approach illustrates how some NGOs are aligning their activities with energy transition goals and contributing to a more sustainable future.

Focusing on MSMEs, the data show a dichotomy in their engagement with the energy transition. Approximately 47.06% of MSMEs, such as the 65-year-old manager of an organic olive oil production company, demonstrate active engagement: "*Our company is actively engaged in the energy transition and has developed a comprehensive energy strategy*". This commitment is evident in their focus on reducing environmental impact and improving efficiency. On the other hand, the remaining 52.94% of MSMEs, represented by a 32-year-old entrepreneur in the hotel industry, show a lack of engagement: "*Our institution is not currently involved in the energy transition and does not have a strategy*". This reflects the multiple challenges MSMEs face, including resource constraints and prioritization of immediate business needs.

The different approaches taken by MSMEs, range from the adoption of specific renewable energy technologies to broader sustainability practices. A 27-year-old solar photovoltaic project manager shares her strategy: "*We are very committed to the energy transition and have a clear and comprehensive energy strategy*".

However, many MSMEs lack a dedicated human resources strategy for the energy transition, as pointed out by a 55-year-old commercial director in Ksar Hlel. This gap highlights the need for skills development and recruitment to support energy transition initiatives and underscores the importance of aligning human resources with environmental goals.

The analysis of institutional strategies and engagement in Tunisia's energy transition reveals a landscape characterized by varying degrees of commitment and strategic integration. The different approaches observed in different sectors highlight the complexity of this transition and its multiple impacts on different entities.

The data shows that while a significant proportion of institutions are actively engaged and have integrated energy transition into their operational frameworks, a significant number are either in the early stages of engagement or show a lack of engagement. This dichotomy not only reflects varying levels of awareness and resource allocation among institutions, but also underscores the challenges of harmonizing energy transition efforts across the board.

The active engagement of some institutions, particularly those that have integrated energy transition into their core strategies, demonstrates the potential for innovative practices and strategic advances in sustainable energy. However, the lack of engagement or the nascent state of engagement among other institutions suggests a gap in the national energy transition framework. This gap may be due to several factors, including resource constraints, strategic oversight, or a lack of awareness of the benefits and imperatives of the energy transition.

The findings point to the critical need for a unified national strategy that encompasses all sectors and encourages and facilitates the effective participation and contribution of various stakeholders. Such a strategy would not only promote a more coherent approach to energy transition, but also ensure that efforts and investments are aligned with national sustainable development and environmental goals. In addition, the transition to sustainable energy systems presents both challenges and opportunities for institutions. Managing these changes requires a multifaceted approach that includes policy support, financial incentives, capacity building, and public-private partnerships. A strategic and coordinated approach is essential to address the challenges and seize the opportunities of the energy transition.

Figure 9: Institutional commitment and strategy in Tunisia's energy transition: A word cloud analysis

5.5.2. Adoption and utilization of renewable energies

Exploring the adoption and use of renewable energy in Tunisia, as shown in the interview data presented in Figures 11a and 11b, reveals a multifaceted and complex scenario. This landscape is intricately woven with a variety of drivers and barriers, each reflecting the unique situational context of different sectors. The complexity of this landscape not only reflects different approaches to renewable energy, but also embodies the broader environmental, economic, and infrastructural dynamics at play in the country. This nuanced picture underscores the heterogeneity of renewable energy adoption and highlights how different motivations and challenges shape the trajectory of each sector's energy journey.

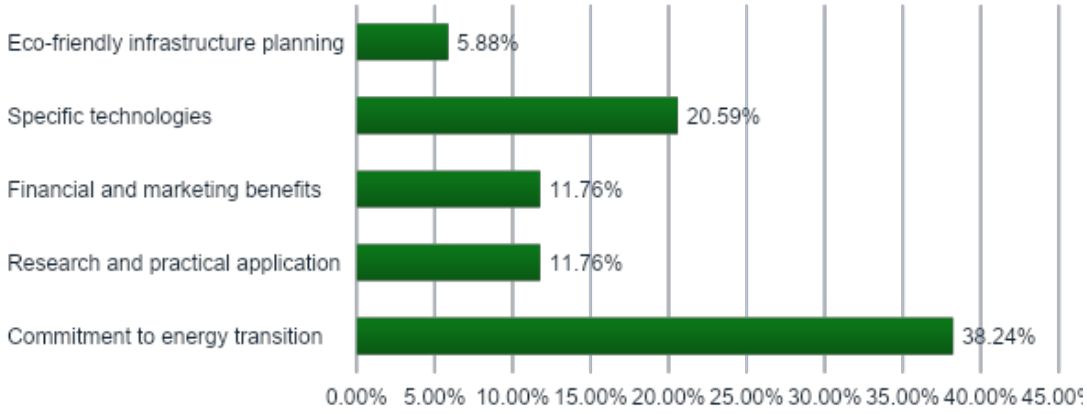

Figure 11b: Main drivers for renewable energy adoption in Tunisia

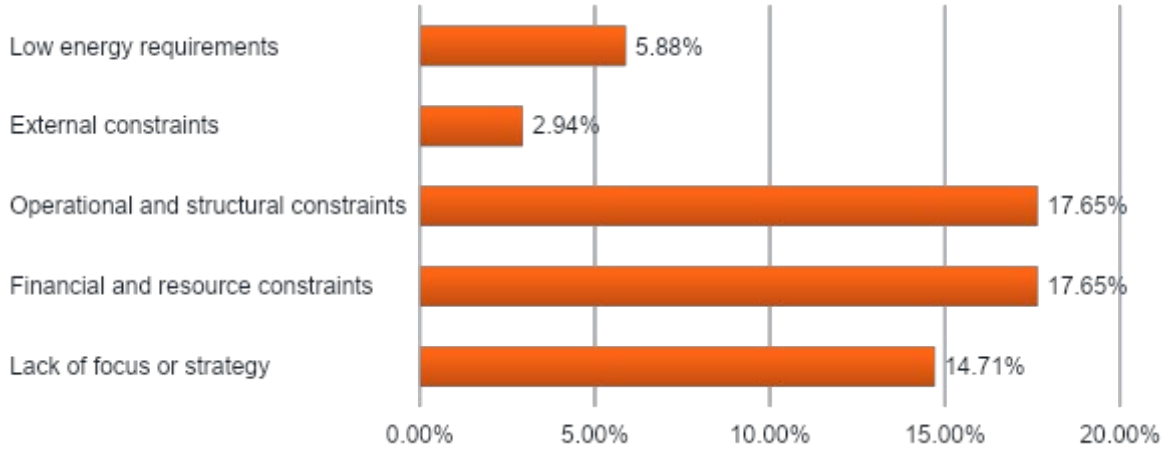

Figure 11b: Barriers to the use of renewable energy in Tunisia

Of the total respondents, 44.12% report active use of renewable energy, underscoring a growing trend toward sustainable practices. This adoption is primarily driven by a commitment to the energy transition, cited by 38.24% of respondents. An outstanding example of this commitment is the words of a 37-year-old consultant from UTS-Palma, who asserts: "*Yes, our institution actively uses renewable energies, with a particular focus on electrical energy research*". This response encapsulates the strategic integration of renewable energy within their operational framework.

