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Policy Research Report

In the Context of the Renewable Energy Transition in MENA

The Role of MSMEs in Fostering Inclusive, Equitable, and Sustainable Economic Growth

Jordan Case Study

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Summary

In Jordan, micro, small, or medium enterprises (MSMEs) make up over 99 percent of enterprises and employ around 60 percent of the workforce, spanning sectors such as manufacturing, services, and trade. These firms, typically with fewer than 100 employees and generating under 1 million Jordanian dinars (JOD), face challenges like access to finance, regulatory hurdles, and market competition. Despite these obstacles, MSMEs significantly contribute to Jordan's GDP and employment. International organizations, including the World Bank, have supported reforms to improve the business environment for MSMEs. As Jordan advances in renewable energy (RE) adoption, MSMEs play a crucial role—especially given the country's heavy reliance on energy imports and grid limitations. Decentralized energy production and smart-grid technology offer potential solutions, aligning with population distribution more effectively than large-scale power plants. This report explores the developmental context of Jordanian MSMEs, focusing on their role in clean energy initiatives, summarizing regulatory frameworks, examining ongoing projects, and identifying best practices within the broader MENA clean energy transition.

The report aims to develop a comprehensive framework for enhancing the involvement of MSMEs in Jordan's RE transition, exploring their relationship with the economic and policy environment, identifying challenges and opportunities, and contributing to the Sustainable Development Goals (SDGs). Specific objectives include assessing the role of MSMEs in the clean energy transition, analyzing the impact of energy policies on MSMEs and economic growth, evaluating sectoral implications—particularly regarding gender equality (SDG 5) and decent work (SDG 8)—and providing decision-makers with data-driven insights to inform policy formulation and revision to support MSMEs in the energy transition.

The report employs a comprehensive mixed-methods approach, integrating quantitative and qualitative research tools to examine the role of MSMEs in the clean energy transition and their contribution to sustainable economic growth. The quantitative component involves a structured questionnaire survey of 400 MSMEs using a stratified random sampling method to quantify their engagement with RE technologies and identify barriers and supports. The qualitative component includes focus group discussions (FGDs), key informant interviews (KIIs), and a desk review, engaging multiple stakeholder groups to provide deeper insights and contextualize quantitative findings. The data gathered from these methods were analyzed to assess the current state of MSMEs in the clean energy sector, identify gaps and opportunities, and recommend strategies for enhancing their role in sustainable economic growth, ensuring that the report's outcomes are robust and actionable for decision-makers.

We would like to extend our heartfelt gratitude to the Phenix team with special acknowledgments to Aysheh Salah Barhoumeh and Stone Rathbun for their invaluable contributions to this study. Their diligent efforts in creating data tables, editing, and proofreading have been instrumental to the completion of this work.

Summary

Jordan is transitioning from fossil fuels to RE, which is crucial for addressing its economic, environmental, and security challenges. This shift is particularly significant for MSMEs, which can benefit from cost savings and increased competitiveness despite facing new taxes and regulatory challenges. Key hurdles include bureaucratic, financial, and infrastructural constraints, emphasizing the need for innovative government policies and MSME responsiveness. Success stories and evolving awareness are encouraging more MSMEs to adopt RE for environmental and competitive reasons, potentially leading to job creation and skill development in the RE sector. Surveys and interviews reveal that maintaining national order is a priority during the transition, with a majority of MSMEs supporting electricity cost subsidies and viewing RE technologies positively despite financial and grid stability challenges. Most MSMEs plan to invest in RE, underscoring a growing commitment to sustainability; however, improved access to information, supportive policies, and infrastructure are needed for a more effective transition.

The report's recommendations focus on enhancing the RE transition for MSMEs through several key areas: improving RE financing by attracting investment and exploring innovative models; refining policy frameworks and regulations to ease adoption and offer incentives; investing in capacity building and raising public awareness; implementing monitoring and adaptation measures to track progress and enhance resilience; upgrading infrastructure to support RE integration; and developing sector-specific strategies tailored to different energy demands, including targeted measures for MSMEs to build awareness and capacity for the energy transition.

Chapter One: Introduction, Methodology, and Context

1. Introduction

In Jordan, micro, small, and medium enterprises (MSMEs) represent more than 99 percent of the total number of enterprises in Jordan and employ approximately 60 percent of the workforce.[1] These enterprises operate across various sectors, including manufacturing, services, and trade, playing a vital role in the Kingdom's economic fabric. In the Jordanian context, MSMEs are generally firms that employ fewer than 100 employees and generate less than 1 million Jordanian dinars (JOD).[2]

MSMEs in Jordan face several challenges, including access to finance, regulatory hurdles, market competition, weak inter-enterprise coordination, and weak linkages with large firms. Despite these obstacles, they continue to contribute significantly to the GDP and employment. The World Bank and other international organizations have supported Jordan in implementing reforms to enhance the business environment for MSMEs, focusing on improving access to finance and reducing regulatory burdens.[3]

In the journey toward the clean energy transition in MENA, Jordanian MSMEs have an important role to play. Jordan has made great strides in the past decade in sourcing more energy from renewable energy (RE) sources. Unfortunately, large-scale RE projects in the Kingdom are limited as the electrical grid faces issues with capacity and efficiency in absorbing and transmitting the generated RE in various areas in Jordan. It is worth mentioning that Jordan imports almost 93 percent of its energy requirements from abroad; hence, the country is vulnerable to price changes in addition to concerns over national energy security.

With the largest single share of electricity used by residential consumers, there is potential for decentralized energy production and storage to aid with the green energy transition in Jordan. Paired with smart-grid technology, RE production can reduce reliance on a national grid for the production, storage, and long-distance transportation of energy.[4] MSMEs represent nodal concentrations of capital distributed across every part of the Kingdom. Their distribution better mirrors the population distribution than large-scale power plants. This study examines the developmental context of MSMEs in Jordan with a special emphasis on the synergy of clean energy initiatives. It summarizes current regulatory frameworks, ongoing initiatives, and the proposed projects for developing these two segments of the economy. It also identifies best practices and compatibilities. The findings are contextualized within the greater MENA clean energy transition.

2. Study objectives

The study provides a comprehensive framework for understanding and enhancing the involvement of MSMEs in Jordan's RE transition. It also seeks to explore the multifaceted relationship between MSMEs and the broader economic and policy environment, identify the specific challenges and opportunities presented by the transition to sustainable energy, and contribute to the achievement of the UN SDGs.

These objectives are designed to equip decision-makers with data-driven insights for the formulation and revision of policies that nurture the MSME ecosystem within the context of Jordan's energy transition. More specifically, the study aims to achieve the following:

- Assess the role of MSMEs in the clean energy transition.
- Analyze the impact of energy policies on MSMEs and economic growth.
- Examine the challenges and opportunities of the clean energy transition in Jordan.
- Evaluate sectoral implications and contributions toward achieving SDGs, especially goals 5 and 8, which concern gender equality and decent work.
- Support decision-makers with evidence to create and amend existing policies, regulations, and strategies to foster MSMEs' role in the energy transition.

3. Methodology

The methodology for this study employs a comprehensive mixed-methods approach, integrating both quantitative and qualitative research tools to explore the role of MSMEs in the RE transition and their contribution to promoting inclusive and equitable sustainable economic

[1] JCI (2024). Small and Medium Sized Services. https://jci.org.jo/Chamber/Services/Sectors/80095?l=en

[2] Department of Statistics of Jordan. Establishments Census 2018. http://dosweb.dos.gov.jo/censuses/establish-census

[3] The World Bank. Jordan Economic Update, Spring 2020. (Information based on general knowledge and available literature).

[4] Jordan Ministry of Environment (2020). Energy Sector Green Growth National Action Plan 2021-2025.

growth. This expanded methodology aims to capture a broad and nuanced understanding of the dynamics at play, leveraging detailed data collection and analysis to fulfill the study's objectives.

4. Quantitative and qualitative tools

Quantitative Research: A structured questionnaire was designed to collect detailed data from 400 MSMEs across various sectors. This survey aims to quantify the extent of MSMEs' engagement with the clean energy transition, including the adoption of RE technologies and energy efficiency practices. The survey also seeks to identify the barriers and enablers to MSMEs' participation in the RE sector from the perspective of the interviewed enterprises and players in the targeted market. The sample MSMEs were selected with a stratified random sampling approach.

Qualitative Research: The qualitative component includes FGDs, KIIs, and desk reviews. These tools are employed to gain deeper insights into the experiences, perceptions, and aspirations of the stakeholders involved in or affected by the clean energy transition. The qualitative research component is crucial for contextualizing quantitative findings and exploring themes that surveys alone cannot fully address. A diverse group of 35 participants were engaged in in-depth interviews as well as five FGD sessions, representing a cross-section of stakeholders directly and indirectly involved in the clean energy transition.

The population of the study includes a wide range of individuals and enterprises concerned with the scope of the study as follows: (1) MSMEs with varied experiences regarding the energy transition; (2) environmental consultants; (3) research scientists specializing in environmental studies; (4) government officials from relevant ministries and agencies; (5) managers from banks, financial, and microfinance institutions; (6) national and International energy sector experts; (7) representatives of environmental associations/NGOs; and (8) RE installation companies. The latter are companies engaged in the energy transition, providers of RE solutions, environmental association representatives, regional energy directorate representatives, and local government officials.

5. Data gathering and analysis

The comprehensive data gathering facilitated by the aforementioned tools are analyzed to provide insights into the current state of MSMEs in the RE transition, identify gaps and opportunities for policy intervention, and recommend strategies to enhance MSMEs' contribution to sustainable economic growth. This methodology, which blends quantitative and qualitative approaches and adopts an intersectional focus, ensures that the study's outcomes are robust, relevant, and actionable for decision-makers aiming to foster a supportive environment for MSMEs within the context of Jordan's energy transition.

Jordan has specific standards for designating whether a firm is micro, small, or medium, depending on the sector. These designations are used to identify the type of business eligibility for different financial, legal, or development services.

The registration and formalization of enterprises in the Jordanian legal system use different standards for defining the enterprise's required documents and fees for registration, as well as its liability, capital requirements, and structure. Since there are codified definitions of each subclass of MSMEs, samples are taken with representation from each group.

6. RE landscape in Jordan

Jordan has set ambitious targets to increase the share of RE in its total energy mix. Growing the use of RE from less than one percent in 2014 to 21 percent by 2021 and aiming to achieve 31 percent by 2030, the Kingdom is on track to become much more energy and environmentally

Table 1. Categorization standards sorted by sector industry (I), services (S), and trade (T) to register and formalize MSMEs

	I Micro	I Small	I Med.	S Micro	S Small	S Med.	T Micro	T Small	T Med.
Employees	<5	<20	<100	<5	<25	<50	<5	<10	<50
Revenue (JOD)	<100,000	<1 mil	<3 mil	<200,000	<500,000	<1 mil	<120,000	<150,000	<1 mil

Source: ARDD (2023). Identifying and Overcoming Obstacles to the Creation of MSMEs in Jordan.

sustainable.[5] The Jordanian government has implemented various policies and initiatives to attract investments in RE projects. The Ministry of Energy and Mineral Resources (MEMR, 2012) Renewable Energy and Energy Efficiency Law No. 13 provides a favorable regulatory framework, offering financial incentives, tax breaks, and guarantees for RE investors.[6]

Solar and wind energy dominate the RE sector in Jordan. Large-scale projects, such as the Ma'an Solar Park and the Tafila Wind Farm, have contributed significantly to the country's RE capacity. Other RE technologies are still being considered but are yet to be adopted on a significant scale. With the exception of one biomass anaerobic decomposition facility, there are no current projects for other RE sources such as hydrogen or geothermal. However, the involvement of MSMEs is essential for achieving a more decentralized and inclusive energy transition.

7. Role of MSMEs in RE development

MSMEs are instrumental in fostering innovation, driving competition, and ensuring the widespread adoption of RE technologies. In Jordan, MSMEs actively participate in various aspects of the RE value chain, from installation to maintenance to efficiency retrofitting services. New standards for construction would require MSME construction firms to learn new energy-efficient practices and increase awareness of energy efficiency incorporated into the infrastructure. Retrofitting older structures would enhance this awareness and create job opportunities. The involvement of MSMEs not only contributes to achieving national RE targets but also enhances the economic development and dissemination of RE practices.

Additionally, taking on the role of prosumers (small-scale energy producers and providers of storage) MSMEs have the opportunity to aid in national development while cutting costs and their carbon footprint in the long run.[7] Through the implementation of a smart grid, even individual residences' water heaters can store energy during peak energy production, and rooftop solar panels can feed electricity back into the local grid with higher efficiency than energy transmitted from further away sources. For the nighttime, energy can be stored by pumping water to a higher elevation and allowing gravity-fed turbines to generate electricity in the evening or for use in gravity-fed municipal water systems. Wind power can also complement solar power by generating electricity at night. These small providers can then efficiently contribute to high energy consumption processes without wasting energy production during peak output.

Sustainable development in Jordan requires supporting the majority of the workforce, which is represented by MSMEs. In terms of equity of access to the clean energy transition, and with the current constraints on the electrical grid and capacity for domestic energy production, there is a need for more dispersed energy production. By investing in MSMEs as nodes of RE production and storage, Jordanian policymakers can empower lower-income individuals while increasing the equity of affordable energy access and bypassing some infrastructure constraints.

8. Challenges faced by MSMEs

Jordan's industry-standard electricity tariff rate is high compared to the benchmark (this includes mining, large industries, and MSMEs) but it reflects adverse implications regarding competition, especially compared to neighboring countries abundant with cheap energy resources.

Despite their vital role, MSMEs in the RE sector in Jordan encounter several other challenges. Access to finance remains a significant hurdle, as securing funding for RE projects can be difficult due to perceived risks and the capital-intensive nature of the industry. There are also opportunities from grant funds like the Innovative Startups Fund Project in Jordan, which has been designed to provide early-stage financing for startups across several sectors, including RE.[8]

MSMEs in Jordan are close to the small size; most of the enterprises do not have proper bookkeeping and some of them operate informally. As such, providing collateral that ensures access to cheap funding is not an easy task. Most of the owners provide personal guarantees to secure funding, which complicates the matter further. Hence, owners take on unlimited liability for financial responsibilities if they do not have JOD 20,000 or more in start-up capital (as opposed to limited liability for

[5] IRENA (2021). The Hashemite Kingdom of Jordan Renewable Readiness Assessment, p.4.

[6] ESCWA (2018). Case Study on Policy Reforms to Promote Renewable Energy Jordan, p.59.

[7] IRENA (2021). The Hashemite Kingdom of Jordan Renewable Readiness Assessment, p.64.

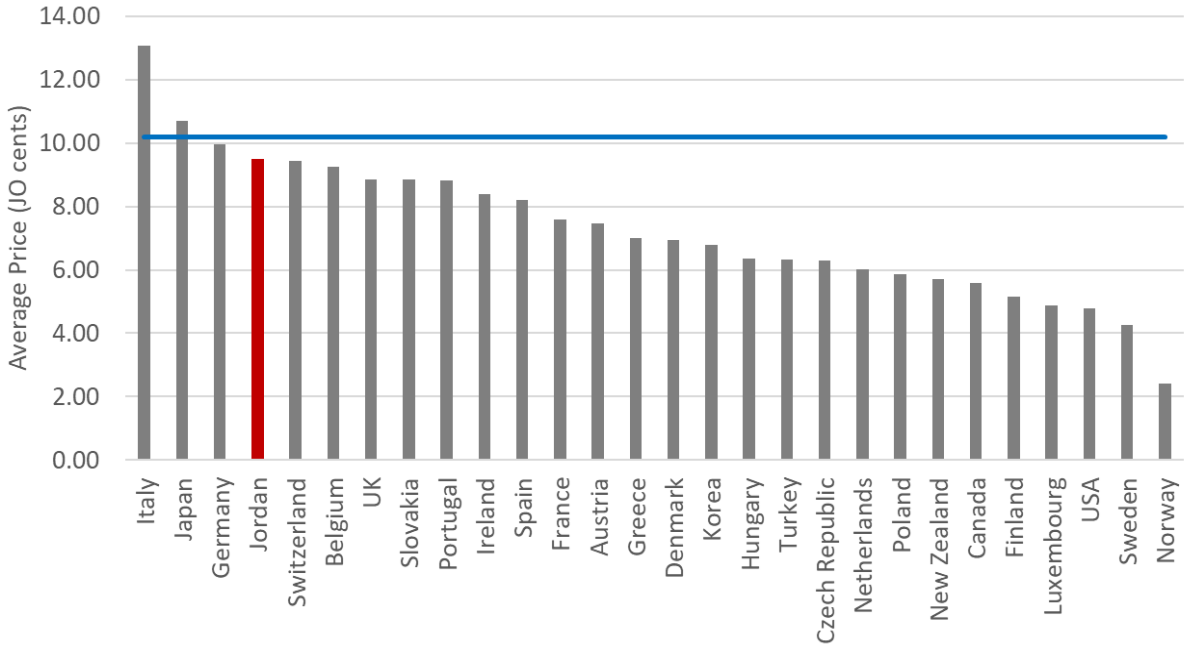
[8] IRENA (2021). The Hashemite Kingdom of Jordan Renewable Readiness Assessment, p.52.

Table 2. Domestic electricity consumption breakdown according to the Jordan department of statistics

	2022		2021	
Usage	**Percentage of Total**	**Gigawatt/ Hour**	**Percentage of Total**	**Gigawatt/ Hour**
Household	47.9	9,862.6	48.1	9,296.4
Industrial	21.2	4,370.1	21.0	4,048.0
Commercial	14.7	3,019.3	14.5	2,808.9
Water Pumping	14.2	2,916.9	14.3	2,769.4
Street Illumination	2.0	408.2	2.0	388.6
Total	100.0	20,577.1	100.00	19,311.3

Source: DOS Annual Report.
Notes: The table shows how electricity is used. A total of 14.2 percent of energy is used for water pumping, which can be done almost entirely during peak electricity generation into water towers and roof storage units to lower energy demand during the low-output hours. Pumping water into points at higher elevations from use during peak generation is an instance of connected storage of energy.

Figure 1. Average price of energy, sorted by country



most larger institutions), and access to legal services.[9] Should an unlimited liability business default on debts, the owner(s) would be obligated to use personal assets to cover the losses.

These conditions create high barriers to entry for starting a new business or formalizing a business that has been operating in the informal domain. More than 62 percent of Jordanians would not start a business for fear of it failing.[10] These fears particularly inhibit younger generations' attempts to enter the market. "A majority of youth trying to open a business (up to 51 percent) in Jordan fail to start it and 42 percent started but failed to sustain it."[11]

Limited technical expertise and insufficient human resources also pose challenges for MSMEs, hindering their ability to compete with larger, more established players. Furthermore, the bureaucratic hurdles in obtaining permits and navigating regulatory processes can be time-consuming and resource-intensive for MSMEs. The lack of a standardized framework for connecting RE projects to the grid adds a layer of complexity, discouraging potential

[9] ARDD (2023). Identifying and Overcoming Obstacles to the Creation of MSMEs in Jordan.

[10] The Global Entrepreneurship Monitor/Jordan National Report 2019/2020.

[11] ARDD (2023). Identifying and Overcoming Obstacles to the Creation of MSMEs in Jordan.

participation and hindering the scalability of MSME-led initiatives.

9. Role of MSMEs in the economy and society

MSMEs are essential for fostering economic growth, employment generation, and innovation in Jordan. They are nimble and adaptable, often more so than larger enterprises, enabling them to innovate and respond to market changes rapidly. This agility is crucial for the development of new products and services, including those related to clean energy and sustainability.

The potential impact of MSMEs on the energy transition cannot be understated. As Jordan and other MENA countries aim to diversify their energy sources and increase energy efficiency, MSMEs are at the forefront of developing innovative solutions. These range from RE technologies to energy efficiency improvements in buildings and industrial processes. By investing in clean energy solutions, MSMEs not only contribute to reducing carbon emissions but can also adapt to new market opportunities and create jobs in emerging sectors.

10. Government commitments to MSME's

The Government of Jordan has made commitments to increase the share of RE in its total energy mix, aiming for a more sustainable and secure energy future. This transition offers a significant opportunity for MSMEs to contribute to and benefit from the growing RE sector.[12] Beyond the commitment, there are many policy tools they can utilize to expedite Jordan's transition.

Thus, the government is and will continue to play a crucial role in promoting inclusive and equitable sustainable economic growth as part of the clean energy transition. By developing and implementing innovative clean energy solutions, MSMEs can help reduce energy costs, improve energy security, and make energy access more equitable. The government would be able to meet green energy targets set out in the Economic Modernization Vision and the UN SDGs by subsidizing financial support for green tech implementation. For example, this can be achieved with the aid of smart-grid technology, which can optimize the distribution and storage of energy from micro and large-scale producers.