Conversely, the 55.88% of respondents who do not use renewable energy cite a variety of barriers. A predominant factor is a lack of focus or strategic direction on energy transition, which accounts for 14.71% of the responses. A 63-year-old energy consultant candidly states, "*No, our institution does not use renewable energy. Our current focus is not on energy transition*", highlighting the strategic gaps in some organizations.

Financial and resource constraints are another significant barrier, cited by 17.65% of respondents. This issue is exemplified by a young entrepreneur who laments, "*Our institution does not use renewable energy due to several constraints, including limited decision-making autonomy and resources*", reflecting the financial and operational hurdles faced by smaller entities such as MSMEs.

Operational and structural constraints, also reported by 17.65% of respondents, further complicate the adoption of renewable energy. These constraints include infrastructure limitations and the operational feasibility of integrating renewable technologies into existing systems.

The banking and finance sector illustrates a nuanced approach, focusing on financial support for renewable energy projects rather than direct use. As a representative of the National Agricultural Bank (BNA) explains, "*Our institution actively invests in renewable energy projects, but we do not directly use renewable energy in our operations*". This attitude underscores the role of the sector in facilitating renewable energy through financial mechanisms.

NGOs show a more proactive approach, with a representative of "Ksar Hlal 2050" stating, "*Our NGO promotes renewable energy, especially solar photovoltaic*". This demonstrates the role of NGOs in not only advocating for renewable energy solutions, but also implementing them in practice.

Specific technologies drive the adoption of renewable energy for 20.59% of respondents, while environmentally friendly infrastructure planning is a factor for 5.88%. These elements highlight the importance of technological innovation and sustainable design in advancing the use of renewable energy.

On the other hand, external constraints and low energy requirements, although less frequently cited, indicate that external market conditions and the specific nature of an institution's operations can influence its renewable energy strategies.

The intricate pattern of renewable energy adoption in Tunisia, highlighted by the diverse factors influencing different sectors, underscores the need for a multi-pronged approach to advancing the country's sustainable energy agenda. The heterogeneity in adoption rates and underlying motivations calls for sector-specific strategies that are finely tuned to the unique challenges and opportunities of each sector. For example, MSMEs, often constrained by limited resources and operational barriers, could benefit significantly from targeted interventions. These could include financial incentives and technical assistance designed to alleviate their specific constraints and catalyze their transition to renewable energy use. In contrast, larger institutions and NGOs, which often have more substantial resources, may find the integration of renewable energy more feasible. However, their journey is not without challenges, highlighting the need for strategies that not only address resource availability, but also focus on maximizing the potential of existing capabilities. In addition, the uneven rates of renewable energy adoption across sectors point to a deeper need for a nuanced and empathetic understanding of each sector's unique landscape. Such understanding is critical to tailoring interventions that resonate with the specific realities of each sector, thereby increasing the effectiveness and relevance of renewable energy initiatives.

The role of collaborative efforts in this context cannot be overemphasized. A synergistic approach involving government agencies, the private sector, and civil society is essential for holistically advancing the adoption of renewable energy. These collaborations can leverage the strengths of each sector and combine policy support, financial mechanisms, and technological innovation to create an enabling environment for renewable energy integration.

The path to renewable energy adoption in Tunisia is therefore not linear, but is characterized by diverse motivations, capabilities, and challenges. Recognizing and addressing these differences through sector-specific strategies and collaborative efforts is critical. This approach will not only facilitate progress towards Tunisia's renewable energy goals, but also contribute significantly to the broader vision of a sustainable energy future. The interplay of collaborative efforts, policy frameworks, and technological advances will be critical to navigating the complexities of this transition and achieving a more sustainable and energy efficient Tunisia.

5.6. Support mechanisms and energy savings

5.6.1. Evaluation of support mechanisms

In analyzing Tunisia's support mechanisms for clean energy adoption and energy transition, a comprehensive review of responses from different professional sectors, as shown in Figure 11, reveals a consensus on the need for more robust and integrated support systems. However, the nature and extent of the improvements needed are perceived differently across sectors, illustrating the multifaceted challenges on the path to sustainable energy adoption.

Researchers and experts express significant concerns about existing mechanisms, with around 50% highlighting the fragmented nature of support and its insufficient integration with broader economic strategies. This fragmentation leads to inefficiencies and missed opportunities that hinder the progress of clean energy initiatives. In addition, 37.5% of respondents in this group point to the lack of adequate funding, suggesting that while initiatives such as ANME and PEESE are in place, their impact is limited by financial constraints. This sentiment is summed up by a young entrepreneur from the hotel sector who describes the support mechanisms as "*ineffective*". There is also a call, noted by 25% of these professionals, for a more holistic approach that extends support beyond financial aspects to include technical and policy support.

In the banking and finance sector, 40% of respondents criticize the mechanisms for not engaging enough with key industry stakeholders. One representative underscores this issue by stating, "*In my view, the support mechanisms are inadequate*", pointing to a disconnect between policy formulation and practical industry needs. A further 20% of respondents from this sector identify gaps in the implementation of these mechanisms and a similar proportion call for more comprehensive support, indicating the need for a more coordinated and comprehensive approach.

The NGO perspective is unanimous in calling for improved communication and access to information, with 100% of respondents highlighting this need. This is exemplified by a statement from a representative of "Ksar Hlal 2050", who notes the challenges of connectivity and information flow between businesses and support mechanisms. In addition, 50% of NGO respondents cite limited access to critical information as an obstacle to effective planning and implementation of clean energy initiatives.

There is a mixed assessment of the effectiveness of support mechanisms from government officials, with 66.67% giving a mixed assessment and 33.33% calling for better implementation and monitoring. This shows recognition of the potential of existing structures, but also highlights shortcomings in their application and effectiveness.

The most critical viewpoint comes from the MSMEs sector, where a majority (62.5%) cites inefficiencies and lack of clarity as major obstacles. These smaller companies face operational and financial barriers that prevent them from effectively adopting clean energy solutions, according to 50% of respondents. In addition, 37.5% of respondents in this sector highlight the need for more targeted support to address the specific challenges faced by smaller businesses. Reflecting on the bureaucratic challenges, one representative from this sector claimed that support mechanisms often act as a barrier rather than a help.

Across all sectors, there is recognition of existing mechanisms, but they are generally seen as inadequate to meet the diverse and evolving needs of clean energy deployment and transition. Concerns range from fragmented support and insufficient funding to inefficiencies, operational barriers, and the need for more targeted approaches. This diversity of perspectives underscores the complexity of the issue and the need for a multifaceted and nuanced approach to developing and implementing support mechanisms. Such tailored strategies, which recognize the unique needs of each sector, are essential to advancing Tunisia's transition to sustainable and renewable energy practices. This nuanced approach ensures that the benefits of renewable energy and clean technologies are realized across the spectrum of Tunisian society and industry, addressing specific challenges while promoting an inclusive and sustainable energy transition.