[12] International Renewable Energy Agency (IRENA). Renewable Energy Market Analysis: MENA Region 2020 (information based on general knowledge and available literature).

11. Overview of relevant stakeholders

The landscape of stakeholders involved in the energy transition within Jordan and the broader MENA region is diverse, encompassing a range of entities from governmental authorities to private sector participants and the public. These stakeholders each play a unique and critical role in advancing the shift toward RE sources, thereby contributing to the region's sustainable development goals.

11.1 Governmental and regulatory authorities

At the helm of the energy transition are the governmental and regulatory authorities, including the ministries of energy, environment, and finance, as well as the Energy and Mining Regulatory Commission (EMRC). These agencies are guided by the goals of the Jordan Economic Modernization Vision and the UN SDGs.

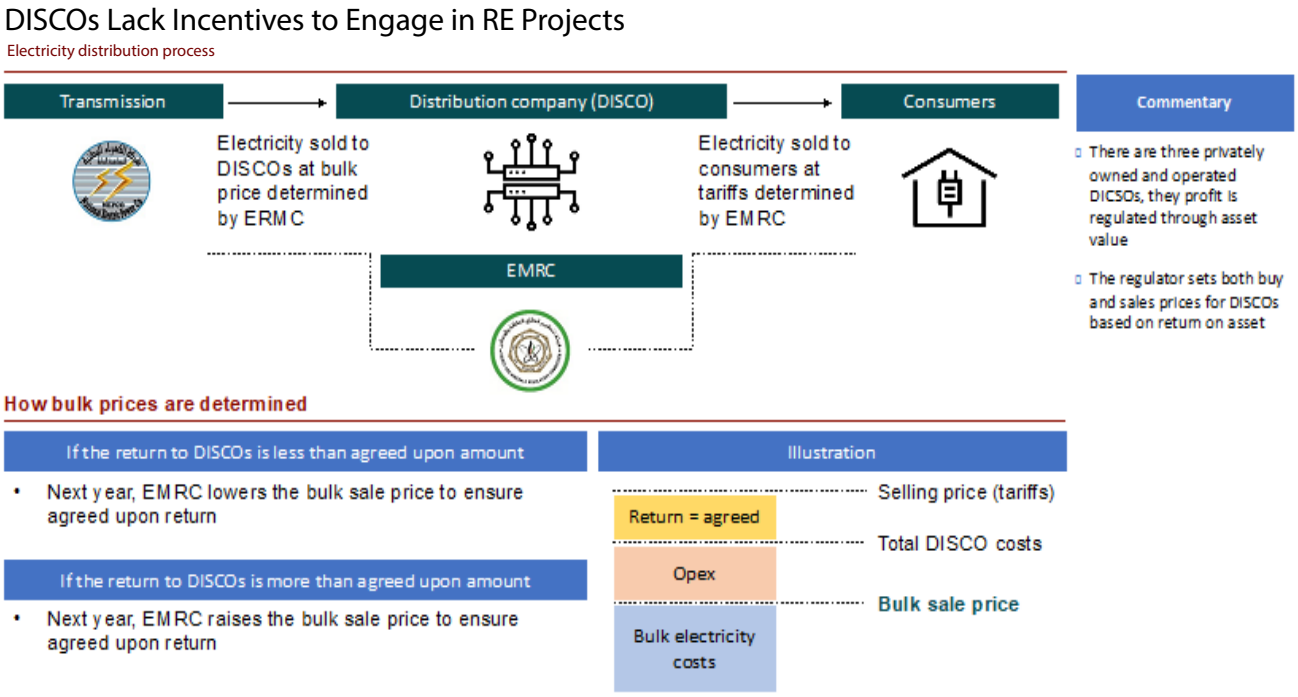
These entities are instrumental in devising, implementing, and overseeing energy policies and regulations. Their responsibilities extend to setting RE targets, formulating incentives for clean energy investments, and establishing frameworks that govern the energy sector's operation within Jordan.[13] The Kingdom's successful transition toward RE hinges on the collaborative efforts of a diverse set of stakeholders. From governmental authorities formulating policies to energy providers driving technological innovation and consumers adopting sustainable practices, each plays a pivotal role in shaping the region's energy future.

11.2 Generations transmission and distribution companies

Jordan adopts a single-buyer model through which the National Electrical Company (NEPCO) buys the electricity from the producers based on long-term contractual arrangements. Those producers are either independent private investors or publicly owned by the state, such as Samra, which produces about 33 percent of the generated electricity. In return, NEPCO sells bulk electricity to the three electricity distribution companies (DISCOs) which take responsibility for connecting to end users in residential, commercial, or industrial settings. The price at which the DISCOs sell is set by the regulator (EMRC). The price is the sum of NEPCO's sale price and a guaranteed return on assets according to EMRC's formula. The graph below exhibits the landscape and the main players

[13] United Nations Economic and Social Commission for Western Asia (ESCWA) (2015). Energy Policies and Regulations in the MENA Region.

Figure 2. DISCOs' electricity pricing and distribution process***



Notes: Developed by Dr. Ibrahim Saif. ** OPEX refers to operational expenses while DISCO refers to electricity distribution companies.*

in the market. Neither NEPCO nor the DISCOs have incentives to introduce RE into the system since NEPCO already has long-term arrangements with producers and DISCOs, which are privately owned and have their return on assets guaranteed. This would partly explain the cumbersome procedures that these companies have implemented for the inclusion of intermittent RE systems.

11.3 The end users

The transition to RE is not solely a technical or financial challenge but also a societal one, where consumers' acceptance and adoption of RE technologies is paramount. This group encompasses a wide array of stakeholders, from individual households to large industrial users, each contributing to the demand side of the energy equation. Consumer behavior, including the willingness to adopt RE solutions and invest in energy-efficient appliances, plays a vital role in determining the pace and success of the energy transition. Engaging consumers through awareness campaigns, incentives, and education is essential to foster a culture that supports sustainable energy practices.[14]

12. Market operations

Jordan adopts two modalities to permit RE projects. The first one is net metering, where consumers can produce and transmit to the grid. At the end of each period, a settlement between the two parties takes place. The settlement depends on the tariff that the consumers pay for their consumption. Normally, households or small enterprises use their rooftops for such a model. The second one is the feed-in tariff; under this modality, the pre-agreed-upon tariff for electricity is paid for generation from various RE technologies. NEPCO is obliged to compensate producers, which are normally large enterprises that normally generate electricity away from where it is being used. They are obligated to use the national grid for transmission. Both these modalities require several approvals from multiple authorities that normally overlap and can be delayed due to bureaucratic and technical reasons primarily concerning grid and transformer capacity. These difficulties can create barriers to entry that deter new entrepreneurial ventures. These frameworks need to remain accessible for new businesses to increase the dynamism of the MSME firms in transitioning into emerging sectors, like RE production and storage.

[14] National Resource Governance Institute, "Energy Transition in the Middle East and North Africa: The Road to COP28," Briefing 30 November 2023, Hanen Keskes Laury Haytayan.

13. Jordan's energy security concerns

Jordan's energy security is a pressing concern given its limited conventional energy resources. The country's reliance on energy imports, which comprises 93 percent of its needs, subjects it to the whims of international markets and the political instability of suppliers. This vulnerability underscores the importance of developing a robust, sustainable, and self-reliant energy sector through the adoption of RE technologies. Such a strategic pivot not only ensures Jordan's energy security but also addresses long-term environmental sustainability goals. The industrial sector faces the dual challenge of enhancing energy efficiency while ensuring its operations and sustainability. Overcoming these obstacles is critical for Jordan's economic resilience and environmental stewardship.

14. Policy framework and international commitments

Jordan's commitment to the clean energy transition is anchored in a solid policy framework and bolstered by its participation in international agreements and regional initiatives aimed at climate change mitigation and sustainable development:

- Paris Agreement: Jordan's ratification of the Paris Agreement illustrates its dedication to reducing greenhouse gas emissions and collaborating on global climate action efforts.
- SDGs: The United Nations' SDGs, particularly Goal 7 (Affordable and Clean Energy) and Goal 13 (Climate Action), guide Jordan's national strategies for sustainable development and clean energy adoption.
- IRENA Membership: As a member of the International Renewable Energy Agency (IRENA), Jordan aligns itself with international best practices and standards in RE development and deployment.
- Regional Initiatives: Participation in regional energy initiatives enhances Jordan's collaboration with neighboring countries to ensure energy security and sustainability across the MENA region.[15]

These frameworks and commitments reflect Jordan's stance on the energy transition, underscoring the country's resolve to embrace RE for sustainable development. Jordan's energy transition is a strategic imperative aimed at reducing reliance on fossil fuels, enhancing energy security, and promoting environmental sustainability.

[15] Regional Center for Renewable Energy and Energy Efficiency (RCREEE). Arab Future Energy Index (AFEX) Renewable Energy 2023. This index evaluates renewable energy development and policy frameworks in the Arab region, including Jordan's participation in regional energy initiatives.

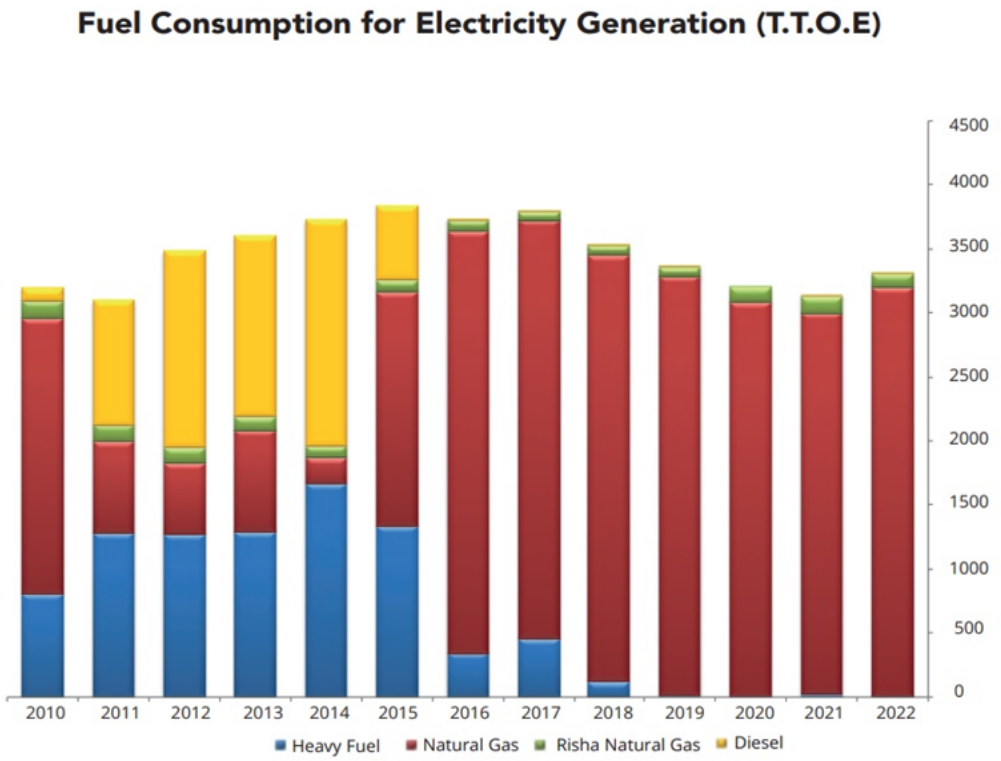
Chapter Two:
Impact of Public Policies on MSMEs in the Energy Transition

1. Introduction

The energy landscape in Jordan is undergoing a significant transformation as the country strives to reduce its dependence on fossil fuels and embrace cleaner and more sustainable alternatives. This transition presents both challenges and opportunities for MSMEs operating within the energy sector.