Figure 11: Evaluating support for clean energy in Tunisia: stakeholder perspectives

5.6.2. Energy savings and efficiency

The analysis of energy savings and efficiency in Tunisia, particularly among MSMEs, reveals a diverse landscape of engagement and implementation. This comprehensive assessment reveals varying degrees of commitment and implementation strategies, each reflecting unique approaches and challenges within the sector.

At one end of the spectrum, a segment of respondents, representing 6.25%, acknowledge that their companies are not currently engaged in active energy conservation measures. This non-engagement, often attributed to early stages of development or other operational priorities, highlights a gap in the integration of energy efficiency into initial business strategies. As one young hotel entrepreneur points out, "*Currently, our company is not actively pursuing energy savings through efficiency due to our early stage of development*". This statement underscores the potential missed opportunities in embedding energy efficiency from the start of business growth.

Conversely, another 6.25% of respondents are at the forefront of implementing energy efficiency measures. These companies are proactively pursuing various initiatives, suggesting a higher level of environmental awareness and a strategic approach to sustainable business practices. Such proactive measures are indicative of a growing trend among Tunisian MSMEs to recognize the long-term benefits of energy efficiency, not only from an environmental perspective, but also for operational cost savings and market competitiveness.

The majority (12.5%) of respondents are in the initial stages of seeking energy savings. This emerging awareness and effort towards energy efficiency, while still in its infancy, marks a positive shift towards more sustainable business practices. However, the lack of responses in certain categories, such as "*strategically improving energy efficiency*" and "*efforts focused on financial savings*", suggests that many companies have yet to fully embrace or realize the potential of comprehensive energy management strategies.

A small segment (6.25%) of respondents highlights modest internal energy conservation efforts, such as awareness campaigns and basic energy conservation measures. While these efforts represent a basic level of commitment, they also underscore the need for more structured and impactful energy management strategies.

The absence of energy efficiency measures, cited by a further 6.25% of respondents, point to a critical area of concern. This group's non-participation in energy-saving initiatives, often due to high operating costs or lack of awareness, signals a significant opportunity for intervention and support.

In contrast, companies that have achieved certifications such as ISO 4001, also representing 6.25% of respondents demonstrate a sophisticated and committed approach to energy management. These companies set the standard for the industry and demonstrate the tangible benefits and successes that can be achieved through dedicated energy efficiency efforts.

The ongoing pursuit of energy savings, represented by another 6.25% of respondents, demonstrates a dynamic and adaptive approach to energy management. In addition to integrating energy-efficient practices and technologies, these companies are continually looking for ways to improve their energy performance. This approach reflects an understanding of the evolving nature of energy management and a commitment to continuous improvement.

These diverse responses reveal a sector that is beginning to realize the importance of energy efficiency. The range of engagement, from initial awareness to strong and strategic commitment, underscores the diverse operational realities and challenges faced by MSMEs in Tunisia. The results show that while there is an emerging trend towards energy efficiency, the depth and consistency of implementation varies widely across the sector.

This diversity in approaches and levels of commitment has significant implications for the broader goal of sustainable energy use in Tunisia. It points to the need for a more nuanced understanding of the barriers and drivers of energy efficiency within the MSMEs sector. Recognizing and addressing these differences is critical to promoting a more comprehensive and effective approach to energy management across the sector. While individual companies show varying degrees of commitment to energy efficiency, the overall trend suggests a growing recognition of its importance. This evolving landscape presents an opportunity for increased engagement and collaboration among businesses, policymakers, and other stakeholders to promote a more energy-efficient and sustainable business environment in Tunisia.

5.7. Recommendations for accelerating energy transition in Tunisia

Building on the findings from the previous sections on perceptions, barriers, and opportunities in Tunisia's energy transition, this section presents a structured set of recommendations. These are organized according to their importance, as indicated by the frequency of mention in the responses. For a comprehensive and visual representation of these recommendations, Figures 12 and 13 are included. Figure 12 provides a graphical representation of the frequency of each category of recommendations, and Figure 13 presents a word cloud that visually summarizes and highlights the key themes and priorities from the responses.

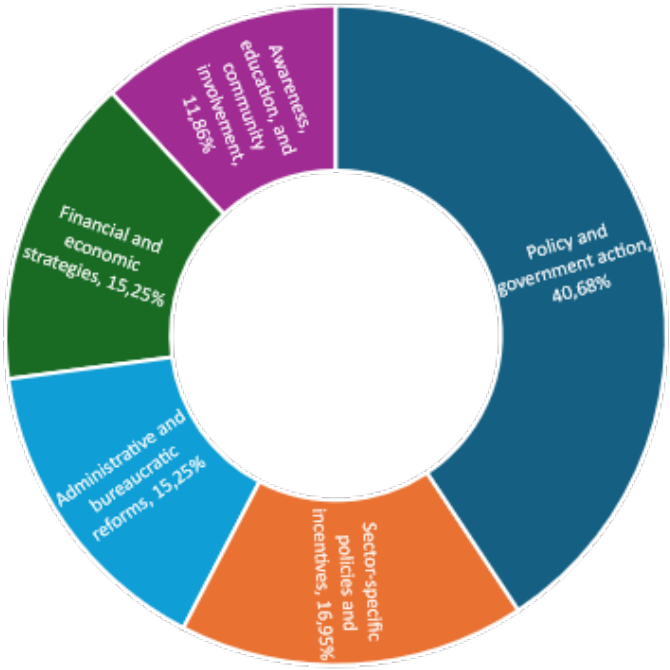

Figure 12: Frequency analysis of recommendation categories for Tunisia's energy transition

Figure 13: Word cloud visualization of key recommendations for accelerating Tunisia's energy transition

5.7.1. Improve government policies and strategic planning

Strengthening government policy and strategic planning is a cornerstone of Tunisia's energy transition and received the largest share of feedback at 40.68%. This section provides a wide range of recommendations on critical government actions to transition Tunisia. These insights include the formulation of policies and the adaptation of specific mechanisms tailored to the needs of the industry, highlighting the complex nature of the transition.

Adopt accountable government policies: The need for government accountability in addressing climate change and promoting renewable energy projects is highlighted. It underscores the importance of ethical and proactive governance, with one ESCT expert noting, "*The challenge of being a socially responsible business in a context where the government is not socially responsible is profound*". This link between government integrity and environmental initiatives points to the critical role of accountable governance in the energy transition.

Implement industry-specific mechanisms: The importance of solutions tailored to the unique challenges of different industries is essential, recognizing that a one-size-fits-all approach falls short. A criticism from a representative of UTS-Palma, "*The mechanisms do not take into account the specificities of Tunisian industries*", suggests the need for policies that are carefully analyzed and adapted to the needs of each industry.

Increase awareness and education: Increasing education and awareness about renewable energy is identified as a fundamental step in the transition process. The importance of disseminating knowledge is emphasized, with one climate change negotiator stating that "*increased awareness and education about renewable energy*" is imperative, suggesting an ongoing strategy to build a sustainable and informed foundation for future policies and practices.

Clarify the vision for the energy transition: The need for a clear and comprehensive vision for the energy transition is essential. A well-defined strategy is essential to effectively guide the nation's transition efforts, as one energy consultant points out: "*Develop a clear vision for the energy transition*". This strategy includes setting specific goals and pathways that are consistent with national and global environmental goals.

Advocate for strong political action with STEG: The need for strong political action to align the STEG with national renewable energy interests is clear. A recommendation from a manager of an organic olive oil production company, "*strong political measures to direct STEG towards national interests*", underscores the importance of political determination in pushing utilities towards renewable initiatives.

Modernization of the STEG for renewable energy: Transforming STEG to prioritize renewable energy is central to advancing a sustainable energy framework in Tunisia. In advocating for an overhaul of the national utility, stakeholders emphasize the need for STEG to become a leader in renewable energy. Highlighting the utility's pivotal role in the transition, a solar energy project manager emphasizes, "*modernizing STEG to focus on renewable energy initiatives*", reflecting the need for significant investment in infrastructure, technology, and workforce development tailored to renewable energy.

Introducing market competition: The proposal to end STEG's exclusive rights to sell electricity aims to invigorate the energy sector with competition and innovation. Proponents of this change argue that

competition will increase market dynamics, efficiency, and the development of innovative solutions. A representative of a multinational company suggests "*ending STEG's monopoly on electricity sales to encourage competition*", underscoring the need for legislative and regulatory reforms to promote a competitive energy market.

Streamline access to subsidies: Improving access to subsidies for energy transition projects by reducing procedural complexities is a proposed measure to assist both organizations and individuals. CAMI ENGINEERING's feedback, "*Simplify subsidy processes and provide targeted support*", calls for a reassessment of the subsidy framework to make it more user-friendly and effective in promoting renewable energy investments.

Adapting banking for energy finance: A responsive banking system that is attuned to the financial needs of energy projects is critical. The proposal for a banking sector that supports sustainable energy financing reflects the evolving financial needs of the sector. "*A responsive banking system for energy projects*", as noted by a senior government official, underscores the importance of adapting financial practices to facilitate energy transformation initiatives.

Implementing existing energy strategies: The critical importance of implementing plans already established since 2012 for Tunisia's energy sector is highlighted. This approach emphasizes leveraging and building on existing strategic frameworks to ensure a coherent and effective energy transition. A strategy and development expert from CDC emphasizes "*implementing plans established since 2012*", pointing to the benefit of continuity and efficient implementation of renewable energy strategies.

Encouraging government action and legislative reform: Advocating for legislative adjustments and the introduction of new policies is important for advancing the energy transition. This includes the enactment and revision of laws, as well as the implementation of supportive policies that are aligned with the goals of the renewable energy transition. A legal director in the tourism sector emphasizes the importance of "*government policies and legislative changes to promote the energy transition*" and identifies it as a strategic priority. These efforts require extensive planning and legislative activities to make significant changes in the legal and regulatory environment.

Securing public funding for the energy transition: Highlighting the need for government financial support for the energy transition reinforces the central role of government investment in renewable energy initiatives. An academic and university lecturer emphasizes the need for "*government funding for energy transition projects*", reflecting the critical need for public investment in sustainable energy. Allocating financial resources within government budgets for these projects requires strategic foresight and is seen as part of a strategic planning process.

Revision of regulations to facilitate the transition: Amending existing regulations has been identified as an essential step in facilitating the transition to renewable energy. This step involves re-evaluating regulatory frameworks that currently impede the adoption of sustainable energy. A manager in the olive oil industry calls attention to "*revising existing regulations to remove barriers to energy transition*", highlighting the need for regulatory adaptability to ensure a seamless transition. This process of regulatory and policy change, involving stakeholder consultation and legislative action, is seen as part of medium-term planning.

Broadening access to technological innovation: Making cutting-edge technologies in the energy sector accessible to all, especially MSMEs and individual consumers, is essential for inclusive

innovation. The goal of "*democratizing technology adoption*", as one technical management specialist put it, underscores the importance of broad technology availability for the success of the energy transition. Developing policies and initiatives to facilitate technology diffusion and adoption is seen as a medium-term strategy.

Digitization of administrative processes: The proposal to digitize administrative processes aims to increase efficiency and reduce bureaucratic time in the implementation of energy projects. Emphasizing the benefits of digital solutions in "*streamlining administrative procedures*", a respondent from the gas engine sector suggests significant improvements in bureaucratic efficiency for energy projects. Developing digital platforms, training staff, and converting existing procedures to digital formats are essential steps in this medium-term strategy.

Stabilize energy policy frameworks: The development of transparent, consistent, and supportive energy policies is instrumental in creating a reliable framework that fosters the energy transition. A stable policy environment instills confidence in investors and stakeholders, which is critical for the long-term planning and implementation of renewable energy projects. As one solar energy professional emphasizes, "*It is essential to develop a favorable regulatory framework with clear, stable energy policies*", pointing to the need for a predictable policy environment. Developing and maintaining such supportive policies requires an ongoing commitment that marks it as an overarching long-term goal.

Establish comprehensive energy transition legislation: The need for a comprehensive legal framework to enforce the transition to renewable energy is underlined. Strong legislative measures are essential to ensure compliance and facilitate the rapid integration of renewable technologies. An industry expert in the field of home appliances notes, "*We need to enact drastic and rigorous laws that mandate the energy transition*", underscoring the need for strong legislative support. This legislative effort, which aims to have a significant impact in the medium to long term, requires rigorous processes to enact laws that promote sustainable energy.

Encourage private sector involvement: The recommendation that the government reduce its direct involvement in the energy sector to pave the way for private investment underscores confidence in the private sector's capacity for innovation and efficiency. In proposing a transition to a market-driven model in the energy sector, a participant from the international household appliance industry suggests: "*The state should divest from the energy sector and encourage private investors*". This medium-term perspective focuses on market restructuring to promote competitive engagement and private sector contributions to renewable energy advances.

Addressing the challenges of improving government policies and strategic planning for Tunisia's energy transition requires balancing ethical governance with tailored industry solutions, effective public engagement, and resource allocation. The key is to implement a synergistic approach that combines immediate action with long-term planning. Overcoming bureaucratic inertia, adapting policies to rapidly evolving technologies, and ensuring sustained public and private sector engagement are critical to a successful transition. This multifaceted effort requires a concerted commitment from all stakeholders to build a sustainable and resilient energy future for Tunisia.

5.7.2. Tailoring strategies to sector-specific needs

Tunisia's progress toward energy transition requires an approach that is finely tuned to the unique needs of different sectors, as 16.95% of respondents emphasized. Recognizing the different challenges and perspectives of each sector is imperative in order to develop and implement strategies that are not only tailored, but also effective for a smooth and sustainable transition to renewable energy practices.

Improving access to finance for MSMEs: Enabling MSMEs to access finance for energy transition projects is critical. The creation of public-private partnerships and green investment mechanisms plays an important role in providing the necessary financial support for large-scale energy transition projects. This method is designed to foster new financial collaborations and infrastructures, as one industry expert points out: "*Public-private partnerships can unlock significant funding for energy transition initiatives, making them more accessible and viable*". Such financial support is critical to launching and sustaining renewable energy projects, facilitating the participation of a wide range of business entities in the energy transition.