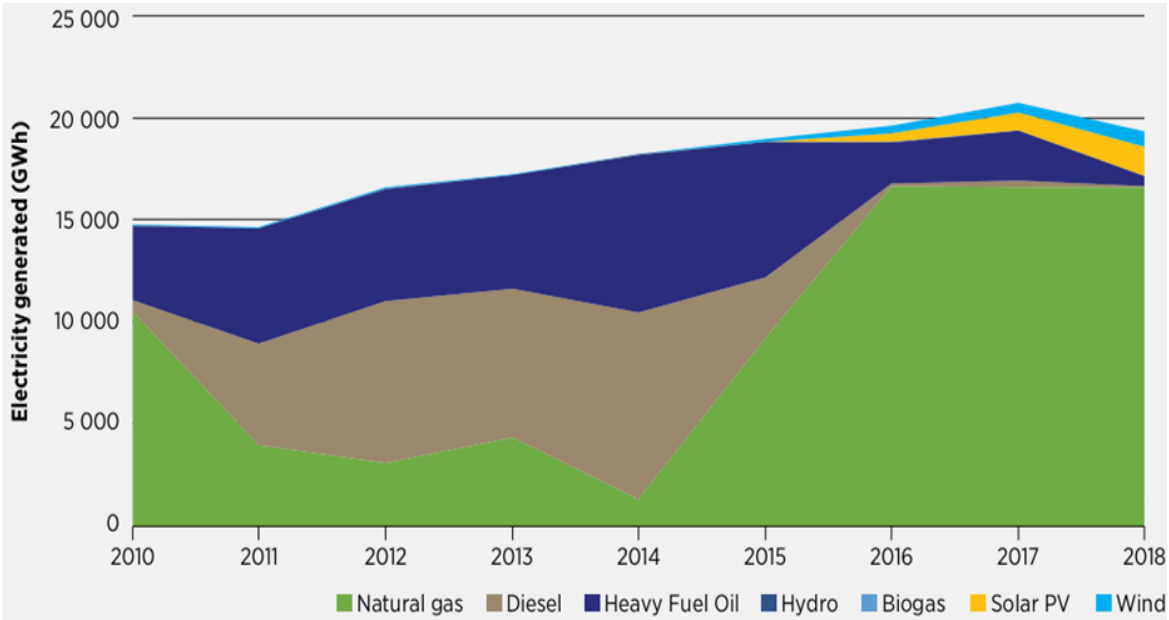
Generally, two major shifts can be observed in energy generation in Jordan; the first one is the shift from oil to gas and the second is the increasing contribution of renewables to the energy mix since 2014. This can be attributed to major policy changes that took place,

Figure 3. Non-renewable fuel consumption for electricity generation and electricity generation by source



Source: National Electric Power Company (NEPCO) Annual Report, 2022.

Figure 4. Non-renewable fuel consumption for electricity generation and electricity generation by source



Source: NEPCO and IRENA. IRENA (2021). Renewable Readiness Assessment: The Hashemite Kingdom of Jordan.

including the introduction of the RE law in 2012 and the government's initiatives and commitments to enhancing energy security and increasing the efficiency of the sector by reducing the cost of generation. Moreover, reducing reliance on fossil fuels has been useful in meeting Jordan's commitment to reduce carbon emissions and other environmental key performance indicators in several government-endorsed protocols and agreements.

2. Financing opportunities and challenges

How has Jordan facilitated the energy transition by using financial incentives to gain commitment from the private sector? The banking system in Jordan has been offering special access to credit for enterprises (Green Finance) that are willing to make the transition.[16] The Ministry of Energy and Mineral Resources (MEMR) created the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF), which has conducted energy audits for MSMEs and helped secure funding sources for some of these enterprises. JREEF's services have proven to be a success story in motivating these enterprises to engage in the energy transition.[17] However, according to the interviews conducted, these efforts have been short of meeting the demand of MSMEs due to the upfront capital requirements in these capital-intensive projects and the banking system's lack of desire to extend finance for MSMEs beyond certain programs supported by the Central Bank of Jordan (CBJ).

The energy transition requires upfront investments, according to the survey, in addition to technical support beyond what the state has offered. While some state support exists for technological upgrades and expansion, it often falls short of covering costs or incentivizing a speedy shift toward sustainable practices/sources. The need for RE technology adoption grows by the year while the price of solar panels has dropped by over 90 percent in the last decade. Between 2010 and 2017, wind power fell by 23 percent. The technology has never been more accessible and—with financial support from the government—can begin rapid assimilation with MSMEs. Access to capital and state support for adopting new technologies remains crucial for MSMEs to grow and engage in larger projects. Although the market for RE and sustainable practices is maturing, with an increasing number of companies entering this space, there's a noticeable deficiency of manufacturing companies and a need for more competition based on quality and adherence to international standards.

3. Barriers to and incentives for MSMEs' participation in clean energy initiatives

The rate of firms agreeing that implementing RE technologies is within their financial means is 44.2 percent for micro, 52.6 percent for small, and 47.4 percent for medium enterprises. A total of 62.5 percent of firms in the wholesale sector feel they have the financial ability to implement RE technology at the highest rate.

4. Regulations and institutions

In 2012, Jordan adopted the Renewable Energy and Energy Efficiency Law (REEL) which has granted investors tax incentives and exemptions to invest in the transition.[18] However, the bylaws after issuing that law have been subject to unfavorable amendments such as introducing fees on RE systems, thereby complicating the landscape for MSMEs. The economic constraints faced by potential clean energy initiative participants, who recognize the benefits of RE but are deterred by installation costs, present a fundamental barrier. Furthermore, disparities in standards across regions and among energy companies in Jordan add to the compliance burden and impact the success rate of projects.

Such barriers not only impede MSMEs' adoption and implementation of RE projects but also hinder the broader national goals of sustainable development and energy independence.

Complex approval processes involving multiple entities and overlapping responsibilities contribute to confusion, delays, and inefficiencies.[19] Moreover, insufficient coordination among relevant authorities, such as municipalities and electric companies, exacerbates the difficulty in processing transactions and obtaining necessary approvals, leading to significant time delays. Despite these barriers, the period between 2016 and 2018 is highlighted as a golden era for solar energy adoption

[16] CBJ Jordan (2023). Green Finance Strategy, p. 10.

[17] JREEEF's support targets small- and medium-sized factories and three-star hotels or lower. JREEEF aims to increase competitiveness by reducing energy costs. This not only helps businesses improve their services and potentially hire new staff but also contributes to their ability to reinvest savings in their facilities. The focus on enhancing services and environmental sustainability demonstrates a holistic approach to sustainable development, going beyond mere energy savings.

[18] ESCWA (2018). Case Study on Policy Reforms to Promote Renewable Energy Jordan, p.5.

[19] ESCWA (2018). Case Study on Policy Reforms to Promote Renewable Energy in Jordan, p.49.

Table 3. MSMEs perceiving RE technologies as within their financial means sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
The cost of implementing RE technologies is within our financial means	Disagree	27.4%	15.7%	14.%
	Neutral	28.4%	31.8%	38.2%
	Agree	44.2%	52.6%	47.4%
	Total	100.0%	100.0%	100.0%

Table 4. MSMEs' opinions on government interventions supporting the RE adoption sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Government incentives and policies support the adoption of RE	Disagree	15%	17.7%	9.2%
	Neutral	28.1%	26.3%	30.3%
	Agree	56.8%	56.1%	60.5%
	Total	100.0%	100.0%	100.0%

in Jordan, offering valuable insights into how MSME engagement in RE projects can be improved. The lack of governmental financial support and high upfront installation costs are identified as significant deterrents for MSMEs, notwithstanding the promising economic benefits and quick payback periods observed in the commercial sector. Policy incoherence, additional fees on RE systems, and logistical restrictions in designated development areas further impede the adoption and expansion of solar energy projects. Innovative financing models, such as the Purchase Power Agreement (PPA), are recognized for their potential to overcome financial barriers, yet their application remains limited, primarily to government projects, due to security of payment concerns. This limitation underscores the need for broader financing options to facilitate MSMEs' access to RE solutions.

According to the survey, most of the interviewed enterprises tend to agree that government interventions and incentives have been effective. Table 4 shows the distribution of MSME opinions on the statement "Government incentives and policies support the adoption of renewable energy." MSMEs shared a similar distribution of agreement, respectively 56.8 percent for micro, 56.1 percent for small, and 60.5 percent for medium. The financial services and real estate (30 percent) and transportation and storage (36.4 percent) sectors have a high disagreement distribution compared to the sample mean.

There's an alarming anticipation of reduced emphasis on RE, stemming from deteriorating trust between electricity companies and citizens. The introduction of taxes, fees, and restrictive measures—such as capacity limits on transformers and bureaucratic hurdles in obtaining RE approvals—could severely hamper the RE sector's expansion, thereby affecting MSMEs' competitiveness and sustainability.

5. Technologies and technical capacity building

Jordan has not restricted the type of technology to be used and it was left to the developers and enterprises to determine what is best for them. The Kingdom tried to upgrade the grid capacity to absorb the new RE projects; however, the investment in the "green corridor" projects that were procured by NEPCO to enhance the transmission capacity of the grid was not adequate.

The analysis of stakeholder insights from Jordan's energy sector underscores the importance of grid and infrastructure improvements, the gap in specialized technical knowledge and expertise, the need for more robust financial support mechanisms, and the crucial role of technical capacity building and support services. Addressing these areas through targeted recommendations such as upgrading grid capacity, expanding technical assistance programs, enhancing financial incentives, supporting local production, and fostering collaborative knowledge-sharing can significantly bolster the growth and sustainability of MSMEs in Jordan's RE sector. By implementing these strategies, Jordan can ultimately advance toward a more sustainable, competitive, and inclusive energy future, leveraging the potential of MSMEs to drive innovation and economic growth in the transition to clean energy.

The feedback from in-depth interviews indicates that while some state support exists for technological upgrades and expansion, it's often insufficient to cover the costs or incentivize significant shifts toward more sustainable practices. Access to capital and state support for adopting new technologies remains a critical need for MSMEs to grow and compete in larger projects. The market for RE and sustainable practices is slowly maturing, with a notable increase in the number of companies operating in this space. However, there's a lack of sufficient manufacturing companies and a call for more competition based on quality and international standards.

Moreover, while renewable technologies become more accessible, a gap in specialized knowledge for energy efficiency and implementing these technologies in diverse industrial applications remains. Despite existing policies and legislation, the lack of financial support hampers effective policy implementation, coupled with difficulties in finding adequately equipped spaces for renewable projects. For sustainability audits and consulting projects, there is a significant need for building domestic technical capacity to make MSME-sized projects economically viable. For auditing energy efficiency with existing structures, certified energy assessors and specialized companies that can provide the necessary technical support and ensure the sustainability of projects are needed.[20] The importance of technical capacity building is seen in demand for such companies that can offer essential technical support and ensure project sustainability.

According to the interviewees, the local production of solar panels has significantly improved, easing logistic and technical support challenges for MSMEs involved in the installation and maintenance of RE systems. However, the infrastructure and the national grid require development to accommodate RE, highlighting challenges in grid capacity, storage costs, and suitable locations for energy production. While RE technologies are becoming more accessible, there is a gap in the specialized knowledge required for energy efficiency and the technicalities of implementing diverse industrial applications.

The insights from various stakeholders highlight the current state of capacity building and technical assistance programs for MSMEs in Jordan's energy sector, focusing on RE. The feedback underscores the availability of materials, the need for grid development, technical challenges, and the importance of specialized knowledge and they reiterated the need for financial support for implementing energy projects.

6. Social and consumer factors

The engagement of MSMEs with RE sources is facilitated by the government's multifaceted approach. They include strategies for enhancing public awareness and education on the benefits of RE, fostering a culture of environmental responsibility, and developing supportive policy and regulatory frameworks to encourage investment in green technologies. Despite the challenges of a national transition, the collective efforts of diverse stakeholders highlight a committed path toward an independent, sustainable energy market in Jordan, offering numerous economic and environmental opportunities. Most of the enterprises interviewed for this study acknowledged that they are aware of the information related to the cost of energy that they are shouldering. This does not mean that they can influence that cost directly; however, they can respond to measures to enhance the efficiency of energy use that include RE sources.

Table 5 shows the distribution of MSMEs that do and do not have access to information regarding fuel price changes, with comparisons sorted according to the size of the firms by employment. The data shows that more than half of MSMEs have access to information regarding fuel price changes (54.4 percent, 58.6 percent, and 59.2 percent, respectively), while the MSMEs that do not have access are distributed respectively at 45.6 percent, 41.4 percent, and 40.8 percent. However, the wholesale sector (66.7 percent) has significantly higher access to information regarding fuel price changes.

7. Enterprise strategies and awareness

Furthermore, the study's FDGs reveal a keen awareness of the challenges MSMEs face, particularly regarding the burden of energy costs. Nevertheless, not all firms within the MSMEs are on the same wavelength, as revealed by the survey.

Table 6 reveals that 27.8 percent of micro, 29.8 percent of small, and 27.6 percent of medium enterprises aren't aware of government policies that support the adoption of RE technologies. On the other hand, more than one-third of MSMEs agree that they are aware of government policies that support RE technology adoption with respective percentages of 38.1 percent, 42 percent, and 36.8 percent.

[20] Colloquially referred to as energy assessors or energy consumption advisors, this specialty is classified within Unit Group 3112 Civil Engineering Technician by the ILO (International Standard Classification of Occuptions-08, 2012, p.171).

Table 5. MSMEs' access to information regarding fuel prices sorted by workforce sizes of micro (<6), small (-6 19), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Do you have access to information regarding fuel price changes?	Yes	54.4%	58.6%	59.2%
	No	45.6%	41.4%	40.8%
	Total	100.0%	100.0%	100.0%

Table 6. MSMEs' awareness of government interventions supporting the adoption of RE technology sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
We're aware of government policies that support RE technology adoption	Disagree	27.8%	29.8%	27.6%
	Neutral	34.2%	28.3%	35.5%
	Agree	38.1%	42%	36.8%
	Total	100.0%	100.0%	100.0%

However, the transportation and storage sector (63.6 percent) is the most aware of the government policies that support RE technology adoption.

There is an evident gap in awareness and regulation regarding environmental sustainability and carbon footprint management within MSMEs. This gap not only impedes the potential for MSMEs to contribute more effectively to sustainability goals but also limits their ability to compete on a global scale where such factors are increasingly prioritized by consumers and regulatory bodies. Moreover, the high energy costs and dependency on unreliable energy sources are significant challenges for MSMEs. The adoption of RE, facilitated by supportive policies, offers a pathway to energy independence, operational cost reduction, and enhanced sustainability. However, the transition requires upfront investment and technical support, areas where policy could be more effective. A significant gap in awareness and regulation around environmental sustainability and carbon footprint management within MSMEs could limit their global competitiveness and ability to contribute to sustainability goals. High energy costs and reliance on unreliable energy sources pose additional challenges. A total of 10.6 percent of small, 9.5 percent of micro, and 7.9 percent of medium enterprises believe the country should prioritize a strong defense force (over a speedy RE transition) moving forward. The majority of MSMEs that mention this are in the transportation and storage sector (18.2 percent).[21]

More than half of MSMEs have access to information from an early warning weather system, with 54.7 percent for micro, 54 percent for small, and 60.5 percent for medium enterprises. Sectors such as the food industry (66.7 percent) and construction or utilities (62.3 percent) mention that they have access to this type of information at a higher rate than most MSMEs.

The vast majority of MSMEs believe the cost of electricity should be subsidized, with 91.2 percent for micro, 94.9 percent for small, and 97.4 percent for medium enterprises, respectively. Most of these work in the food industry sector (95.6 percent). The majority state that the subsidy should be universal (70.2 percent for micro, 63.8 percent for small, and 54.1 percent for medium enterprises). In addition, 73.4 percent of them are in the retail sector.

Most MSMEs (88.8 percent of micro, 92.4 percent of small, and 89.5 percent of medium) state that electricity from renewable sources should be subsidized, with 96.3 percent of them working in the wood products, furniture, paper, and publishing sectors.

[21] Researchers posit that this is due to the perceived threats to shipping corridors.

Table 7. MSMEs with access to an early warning weather system, sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Do you have access to information from an early warning weather system?	Yes	54.7%	54.0%	60.5%
	No	45.3%	46.0%	39.5%
	Total	100.0%	100.0%	100.0%

Table 8. MSMEs' opinion on government subsidies for electricity, sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Should the cost of electricity be subsidized?	Yes	91.2%	94.9%	97.4%
	No	7.0%	3.5%	2.6%
	Don't know	1.8%	1.5%	
	Total	100.0%	100.0%	100.0%

Table 9. MSMEs' opinion on government subsidies for electricity, sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Should electricity from renewable sources be subsidized?	Yes	88.8%	92.4%	89.5%
	No	3.3%	5.1%	3.9%
	Don't know	7.9%	2.5%	6.6%
	Total	100.0%	100.0%	100.0%

Chapter Three: Impact on Different Economic Sectors

1. Introduction

The transition toward renewable energy in Jordan has a significant impact across various economic sectors, depending on the nature of the enterprises and the technology they use. Within the manufacturing sector, the shift toward clean energy sources such as solar and wind power not only promises a reduction in operational costs but also necessitates significant adjustments in production processes and technology adoption. The industrial sector will see some of the biggest financial returns because of its generally energy-intensive modes of production. In some sectors/enterprises, energy is a prominent element of intermediate production. For example, industries such as plastic, furniture, and mining-related small-scale firms consume more electricity than the services or food industries. Accordingly, the interviewees' desire for the energy transition is expected to vary.

2. Impacts of the RE transition on economic sectors in Jordan

The majority of MSMEs agree with that the use of RE technologies would enhance their daily operations (74.1 percent for micro, 77.8 percent for small, and 77.8 percent for medium enterprises). Based on the sectors, the highest agreement with this statement is in the leather, chemical, petroleum, plastics, rubber, and metallic products sector (72.3 percent). Meanwhile, 40.6 percent of micro, 48 percent of small, and 30.3 percent of medium enterprises say the most important thing for them during the transition to RE is a stable economy. In other words, these industries are energy-intensive, therefore, managing the cost of energy would enhance their competitiveness.

Table 10. MSMEs' sentiment on RE technology enhancing daily operations sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
The use of RE technologies would enhance our daily operations	Disagree	11.3%	7.6%	5.2%
	Neutral	14.6%	14.6%	18.4%
	Agree	74.1%	77.8%	76.3%
	Total	100.0%	100.0%	100.0%

Manufacturers and experts believe that RE, particularly wind and solar, would reduce energy costs and increase competitiveness. Energy-saving technologies like Japanese energy, which relies on inter-ministerial coordination and increased efficiency in energy conveyance, have been implemented to reduce electricity consumption.[22] However, the transition is marred by infrastructural challenges and the need for greater awareness and encouragement for green energy adoption.[23] The potential for cost savings and efficiency improvement is significant, provided that there's support for overcoming initial financial and technical barriers. The services sector, which encompasses banking and consulting, is progressively acknowledging the financial and operational benefits of green energy, with a noticeable shift toward green financing.[24] This evolution points to a broader recognition of RE's economic advantages, including cost reductions and minimizing the risks associated with climate change.

The implications of RE for the agricultural sector are substantial, promising reduced operational costs and more sustainable agricultural practices. Solar energy in particular can advance irrigation and farming techniques, bolstering food security and rural development. Similarly, the tourism sector can harness RE to improve the sustainability of tourism facilities and attractions, positioning Jordan as a desirable destination for eco-conscious tourists.