Create a supportive regulatory environment: Creating a regulatory environment that supports renewable energy initiatives is identified as a foundational strategy. Implementing policies and regulations that encourage renewable energy deployment and investment is critical to driving sector growth. As one participant notes, "*A regulatory framework that is supportive of renewable energy will not only encourage adoption but will also attract investment in the sector*". This regulatory foundation is essential to activate other strategic policies and ensure their long-term success.

Encourage renewable energy enterprises: Supporting renewable energy enterprises through favorable policies, such as special status and tax incentives, aims to encourage growth and innovation in the sector. This strategy is expected to increase the dynamism of the sector over time, with one respondent pointing out that "*providing tax benefits to renewable energy companies can significantly drive expansion and innovation in the sector*". Such initiatives are expected to strengthen the foundation of the renewable energy sector and contribute to the realization of a sustainable energy future.

Promoting energy efficiency and sectoral technological innovation: The transition to energy-efficient buildings and the adoption of advanced technologies across sectors are seen as critical components of the medium-term strategy. This transition requires an overhaul of building practices and the integration of cutting-edge technologies, as articulated by one expert: "*The transition to energy-efficient buildings requires a concerted effort and sector-specific technological advances*". This strategy reinforces the importance of taking immediate action to achieve long-term sustainability goals.

Streamline certification for new technologies: Encouraging the rapid integration of innovative energy technologies through a flexible certification process is essential. By supporting investor-provided technologies with simplified certification, Tunisia can accelerate the deployment of efficient energy solutions. This adaptation of the process, aimed at fostering confidence in new technologies, facilitates faster market entry for advanced energy solutions, thereby increasing the dynamism of the sector. One respondent emphasized this point: "*Investor-provided certifications should be trusted to encourage the adoption of new and efficient energy technologies*", pointing to the need for regulatory adaptation to support innovation.

Improve education and public awareness: Developing comprehensive education and awareness initiatives is essential to fostering a societal ethos that embraces sustainable energy practices. This long-term effort focuses on changing attitudes and cultivating a supportive culture for energy transformation. Highlighting the importance of public engagement, as one respondent aptly put it, "*Awareness campaigns play a critical role in changing perceptions and encouraging the adoption of renewable energy*", demonstrating the impact of informational campaigns on societal support for energy transition measures.

Integrating renewable energy into industrial processes: Modifying existing industrial frameworks to incorporate renewable energy sources is a strategic adjustment necessary to improve sector efficiency. This medium-term effort allows industries to evolve by integrating sustainable practices into their operations. One industry expert might say: "*Integrating renewable energy into existing industrial processes is the key to a smoother transition and immediate impact on energy consumption*", emphasizing the importance of seamless integration for energy efficiency improvements.

Sector-specific incentive programs: Developing incentive programs tailored to the specific needs of different sectors, such as agriculture, manufacturing, and services, can significantly increase the adoption of renewable energy. By addressing the unique challenges and needs of each sector with targeted incentives, this strategy aims to increase the adoption of renewable technologies. As one expert in the field notes, "*Sector-specific incentives are critical to encouraging the adoption of renewable technologies across diverse industrial landscapes*", advocating for a targeted approach to incentive alignment.

Collaborate with international experts: Partnering with global renewable energy specialists for knowledge sharing and technical assistance is instrumental in improving local energy strategies. This long-term strategy aims to import global best practices and increase the effectiveness of Tunisia's energy initiatives. A proponent of international collaboration shares, "*Working with global energy experts will bring advanced know-how and innovative practices to Tunisia's energy sectors*", highlighting the value of international expertise in local developments.

Adopting these tailored strategies represents a multifaceted approach to energy transition that is critical to addressing both immediate and long-term challenges. The success of Tunisia's energy transition depends on the effective implementation of these sector-specific strategies. However, this also introduces complexity, as each sector requires a unique combination of policy support, technological innovation, and stakeholder engagement. Overcoming these challenges will require a coordinated effort among government, industry, and community stakeholders to ensure that each sector's transition contributes to the overall goal of sustainable and efficient energy use in Tunisia.

5.7.3. Financial incentives and economic mechanisms

Financial incentives and economic frameworks are key to advancing Tunisia's energy transition, according to 15.25% of respondents. This includes a range of strategies, from designing effective subsidy programs to revising pricing policies to encourage investment in renewable energy. These fiscal and economic policies are important for fostering an environment that supports sustainable energy progress.

Dedicated renewable energy subsidy programs: The establishment of a special subsidy program for MSMEs that are transitioning to renewable energy is considered essential. This initiative seeks to

reduce the financial burdens associated with adopting green technologies, with the consensus being: "*Subsidy programs need to be tailored to help businesses manage the upfront costs of adopting renewable energy*".

Facilitate access to low-interest financing: Providing low-interest financing is emerging as a critical financial strategy to improve the affordability of renewable energy projects. Reducing the cost of capital in this way makes such investments more attractive to financiers. One banking industry representative stresses this point: "*Low-interest financing can fundamentally change the financial landscape for renewable energy initiatives*".

Optimize compensation for excess energy production: Revising the pricing of excess energy to reflect current purchase prices addresses the economic challenges facing renewable energy producers. This adjustment, which is expected to take shape as a medium-term policy, aims to ensure fair compensation for energy fed back into the grid, with one industry authority noting, "*Fair pricing for surplus power is fundamental to the economic viability of renewable energy efforts*".

Encouraging private sector engagement through reduced government intervention: Advocating for reduced government involvement in the energy sector reflects a strategic shift toward inviting private sector innovation and investment. This policy, envisioned for the medium term, is intended to accelerate technological advancement and efficiency in the energy transition. As one voice from the financial industry suggests, "By stepping back, the government can pave the way for private sector ingenuity and drive in the renewable energy sector", recognizing the indispensable contribution of the private sector to the energy transition.

Simplifying administrative procedures and improving access to finance: The importance of reducing bureaucratic complexity and improving access to financial mechanisms, especially for MSMEs, is identified as a strategic priority. Simplified administrative pathways, coupled with financial support such as special loans with low interest rates, are decisive in lowering the threshold for engaging in energy transition activities. As one NGO representative points out, "*Simplifying administrative procedures and introducing accessible financial support are essential for the widespread adoption of sustainable technologies*".

Increased government commitment and strategic clarity: Increased government commitment, along with increased funding and a well-defined strategic outlook, is seen as a major factor in advancing the energy transition. This strategy underscores the need for government leadership to pave the way to a sustainable energy future. As one participant notes, "*A strong commitment from government, backed by substantial funding and a coherent strategic direction, is essential to drive the energy transition forward*". The effectiveness of this approach depends on the government's determination to allocate the necessary resources and set a clear path for the transition.

Facilitate business digitization: The digital transformation of business operations is recognized as a facilitator of the energy transition. This strategy, supported by government officials, aims to leverage technological advances to improve operational efficiency and sustainability. "*Assisting enterprises in their digital transformation efforts will streamline the transition*", notes one ministry official, highlighting the role of digitalization in reducing operational costs and seamlessly integrating renewable energy solutions.

Comprehensive support for enterprises: Providing comprehensive support to enterprises, with a focus on MSMEs, through subsidies, tax incentives, and navigational guidance is recognized as an essential long-term approach. This strategy underscores the important role of MSMEs in the economy and their potential impact on the energy transition. "*Ensuring thorough support for businesses, especially MSMEs, throughout the decision-making process is critical*", one respondent said, advocating for a holistic support system.

Implementing pre-defined plans: The execution of pre-established plans, especially in the context of current geopolitical challenges, is highlighted as a critical strategy. Commitment to implementing the strategies laid out since 2012 is emphasized as crucial to maintaining the momentum and effectiveness of the transition efforts. As one respondent from the banking sector points out, "*Adherence to the strategies laid out in 2012 is more urgent than ever, given the current geopolitical climate, such as the conflict between Ukraine and Russia, which underscores the urgency of accelerating the energy transition*".

Promoting R&D in green technologies: Prioritizing research and development in green technologies through financial incentives is seen as a strategic approach for medium to long-term planning. Such support aims to promote innovation and sustainability within the renewable energy sector. "*Investment incentives for R&D in sustainable technologies are essential to stimulate innovation and promote sustainability in the energy sector*", according to one industry expert, highlighting the importance of financial support for technological advancement.

Tax incentives for renewable energy investments: The use of tax incentives to encourage investment in renewable energy represents a medium-term financial strategy to increase the attractiveness of the sector. This method seeks to increase the rate of adoption of renewable technologies by making investments financially attractive. As one policy analyst suggests, "*Providing tax incentives for renewable energy investment can significantly accelerate the transition by making it financially attractive*".

Facilitate grants and financing for renewable energy initiatives: The establishment of grant programs and specific financing avenues for small-scale renewable energy projects is identified as a strategic priority. This approach is particularly beneficial for MSMEs and community efforts that typically face financial constraints. To highlight the importance of this support, an SME representative may stress: "*Access to grants and specialized financing is critical to fostering broader engagement in the energy transition, especially among smaller entities and local initiatives*". This approach aims to democratize the energy transition by ensuring that entities of all sizes have the necessary financial resources to contribute to sustainable energy development.

This review of financial incentives and economic strategies highlights the need for an integrated and nuanced approach to financing the energy transition in Tunisia. The successful transformation of the energy sector requires synergies between government policy initiatives, private sector engagement, financial institutional support, and active public participation. Strategies range from immediate actions, such as implementing existing programs, to developing medium- and long-term initiatives, including promoting green technology innovation and introducing tax incentives for renewable energy investments. These diverse strategies aim to reduce financial barriers and cultivate a vibrant, sustainable energy ecosystem. The imperative is to effectively coordinate these diverse financial mechanisms to ensure that they collectively contribute to the overarching goals of the energy

transition and avoid compartmentalizing efforts into rigid timeframes. This approach emphasizes the fluidity and adaptability required in policy implementation to support the evolving landscape of renewable energy development.

5.7.4. Simplification of administrative procedures and minimization of red tape and bureaucracy

In the pursuit of accelerating Tunisia's energy transition, a significant focus, represented by 15.25% of the feedback, highlights the need for administrative and bureaucratic reforms. The consensus underscores the critical need to streamline administrative processes and minimize bureaucratic hurdles, in line with the broader goal of improving the efficiency of the energy sector and its responsiveness to the evolving dynamics of the energy transition.

Optimize administrative efficiency: Improving the administrative framework, particularly for renewable energy projects, is essential. One energy sector expert emphasized, "*Efficient administrative processes are essential for the rapid implementation of renewable energy projects*" and noted the importance of refining procedural timelines to expedite project implementation, without explicitly categorizing the recommendation within a specific timeframe.

Facilitating interactions with the STEG: The need to simplify procedures and improve the efficiency of project development with the STEG is highlighted as a significant initiative. Representatives from the electricity and broader energy sectors underscore the importance of this goal, with one noting, "*Simplifying procedures with STEG can significantly speed up the development of energy projects*", and another adding, "*Streamlining procedures with STEG is essential to speed up project approvals and implementation*". These findings converge on the need to make STEG processes more efficient to support a smoother energy transition.

Encourage rapid adoption of new technologies: Making new energy technologies more accessible by streamlining their certification processes is seen as critical. As one renewable energy technology expert noted, "*Streamlining the certification process for new technologies is critical to their rapid adoption*", underscoring the goal of removing barriers to innovation and encouraging the adoption of innovative energy solutions.

Digitizing administrative procedures: The transition to digital administrative processes is identified as a strategy to improve operational efficiency and transparency. "*Digitizing administrative procedures is an important step to improve efficiency and transparency in the energy sector*", noted one digital transformation expert, highlighting the potential of digital solutions to streamline bureaucratic operations.

Reducing bureaucratic complexity: Simplifying the bureaucratic landscape within the energy sector is identified as a critical goal. One respondent from the energy sector stressed, "*Simplifying bureaucratic processes is crucial for the smooth implementation of energy projects*", stressing the importance of administrative reform in facilitating energy transition efforts.

Facilitating digital transformation in enterprises: The transition to digital operations for MSMEs is highlighted as a core need for facilitation. An official from the Ministry of Energy emphasizes, "*Supporting enterprises to digitize their processes is essential to meet the technological demands of the energy transition*", highlighting the role of digital literacy in increasing adaptability and efficiency.

Valuing certificates from investors in new technologies: A more flexible regulatory approach to investor certificates for new technologies is advocated to accelerate the adoption of innovative solutions. As one industry expert notes, "*Trusting investor-provided certificates can accelerate the deployment of new technologies, thereby accelerating the energy transition*", suggesting a shift toward more flexible regulatory practices.

Develop centralized digital systems for project approvals: The creation of integrated digital platforms to facilitate energy project approvals is suggested to increase efficiency and transparency. One digital systems specialist mentions, "*Integrated online platforms are critical to reducing the turnaround time for energy project applications*", highlighting the need for digital solutions to streamline administrative processes.

Improve government officials' understanding of renewable technologies: Continuing education for government officials on the latest renewable energy technologies is essential for informed policymaking and project evaluation. As one energy training consultant points out, "*Regular training for officials is essential to keep up with the rapid advances in renewable energy*", underscoring the importance of knowledge in facilitating the energy transition.

Leveraging public-private partnerships for government innovation: Collaboration between the public and private sectors is identified as a means to bring efficiency and innovation to government operations. One policy analyst notes, "*Public-private partnerships are essential for introducing innovative administrative solutions in the energy sector*", and advocates cooperative efforts to reform administrative practices.

Establish a business feedback mechanism: Establishing a mechanism for businesses to provide feedback on administrative experiences aims to improve procedural efficiency and user-friendliness. As one business consultant points out, "*A feedback mechanism is crucial for the continuous refinement of administrative processes in the energy sector*", emphasizing the value of stakeholder input in administrative improvements.

Ensure regular review and simplification of energy regulations: Regular review and simplification of energy regulations is suggested to eliminate outdated or unnecessary procedures. One regulatory expert states, "*Regular review of energy regulations is necessary to ensure their effectiveness and prevent them from hindering the progress of energy projects*", underscoring the need for a regulatory framework that supports rather than hinders the energy transition.