3. Evaluation of the challenges and opportunities faced by MSMEs within each sector

Around 35 percent of micro-enterprises do not have any problems related to the electricity grid, while 27.3 percent and 31.6 percent of small and medium enterprises face unpredictable interruptions, respectively. However, the textile and garments sector and the food industry sector suffer from unpredictable interruptions, with 40 percent of firms confirming they faced interruptions. A total of 21.8 percent of those in the retail sector faced unexpectedly high bills (irregularly), but the financial services and real estate sectors had no problems (55 percent).

[22] Nagata, T. (2014). Japan's Policy on Energy Conservation.

[23] ESCWA (2018). Case Study on Policy Reforms to Promote Renewable Energy in Jordan, p.49.

[24] CBJ Jordan (2023). Green Finance Strategy, p. 10.

Table 11. MSMEs' sentiment on installation and maintenance of RE sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
The installation and maintenance of RE technologies seem hassle-free	Disagree	12.8%	11.6%	10.5%
	Neutral	41.2%	39.4%	40.8%
	Agree	46%	49%	48.7%
	Total	100.0%	100.0%	100.0%

Nearly 46 percent of medium enterprises find that the installation and maintenance of RE technologies seem to be hassle-free, and 49 percent of small and 48.7 percent of medium enterprises said the same. The majority (55 percent) of the financial services and real estate sectors mention that the installation and maintenance of RE technologies seem hassle-free. Moreover, 19.3 percent of micro, 30.8 percent of small, and 11.8 percent of medium enterprises believe that fighting rising prices is the most important thing to consider when converting to RE, while 6.9 percent of micro, 6.6 percent of small, and 11.8 percent of medium enterprises mention that protecting freedom of speech is the most important. Notably, the market for certain RE technologies, especially those required for heavy transport and industrial applications, is still in its infancy in Jordan. There's also a general lack of awareness among MSMEs about the benefits and opportunities of RE.

Opportunities for RE systems offer the potential for significant cost savings for MSMEs, with payback periods as short as two to three years and warranties lasting up to 25 years.[25] The RE sector has created several job opportunities in Jordan, both directly within the sector and indirectly in related fields like installation, maintenance, and manufacturing of RE components. Even low-end estimates posit net job creation at 15 to 45 percent above the equivalent energy generation with fossil fuels.[26]

[25] Solar SME (2023). What is the Payback Period on a Solar Panel?

[26] Kis, Z., Pandya, N. and Koppelaar, R. (2018). Electricity Generation Technologies: Comparison of Materials Use, Energy Return on Investment, Jobs Creation and CO2 Emissions Reduction.

Chapter Four:
Impact on Inclusive Economic Growth, Innovation and Competitiveness

1. Introduction

This chapter analyzes how MSMEs are driving the RE transition, from spearheading innovative solutions to collaborating with larger energy companies. It also underscores the potential of these endeavors for the broader socioeconomic context. Through an analysis of the impact of the transition on the labor market, skills demand, and the retraining of workers, this chapter sheds light on the effects on MSMEs' competitiveness. It also highlights the challenges and opportunities faced by marginalized groups within the MSME sector, emphasizing the importance of inclusive policies and targeted interventions to ensure that the benefits of the RE transition are equitably distributed across society.

2. Importance of the energy transition in generating green jobs for the long-term SDGs

The adoption of RE technologies by individuals, communities, the public sector, and firms, would lead to energy independence. Central to this discourse is the emphasis on reducing carbon footprints through more sustainable manufacturing processes and a pivot toward RE sources. Such efforts not only align with global climate objectives but also promote energy independence by reducing reliance on imported fossil fuels, thereby conserving financial resources and diminishing the impact of global energy market volatility on Jordan's economy.

The expansion of RE infrastructure further invigorates the local job market by fostering domestic labor opportunities and enhancing manufacturing capabilities, thus contributing to a durable and sustainable employment landscape. RE's ascendancy opens avenues for economic diversification, notably in EV services, and solar and wind energy, catalyzing the creation of specialized green jobs. This surge in demand for skilled labor necessitates investments in education and training to prepare the workforce for the green economy. A focus on RE would also propel innovation and technological adoption, underpinning economic growth and job creation in emerging sectors. This is seen with electric vehicles (EVs) with EV maintenance and the installation of charging stations. Residential RE systems would include services for smart meters, batteries, and energy generation hardware (solar panels and turbines).

The transition to RE is poised to significantly impact job creation across various sectors. This transition involves not only the manufacturing and installation of RE systems, such as solar panels and wind turbines, but also encompasses a wide range of supporting industries including the production of components like cables, metal structures, and batteries. This expansion into RE is expected to stimulate job growth in both the manufacturing sector and the installation and maintenance of RE systems. Additionally, the reduction in operational costs, particularly energy costs, is projected to boost investment opportunities and, consequently, create numerous job opportunities across different industries.

For example, Jordan's pioneering efforts, exemplified by projects like the Shams Ma'an solar station, have established it as a leader in the region, generating not only direct jobs in installation, maintenance, and operation but also setting a precedent for skill and knowledge development within the country. Despite facing challenges such as bureaucratic hurdles and inadequate support from electricity companies, Jordanian companies and professionals have earned recognition abroad, contributing to RE projects in countries like Morocco, Saudi Arabia, and Dubai.

Jordan's geographical attributes, including swaths of land with high solar radiance and low population density, provide a unique platform for RE innovation, similar to initiatives like Singapore's floating solar panels.[27] The active involvement of entities such as the German GIZ, the Royal Scientific Society, and the Jordan Chamber of Industry in professional training and development in RE underscores a solid foundation for capacity building. However, the challenge remains to retain this burgeoning talent within Jordan, ensuring that the benefits of this green transition are fully realized domestically, thereby contributing to the nation's economic growth, sustainability, independence, and contributions to achieving the global climate objectives.

3. Contributions of MSMEs in the RE transition to inclusive economic growth, job creation, and poverty reduction

Around 60.2 percent of micro and 42.9 percent of small enterprises are not interested in considering RE in their business, while 46.1 percent of medium enterprises are interested. Moreover, 19.7 percent of medium enterprises use clean energy in their business compared with only 2.5 percent of micro and 10.6 percent of small enterprises. The

[27] Lin, C. (2021). Singapore Unveils One of the World's Biggest Floating Solar Farms, Reuters.

Table 12. MSMEs' consideration of using RE sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Have you personally considered using RE for your business?	Yes	36.6%	46.0%	46.1%
	No	60.2%	42.9%	34.2%
	I am using it	2.5%	10.6%	19.7%
	I know nothing about it	0.7%	0.5%	-
	Total	100.0%	100.0%	100.0%

most interested sector in using RE is the food industry (60 percent). On the other hand, the financial services and real estate sectors are not interested (75 percent). However, the sector that uses RE the most is agriculture, fishing, and mining (13.6 percent). The larger the size of the enterprises, the more interested they are in adopting RE. Several factors may contribute to this such as the location, the size, and ownership of the place of work; for example, most of the micro-enterprises are rented and informal. These kinds of specific challenges must be addressed to promote the adoption of RE as part of their energy transition.

A total of 10.9 percent of small, 15.2 percent of micro, and 13.2 percent of medium enterprises, believe that during the conversion to RE, firm owners must emphasize communicating about their work standards with their community. The majority of MSMEs who mention this work in the textile and garments sector (20 percent).

4. Opportunities for inclusion of vulnerable groups in economic sectors

The in-depth interviews with experts across various sectors highlight significant opportunities for the inclusion of vulnerable groups in the economic sectors as the Kingdom transitions toward RE. This transition not only promises environmental and health benefits but also opens economic and educational opportunities, especially for vulnerable populations.

Including vulnerable groups poses opportunities such as creating many jobs in the RE sector, ranging from technical positions like engineers and technicians to broader roles in project management, finance, and administration.[28] This diversification of job opportunities can significantly benefit vulnerable groups, including women and the youth, by providing them with avenues for employment and skill development. Additionally, Jordan should focus on RE in academic institutions and vocational training centers that offer educational opportunities that can empower vulnerable groups. By gaining knowledge and skills in this growing field, these groups can increase their employability and independence.

The reduction in energy costs associated with adopting RE systems offers direct economic benefits to households, including those from vulnerable groups. Lower energy bills mean more disposable income that can be used for other essential needs, contributing to poverty alleviation. Otherwise, transitioning to RE sources reduces pollution and improves air quality, which has direct health benefits for all, especially vulnerable populations who might be more exposed or sensitive to environmental pollutants.[29] By focusing on inclusive policies and practices, Jordan's RE sector can play a crucial role in empowering vulnerable groups, enhancing their economic opportunities, and improving their quality of life.

In this context, it's worth studying the JREEEF fund experience in Jordan. After selecting certain areas in Jordan classified as low-income communities, the fund arranged for the installation of solar panels wherever possible to reduce the energy bills for MSMEs operating in these areas. This scheme has also covered some of the community centers such as youth centres, and mosques. Such schemes have contributed to improving the well-being of these targeted local communities.

5. Collaborations and partnerships between msmes and larger energy companies

Around 12.1 percent of small, 9.6 percent of micro, and 14.5 percent of medium enterprises are trying to make their cities and countries cleaner by converting to RE. Most of them work in the transportation and storage sector (27.3 percent). This study's qualitative discussions highlight the pivotal role of collaborations and partnerships between MSMEs and larger energy companies, academia, and the government in the RE transition. These collaborations are

[28] Jordan Ministry of Environment (2020). Green Growth National Action Plan 2021-2025, p. xi.

[29] US Department of Energy (2007). Improving Air Quality with Solar Energy.

essential for inclusive economic growth, job creation, and poverty reduction. The analysis showcases the benefits and challenges of such partnerships, drawing from experiences across various sectors.

The FGDs shed light on the dynamics of these collaborations within Jordan's RE landscape. They point out that larger companies, motivated by the need to reduce high energy costs, were among the early adopters of RE solutions. This shift, initially driven by financial considerations, has broader implications for the energy sector, influencing MSMEs' trajectory and shaping the overall landscape of energy efficiency and RE adoption in Jordan.

6. Involvement of MSMEs in research and development for energy innovations

A total of 3.5 percent of micro, 11.1 percent of small, and 7.9 percent of medium enterprises believe that during the process of the RE transition, society needs to value ideas that consider more than just money. The involvement of MSMEs in the research and development (R&D) for energy innovation is a critical factor in the transition toward more sustainable and efficient energy systems. Based on the in-depth interviews conducted with experts across various sectors, MSMEs play a pivotal role in advancing energy innovations through various means.