Adoption of automated tracking systems: The adoption of automated systems that allow MSMEs to track the status of applications in real time is advocated to increase transparency and predictability in government processes. An IT specialist focused on government processes suggests, "*Automated tracking systems are crucial for providing real-time updates and enhancing the transparency of application procedures in the energy sector*". This recommendation reinforces the importance of technology in streamlining government interactions.

Promoting efficient government processing: Encouraging faster action by government agencies and officials through efficiency incentives is suggested to speed up procedural timelines. This could be implemented as an immediate impact strategy, with one government efficiency expert recommending, "*Incentives for swift processing are imperative to promote efficiency and minimize delays in the administrative handling of energy initiatives*".

Create dedicated units for renewable energy projects: The creation of dedicated units within government agencies to specifically manage renewable energy projects is identified as a strategy to ensure that these initiatives are handled with the necessary expertise and focus. As one consultant specializing in government restructuring points out, "*Specialized units for renewable energy projects are important to ensure that these initiatives are managed with the appropriate expertise and efficiency*".

Establish cross-sectoral coordination mechanisms: The establishment of formal coordination frameworks among the sectors involved in the energy transition aims to achieve a unified and coherent strategy. As one cross-sector integration specialist points out, "*The development of cross-sector coordination mechanisms is essential for a synchronized approach to the energy transition*". This long-term strategy aims to reduce inconsistencies and delays resulting from fragmented administrative practices.

The collective feedback highlights the urgent need for reforms that extend beyond simply improving administrative efficiency. It calls for the integration of technological solutions and digital innovations to modernize existing bureaucratic systems. By addressing these challenges, Tunisia can cultivate an environment conducive to the energy transition, characterized by streamlined procedures, technological advances, and an adaptable bureaucratic framework. This comprehensive approach, which includes policy reforms, investments in digital infrastructure, and administrative capacity building, is considered critical to the sustainable future of Tunisia's energy sector. The emphasis on multifaceted administrative reform reflects the importance of keeping pace with technological advancements and the global shift toward sustainable energy to ensure the agility, efficiency, and progressive outlook of Tunisia's energy sector.

5.7.5. Promoting awareness and education initiatives

Feedback on Tunisia's energy transition strategy highlights the critical role of public awareness, education, and community engagement. Representing approximately 11.86% of the feedback, the emphasis on awareness and education is identified as a fundamental element in promoting and advancing sustainable energy practices. It signifies the importance of cultivating a deep-rooted understanding and proactive participation among various segments of society, laying the groundwork for informed action and collaborative efforts toward a sustainable energy future.

Strengthen communication efforts: Increasing public and stakeholder understanding of the energy transition and its benefits is seen as critical to ensuring widespread support and participation. This includes providing clear, compelling information about the benefits of transitioning to sustainable energy models. As one energy sector authority emphasizes, "*Improving communication about the energy transition and its benefits is critical to generating broader support*". This approach, which focuses on fostering a shared understanding and positive view of the energy transition, is critical to its fruitful implementation.

Integrate renewable energy education into schools: Integrating renewable energy education into early school curricula is recognized as a strategic, long-term endeavor. This initiative seeks to instill the importance and principles of sustainable energy at an early age, thereby shaping the perspectives of future generations on energy use and conservation. As one researcher advises, "*Incorporating renewable energy issues into school curricula from an early age is fundamental to*

cultivating a culture of sustainability". This strategy is designed to have a lasting impact and ensure that future generations will continue to engage with renewable energy concepts.

Raise public awareness of environmental issues: Raising awareness of environmental and energy challenges is seen as a core strategy for fostering a society that values sustainable energy practices. "*Educating the public on environmental and energy issues is essential to creating a supportive environment for the energy transition*", notes one participant, emphasizing the integration of environmental awareness into societal norms and values as a long-term goal.

Launch targeted education and awareness campaigns: Initiatives aimed at broadening understanding of the benefits of the energy transition across different sectors of society are seen as essential. "*Specialized education and awareness campaigns tailored to different segments of society are needed to explain the benefits of the energy transition*", notes one contributor. This strategy, which involves medium- to long-term efforts, is critical to garnering widespread support for renewable energy projects.

Establish media partnerships to raise public awareness: Partnering with the media to disseminate information about renewable energy and sustainability practices aims to engage a diverse audience. The use of television, radio, online platforms, and print media serves as a conduit for widespread awareness. As one energy industry professional articulates, "*Media partnerships are fundamental to broadening public understanding of the benefits of the energy transition*", highlighting the role of the media in educating the public about the benefits of sustainable energy.

Business-focused awareness programs: Awareness initiatives specifically tailored to the business community are aimed at increasing the sector's awareness of the energy transition. The goal is to explain the economic and environmental benefits of using renewable energy sources. As one respondent from the business sector emphasizes, "*It is imperative to raise awareness within the business community about the energy transition*", pointing to the need to foster a sustainable business culture.

Inform about support mechanisms: Illuminating the range of available mechanisms that facilitate the energy transition, such as subsidies and incentives, is indispensable. This requires a concerted effort to make stakeholders aware of existing support frameworks. "*Awareness of the various support mechanisms for the energy transition is essential*", notes one expert, underscoring the importance of making businesses and the broader community aware of the resources and support available for transitioning to sustainable practices.

Diversify solution promotion: Advocating for a broad range of solutions and technologies relevant to the energy transition reflects a commitment to a diverse and inclusive approach. Recognizing the need for diverse renewable energy pathways that meet different needs and contexts is essential. "*Highlighting a range of solutions and technologies for the energy transition is essential for adaptable renewable energy deployment*", comments one respondent, advocating for innovation and flexibility in meeting energy needs.

Incentivize clean energy adoption: Educating businesses about the incentives and benefits of adopting clean energy is identified as a critical strategy. The goal is to highlight the economic and environmental benefits and motivate businesses to become more actively involved in the transition. "*Educating businesses about the benefits and incentives of adopting clean energy is crucial for their*

involvement in the energy transition", explains one business representative, stressing the importance of fostering a business environment that is receptive to and proactive about sustainable energy solutions.

Launch targeted business campaigns: Organizing targeted campaigns to educate businesses on the benefits of the energy transition, funding opportunities, and best practices aims to provide them with actionable insights. "*Special campaigns to educate businesses about the benefits of the energy transition are essential for their active engagement*", notes one business development expert, underscoring the strategy's focus on providing practical, supportive information to facilitate informed decision-making and investment in sustainability.

Fostering community involvement in renewable energy projects: The development of community engagement programs is seen as an essential part of building grassroots support and understanding for renewable energy projects. Initiatives can include community-led energy projects, educational workshops, and inclusive decision-making processes. As one community development specialist put it, "*Engaging communities directly in renewable energy efforts fosters local understanding and builds support for the transition*", illustrating the value of grassroots involvement in the energy transition.

Promoting corporate sustainability practices: Providing training programs tailored to businesses on the adoption of sustainable practices and energy-efficient technologies is important to facilitating the transition to greener energy sources. These trainings are designed to provide actionable insights on how to minimize the carbon footprint of corporate operations. According to a corporate training professional, "*Corporate sustainability training is essential to encourage actionable steps towards improved energy efficiency and the adoption of renewable energy*", underscoring the role of education in facilitating corporate sustainability transitions.