MSMEs are pioneering in integrating RE systems into sectors such as agriculture, demonstrating a direct link between sustainability and food security. These projects not only push the envelope in terms of what's technologically possible but also provide practical, scalable solutions for critical global challenges. On the other side, entrepreneurs have observed a significant shift in the public perception of RE systems. This cultural shift, from skepticism to active interest, highlights the importance of MSMEs in driving consumer awareness and adopting RE technologies.

MSMEs are taking crucial initial steps by conducting energy audits and implementing efficiency measures, paving the way for RE solutions. Furthermore, they play a vital role in promoting green skills and knowledge through educational initiatives, ranging from vocational training to influencing school curricula, ensuring that the next generation is well-prepared to support sustainable energy goals.

However, a gap remains in awareness and access to support programs for R&D in energy innovations, underscoring the need for increased knowledge and resources among MSMEs. Despite RE contributing only modestly to the industrial sector's energy consumption, FGDs within Jordan's industrial sector reveal the necessity of enhanced energy efficiency and the adoption of renewable solutions. The geographical concentration of renewable adoption and broader systemic challenges in energy efficiency indicate an area where MSMEs, with their agility and local insights, can lead innovative R&D efforts to improve energy solutions tailored to specific needs.

7. Impact of the RE transition on MSMEs, the labor market, skills demand, (re)training of workers, and highlighting marginalized groups

Evaluating the impact of the RE transition on MSMEs, the labor market, skills demand, and the (re)training of workers—particularly among young people, women, and other marginalized groups—involves analyzing various factors influenced by this transition. The insights gathered from experts across different sectors provide a comprehensive view of how the shift toward RE affects these areas.

The transition to RE necessitates a workforce equipped with 'green skills', including knowledge of RE technologies, energy efficiency, and sustainable practices. This requires a comprehensive approach to vocational training and higher education. The emphasis on technical education and the development of green skills, as discussed by experts, is critical. Tailoring curricula for the next generation to include RE and energy efficiency topics would prepare the workforce for the evolving demands of the RE sector.

As the RE sector grows, it demands a workforce proficient in renewable technologies and energy efficiency solutions. Yet, the high costs of training and certification pose significant challenges, risking a skills mismatch in the labor market that could hamper productivity and innovation. Moreover, the transition presents a prime opportunity to foster inclusivity by extending vocational training to marginalized groups. If the high costs are not reduced, emerging markets will represent the same exclusive.

The RE sector is marked by a scarcity of skilled technicians for the installation and maintenance of RE systems, underlining the necessity for targeted training and education programs. The RE sector will create a vast number of new jobs and sustained opportunities for increased employment;[30] it offers distinct opportunities in specialized skill areas crucial for the installation, maintenance, and operation of renewable technologies.

[30] Kis et al. (2018). Electricity Generation Technologies: Comparison of Materials Use, Energy Return on Investment, Jobs Creation and CO2 Emissions Reduction, pp. 144-157.

Table 13. MSMEs' previous month's spending on electricity sorted by workforce sizes of micro (<6), small (-6 19), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
In the last month, how much did the establishment spend on electricity?	Less than 100 JD	66.3%	33.3%	21.1%
	101 - 300 JD	22.9%	26.3%	14.5%
	301 - 600 JD	3.2%	15.7%	13.2%
	601 - 800 JD	0.8%	4.5%	-
	801 – 1,000 JD	0.3%	2.5%	5.3%
	More than 1,000 JD	6.6%	17.7%	46.1%
	Total	100.0%	100.0%	100.0%

Table 14. MSMEs' previous month's spending on electricity sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
In the last 12 months, did the establishment use any stored electricity?	Yes	3.3%	9.1%	7.9%
	No	96.7%	90.9%	92.1%
	Total	100.0%	100.0%	100.0%

Addressing the need for a 'green-skilled' workforce entails a holistic approach to vocational training and higher education, with curricula tailored to include topics on RE, energy efficiency, and sustainable practices. By focusing on technical education and the cultivation of green skills, the transition to RE can navigate the current obstacles and harness the sector's full potential for economic and environmental benefits, ensuring a more inclusive and sustainable future.

8. Effects on the competitiveness of MSMEs in local and international markets

Two-thirds (66.3 percent) of micro-enterprises spend less than JOD 100 on electricity, compared with 33.3 percent of small and 21.1 percent of medium enterprises. Around 77.8 percent of the wood products, furniture, paper, and publishing sector spends less than JOD 100 on electricity, while 29.4 percent of the retail sector spends JOD 101-300 and 13.6 percent of the agricultural, fishing, and mining sector spends JOD 301-600. In addition, 5.6 percent of the leather, chemical, petroleum, plastics, rubber, and metallic manufacturers spend JOD 601-800, while 20 percent of the food industry spends more than JOD 1,000 on electricity.

The majority of MSMEs haven't used the stored electricity in the last 12 months; the percentages, respectively, are 96.7 percent, 90.9 percent, and 92.1 percent for micro, small, and medium enterprises. Depending on the sectors, the most use for stored electricity is in the wholesale sector (12.5 percent), while the retail sector (97.5 percent) hasn't used the stored electricity during the last 12 months.

The desire to engage in the energy transition is dictated by monthly bills, among other factors. The transition to RE sources, particularly in the industrial sector, enables MSMEs to significantly lower their energy expenses, which are often a major component of their operational costs. This reduction not only boosts their profitability but also enhances their competitiveness, more so for those competing against firms in regions with lower energy costs. By embracing RE and energy efficiency measures, MSMEs can distinguish themselves in the market, a factor becoming increasingly crucial as international buyers grow more focused on sustainability. This alignment with global environmental standards, such as the EU Green Deal, facilitates easier access to international markets previously restricted by carbon footprint considerations. Despite the benefits of energy efficiency in complementing RE efforts and further cost reductions, its adoption lags, partially due to insufficient awareness and support.

The current shortage of skilled technicians poses a challenge, yet it also offers an opportunity for targeted workforce development and training initiatives. Without intervention, there is potential for international labor or an oligopoly of local green tech to dominate the emerging market. This outcome would be less competitive and less inclusive than the result of deliberate intervention. There's a pressing need for education and training programs focused on green skills to support the RE shift, requiring adjustments in vocational training and higher education curricula to equip the workforce for the changing job market. This comprehensive approach would help MSMEs navigate the complexities of the RE transition and leverage its benefits to improve their competitive stance both domestically and internationally.

Chapter Five: Impact on Achieving Sustainable Development Goals (2030)

1. Introduction

The chapter examines into the pivotal role of MSMEs in driving the clean energy transition within Jordan, which aligns with the UN SDGs. However, achieving these goals requires robust governmental policies, regulatory frameworks, and supportive initiatives to guide and incentivize MSMEs toward sustainable practices. Collaborations between various stakeholders, including the government, the private sector, financial institutions, and MSMEs, are essential in navigating this transition effectively. The testimonies collected in this study are corroborated by the SDGs and the IRENA Renewable Readiness Assessment.

2. MSMEs in the RE transition contributing to achieving specific SDGs

The involvement of MSMEs in the RE transition plays a crucial role in achieving specific SDGs, particularly those related to affordable and renewable energy (SDG 7); decent work and economic growth (SDG 8); industry, innovation, and infrastructure (SDG 9); sustainable cities and communities (SDG 11); and climate action (SDG 13).[31]

The insights were gathered from interviews with diverse and representative samples of MSMEs, scientists, technicians in RE, the Jordanian government, foreign investors, bankers, local banks, and the private sector. They highlight several critical areas where MSMEs contribute to the RE transition and the achievement of SDGs. They also identify knowledge gaps and inconsistencies about RE across sectors and firm size from the sample surveyed. Furthermore, the SGDs that benefit from certain suggestions are noted.

The majority of MSMEs are familiar with the term 'renewable energy,' with the percentages being 83.6 percent for micro, 86.4 percent for small, and 90.8 percent for medium enterprises. On the other hand, 16.4 percent of micro, 13.6 percent of small, and 9.2 percent of medium enterprises are not familiar with the term. Categorizing by sector, the sectors most familiar with the term are agriculture, fishing, or mining as well as wholesale (95.5 percent, and 95.8 percent, respectively). The sectors least familiar with the term are the transportation and storage sector and the industry of mechanics, electronics, and vehicles and vehicle services (27.3 percent and 22.8 percent, respectively).

Most small and medium enterprises agree that RE technologies would have a positive impact on the environment (93 percent and 93.4 percent), while two-thirds of micro-enterprises agree (68.1 percent).
Engineers and experts stress the importance of adopting clean energy technologies like solar and wind to reduce carbon emissions and improve energy efficiency for MSMEs. While wind and solar are the most prominent and accessible means for MSMEs to utilize RE, other technologies like biogas also hold potential. For example, the biogas plant at the Rusaifeh landfill currently generates electricity through capture of landfill gas (LFG) from the anaerobic decomposition of waste. Green hydrogen also holds promise as a method of energy storage and in hydrogen fuel cell-powered vehicles. This technology is still in its infancy in Jordan and its utility for MSMEs is still unclear.

Biogas is expected to play a larger role in the future. The potential of Jordan's current major landfills has latent potential to generate energy with LFG recovery projects, which could increase biogas' share of Jordan's renewable energy mix from 1% to 6% by harnessing 34.8 MW of potential energy and mitigating 18 million tons of CO2 emissions by 2030.[32] Though this source still emits carbon dioxide, it reduces the impact of the GHGs that are emitted by converting more harmful gases such as methane into carbon dioxide. It also substitutes an unutilized emission that is a by-product of landfills for fossil fuels that are extracted from the environment.

The efficiency of this method for generating RE is dependent on the methods of waste sorting, which is most effective when supported at the business and household level. High-quality waste management in rural areas supported by MSMEs sorting organic waste from inorganic waste, makes LFG generation projects more viable for smaller and more remote communities. The extra logistical difficulties of this coordination, and the necessary equipment to refine the LFG are barriers that

[31] UN (2023). The Sustainable Development Goals Report 2023: Special Edition.

[32] Abu-Qdais, et al, "Assessment of Greenhouse Gas Emissions and Energetic Potential from Solid Waste Landfills in Jordan: A Comparative Modelling Analysis," 2022.

Table 15. MSMEs' consideration of using RE sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Are you familiar with the term 'renewable energy'?	Yes	83.6%	86.4%	90.8%
	No	16.4%	13.6%	9.2%
	Total	100.0%	100.0%	100.0%

Table 16. MSMEs' consideration of using RE sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
RE technologies would make a positive impact on the environment	Disagree	5.8%	3.5%	2.6%
	Neutral	7.6%	3.5%	3.9%
	Agree	68.1%	93%	93.4%
	Total	100.0%	100.0%	100.0%

relegate this method of RE generation to a lower level of emphasis for MSMEs and their role in the energy transition.