Strengthening youth leadership in sustainability: Engaging youth in discussions and activities related to the energy transition is essential to cultivating a future cadre of sustainability advocates. Activities could include forums, innovation competitions, and leadership programs focused on energy and environmental stewardship. As one education expert notes, "*youth-led initiatives are fundamental to developing a generation committed to sustainable energy*", underscoring the importance of youth involvement in shaping future sustainability efforts.

Expanding access to online educational resources: The creation of online learning tools, such as e-courses, webinars, and interactive platforms, aims to expand access to knowledge about renewable energy and sustainability. This approach uses digital media to disseminate information widely. As one researcher suggests, "*Online educational platforms make knowledge about renewable energy accessible to a wide audience*", highlighting the potential of digital tools to expand educational outreach.

Partner with academic institutions: Partnering with universities and research institutions to advance renewable energy education programs and research is key to integrating academic expertise into the energy transition. This strategy seeks to connect research-based knowledge with practical energy solutions. An academic liaison asserts, "*Synergy between the energy sector and academic institutions is critical to fostering innovation and advancing knowledge in renewable energy*", and advocates for bridging industry and academia to advance the energy transition.

This strategic focus on awareness, education, and community participation envisions a comprehensive shift beyond technological adaptation to a societal transformation underpinned by widespread understanding, engagement, and support for sustainable practices. The collective input underscores the importance of cultivating an informed, engaged society as the cornerstone of successful and sustainable energy transition efforts. By prioritizing these areas, Tunisia is positioning itself to foster a culture attuned to sustainability and innovation, laying a solid foundation for lasting change. The implementation of these strategies is paramount to ensuring that sustainable energy practices are not only communicated, but deeply ingrained and actualized across all sectors of society, fostering an atmosphere conducive to a thriving and sustainable energy future.

6. Conclusions and policy recommendations

6.1. Summary of key findings

This study highlights the multifaceted nature of the energy transition in Tunisia from the perspective of MSMEs. The findings paint a detailed picture of the current state of the energy transition, characterized by a variety of awareness levels and attitudes towards energy sustainability entities. There is a clear indication that while some MSMEs are well informed and proactive, others lag behind in understanding and implementation, suggesting a need for more tailored education and support initiatives.

A critical aspect revealed is the diversity of perceptions and approaches to renewable energy adoption among SMEs. Economic factors such as cost and return on investment, as well as environmental considerations, play an important role in the decision-making process. However, these are often weighed against existing challenges such as bureaucratic inertia, which hinders rapid action and innovation.

The study also highlights the need for sector-specific strategies, recognizing that a one-size-fits-all approach is ineffective in addressing the unique needs and constraints of different SME sectors. In addition, financial and technological barriers emerge as significant obstacles, pointing to the need for more robust support systems and infrastructure.

The research also underscores the critical role of government policies and strategic planning. Effective policies and plans are essential not only to guide but also to accelerate the energy transition. This includes simplifying administrative processes, reducing red tape, and fostering an environment conducive to the adoption of sustainable practices and technologies.

The key findings highlight the complexity of the energy transition in Tunisia and the need for more targeted approaches, stronger policy frameworks and comprehensive support systems to address the different needs and challenges of SMEs.

6.2. Strategic implications for SMEs and policymakers

For SMEs, the study's findings point to an urgent need to actively engage in the energy transition process. This engagement includes not only the adoption of renewable energy technologies, but also active participation in policy development and advocacy. SMEs should be encouraged to voice their specific challenges and needs to ensure that their perspectives are considered in policy formulation.

On the policy front, the findings call for a nuanced understanding of the unique challenges and needs of SMEs in the context of the energy transition. Policymakers should aim to develop and implement policies that not only facilitate the transition to renewable energy, but also provide tangible support to SMEs. This includes creating financial incentives, providing technical assistance, and ensuring access to necessary resources and information.

A key strategic implication is the need for a collaborative approach that bridges the gap between SMEs and policy makers. Such an approach would involve regular dialogue, shared decision-making and joint initiatives aimed at overcoming barriers to the energy transition. Policymakers should work closely with SMEs to ensure that policies are practical, effective, and responsive to the real challenges and opportunities faced by these businesses.

The strategic implications essentially highlight the need for a cohesive and collaborative effort between SMEs and policymakers. This joint effort is critical not only for the successful implementation of the energy transition, but also for ensuring that SMEs can thrive and effectively contribute to Tunisia's sustainable energy future.

6.3. Recommendations to enhance the energy transition

In light of the detailed findings in Subsection 4.7, the following recommendations are proposed to improve the energy transition process, with particular emphasis on the role of MSMEs in Tunisia:

Government policies: Prioritize the development and implementation of clear and strategic government policies that are ethically grounded and tailored to the specific needs of different industries. These policies should foster an environment conducive to sustainable practices and support the integration of renewable energy. It's essential that these policies not only provide a framework for action, but also offer the necessary support and resources to ensure effective implementation, especially for MSMEs.

Sector-specific strategies: Develop and implement strategies tailored to the specific challenges and opportunities of each sector. Recognize the different nature of MSMEs and tailor support mechanisms to their specific contexts. This approach should include a detailed analysis of sector-specific needs and the creation of targeted initiatives that effectively address these needs and promote a more inclusive and efficient energy transition process.

Financial incentives: Establish and strengthen financial incentives and economic mechanisms that actively promote the uptake of renewable energy and innovation within SMEs. This could include tax breaks, grants, low-interest loans or subsidies specifically designed to lower the barriers to entry for SMEs engaged in renewable energy projects. These incentives should be easily accessible and clearly communicated to ensure maximum uptake and impact.

Administrative simplification: Focus on streamlining administrative processes and minimizing bureaucratic hurdles that currently impede the transition to renewable energy. Simplifying these processes is critical to reducing the delays and costs associated with adopting sustainable energy solutions. Efficient and user-friendly administrative procedures can significantly increase the willingness and ability of SMEs to invest in renewable energy technologies.

Awareness and education: Invest heavily in awareness and education campaigns targeting all sectors of society, with a particular focus on explaining the role and potential contribution of SMEs in the

energy transition. These campaigns should aim to increase understanding of the benefits of renewable energy, the support mechanisms available and the critical role of SMEs in achieving a sustainable energy future. Educational initiatives should include a range of platforms and media to ensure broad reach and engagement.

By implementing these recommendations, Tunisia can foster a more robust and inclusive energy transition and ensure that MSMEs are not only participants but also drivers of sustainable change. These recommendations aim to create a supportive ecosystem that enables these enterprises to effectively contribute to the national goal of a sustainable and resilient energy future.

6.4. Suggestions for future research

Future research should examine the long-term impacts of the energy transition on SMEs, including economic, social and environmental aspects. Studies could also examine the effectiveness of specific policies and incentives implemented to support MSMEs in the energy transition. Furthermore, research on the role of digital technologies and innovation in facilitating MSMEs' transition to renewable energy would be valuable. Comparative studies with other countries undergoing similar transitions could provide insights into best practices and lessons learned.

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