The push toward green hydrogen and energy storage solutions also represents areas where MSMEs can innovate and contribute significantly to the RE transition but are still underutilized. The UN emphasizes a higher deployment of renewables to achieve SDGs 7, 11, and 13, and public financing for RE on a global scale has been on the decline since pre-COVID-19.[33] The higher adoption of RE by MSMEs would increase energy output (7), provide a more dispersed and accessible electricity production network (11), and lower the energy sector's carbon footprint (13).

The role of the government in setting policies, strategies, and regulatory frameworks is essential for guiding and supporting MSMEs in the transition to RE. Initiatives like energy efficiency standards, incentives for RE adoption, and stringent environmental regulations are crucial for encouraging MSMEs to align with sustainable practices.[34] These policies and frameworks would especially impact SDGs 8 and 9 in terms of guiding economic growth and industry standards, with implications for SDG 13 as well.

Capacity building, awareness, and education among MSMEs and the broader community about the benefits and importance of RE and sustainability practices is crucial. Training programs and awareness campaigns can help bridge knowledge gaps and promote sustainable practices. This ties into meeting components of SDG 8 and 11 since communities benefit from increased knowledge and capacity to participate in the RE transition in the Kingdom. Additionally, this knowledge could motivate MSMEs to participate in sustainable growth strategies that would decrease costs and increase technical capacity, thereby supporting higher economic growth.

The interviews highlight the need for accessible financing mechanisms for MSMEs to invest in RE technologies. Financial incentives, green financing, and supportive banking policies are vital to enable MSMEs to make the transition. Programs like JREEEF are critical in expanding access to RE technology financing and creating a sector with more innovative capacity across firm sizes.[35]

[33] UN (2023). The Sustainable Development Goals Report 2023: Special Edition, p. 27.

[34] IRENA (2021). Renewable Readiness Assessment: The Hashemite Kingdom of Jordan, p. 50.

[35] IRENA (2021). Renewable Readiness Assessment: The Hashemite Kingdom of Jordan, p. 14.

Chapter Six: Opportunities and Constraints

1. Introduction

This chapter sheds light on the complexities surrounding grid stability and infrastructure, emphasizing the technical intricacies that MSMEs must navigate to thrive in the RE landscape. By relying on expert insights and analysis, this chapter dissects these challenges, offering an understanding of the technical landscape that MSMEs must navigate in their quest for sustainable energy solutions.

The chapter also dives into the broader spectrum of constraints faced by MSMEs venturing into the RE market. From political and administrative barriers to economic and financial constraints, the discussions unveil the impediments hindering the full realization of the RE transition in Jordan. By examining notable examples of successful implementation and extracting lessons about best practices, the chapter provides the knowledge and insights necessary to tackle these obstacles and propel Jordan toward a more sustainable and prosperous energy future.

2. Identifying opportunities for MSMEs in the RE sector

Around 42.9 percent of small and 60 percent of medium enterprises that use RE pay tariffs on energy production, compared with only 27.8 percent of micro-enterprises. The textile and garments sector pays for tariffs 100 percent of the time. The majority (72.2 percent) of micro as well as 57.1 percent of small enterprises do not pay tariffs on the final product, compared with 40 percent of medium enterprises. Sectoral productions such as the leather, chemical, petroleum, plastics, rubber, and metallic products sectors and the wood products, furniture, paper, and publishing sectors do not pay for tariffs at all.

More than half of the MSMEs agree that their staff finds RE technologies easy to understand and operate, with a negative correlation with firm size (60.2 percent for micro, 58.1 percent for small, and 56.6 percent for medium enterprises). The food industry sector (66.7 percent) has the highest "agree" rate with this statement.

The transition to RE presents significant opportunities and challenges for MSMEs, especially in areas with high solar radiation, like Jordan.[36] This transition can drastically reduce operating costs for MSMEs, particularly those owning EVs or those in the manufacturing sector, through advancements in solar technology such as panels that double as windows and tiles. These innovations signal a shift toward multifunctional, aesthetically pleasing RE solutions and underscore the necessity for MSMEs to not only invest in RE but also enhance their energy efficiency.

Financing options, including those with remarkably low interest rates backed by the Jordanian Central Bank, present an underutilized avenue for RE investments.[37] However, a gap in the technical understanding of RE systems among financial institutions and regulatory and infrastructure challenges complicate the transition. Fluctuating laws and regulations, such as inconsistencies in net metering versus net billing policies, add to the uncertainty for potential investors. Despite these obstacles, the potential for MSMEs in the RE sector remains significant, with opportunities in finance, technology, capacity building, and market access. Overcoming regulatory uncertainties, bridging the knowledge gap among financiers, and addressing infrastructural constraints are essential steps toward realizing the full potential of RE for MSMEs, thereby contributing to Jordan's broader economic goals and global competitiveness. On the supply side, there seems to be stability for the electricity suppliers, as revealed by the survey.

3. Technical challenges for grid stability and infrastructure

The majority (82.8 percent) of small enterprises state that blackouts never happen, a sentiment shared by 72.9 percent and 67.1 percent of micro and medium enterprises, respectively. In addition, 27.6 percent and 26.4 percent of micro and medium enterprises, respectively, say it happens once or twice monthly. Based on sector, 31.1 percent of the food industry faces blackouts once or twice a month, while the transportation and storage sectors do not face blackouts. The power cut is not a hindrance in the production process for MSMEs.

More than half of the MSMEs say that the total duration of blackouts is one hour. Micro, small, and medium enterprises respectively have a distribution of 56.8 percent, 58.8 percent, and 60 percent. However, 16.1 percent, 17.6

[36] Maguire, G. (2023). The Top Solar Power Potential Hotspots.

[37] Central Bank of Jordan (2023). Green Finance Strategy 2023-2028.

Table 17. MSMEs using RE and paying taxes on their energy production sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
If you use renewables, do you pay any tariffs on the final product?	Yes	27.8%	42.9%	60.0%
	No	72.2%	57.1%	40.0%
	Total	100.0%	100.0%	100.0%

Table 18. MSMEs' sentiment on RE reducing costs sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
RE technologies would reduce our energy costs	Disagree	7.5%	8.1%	6.6%
	Neutral	32.4%	33.8%	36.8%
	Agree	60.2%	58.1%	56.6%
	Total	100.0%	100.0%	100.0%

Table 19. MSMEs experiencing electrical outages (frequency and duration) sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

	Frequency	Less than 6 Workers	6 to 19 Workers	20-99 Workers
In a typical month, how many outages/ blackouts of the grid happen?	Daily	0.1%	0.5%	1.3%
	Once/Twice A Week	0.8%	1.5%	3.9%
	Once/Twice A Month	26.4%	15.2%	27.6%
	Never	72.6%	82.8%	67.1%
	Total	100.0%	100.0%	100.0%

Table 20. MSMEs experiencing electrical outages (frequency and duration) sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

	Hours	Less than 6 Workers	6 to 19 Workers	20-99 Workers
On average, what is the total duration of all the outages/ blackouts?	1	56.8%	58.8%	60.0%
	2	16.1%	17.6%	24.0%
	3	9.5%	11.8%	4.0%
	4	7.5%	5.9%	-
	5	4.5%	-	8.0%
	6	2.5%	2.9%	-
	More than 6	3.0%	2.9%	4.0%
	Total	100.0%	100.0%	100.0%

percent, and 24 percent of micro, small, and medium enterprises, respectively, mention that the blackout duration is two hours. Categorizing by sector, the longest durations are observed for the agriculture, fishing, or mining sector with five hours for 25 percent of outages, while the shortest durations are for the wholesale sector with 75 percent of outages only lasting one hour.

More than half of the micro and small enterprises note that most blackouts are unannounced, and 31.9 percent of medium enterprises say the same. Around 32.4 percent, 27.8 percent, and 38.2 percent of micro, small, and medium enterprises respectively mention that the blackouts are announced. The highest rate of announced outages is with the wood products, furniture, paper, and publishing sector

(48.1 percent). Conversely, the textile and garments sector and the industry of mechanics, electronics, and vehicles and vehicle services sector have the lowest rates of announced outages (two-thirds for both).

The majority of micro-enterprises (81.3 percent) do not use any backup source of electricity during outages, along with two-thirds of small and medium enterprises (59.2 percent and 65.8 percent, respectively). However, only 4.4 percent of micro-enterprises use generators compared with 16.2 percent of small and 23.7 percent of medium enterprises. The most common backup source in the agriculture, fishing, or mining sector is a generator (22.7 percent), while battery or storage devices are common in information and communication technology (10.3 percent). However, 92.6 percent of firms in the wood products, furniture, paper, and publishing sector do not use any backup source during electricity outages.

Experts have identified several weaknesses in current laws and infrastructure that hinder the efficient use and storage of RE. Regulatory restrictions that prevent energy storage and use during off-peak hours, along with the high cost of storage solutions such as batteries, pose critical concerns. The existing electrical network infrastructure is not sufficiently developed to support the integration of RE sources, especially in remote areas. Furthermore, incorporating RE sources, like wind energy, introduces variability and unpredictability into the power supply, which can jeopardize grid stability. Such sudden changes in power production necessitate the sophisticated management of frequency and voltage to maintain grid reliability.

4. Discussions with experts on constraints and barriers faced by MSMEs

More than half of the MSMEs do not have information regarding backup generator technologies, with distributions of 64.5 percent for micro, 56.6 percent for small, and 59.2 percent for medium enterprises. The financial services and real estate sectors have greater access to information (57.5 percent) compared with 72.7 percent of the agriculture, fishing, or mining sector, which has no access to this type of information.

5. Opportunities created by the RE transition for the labor market

The rates of accepting financing terms of 24 months or more for RE installments are 27.7 percent for micro, 23.2 percent for small, and 30.3 percent for medium enterprises. Several firms wouldn't accept any offers at all, and they were the largest proportion (42.7 percent for micro, 34.3 percent for small, and 43.3 percent for medium enterprises). From a sectoral perspective, the accommodation and food services sector prefers six-month installments (27.9 percent), while the textile and garments sector prefers 12 months (33.3 percent). The food industry prefers 24 months or more (33.3 percent), while wood products, furniture, paper, and publishing won't accept the offer more than half the time (51.9 percent).

When MSMEs are asked why they wouldn't accept the offer, more than a third of micro and small enterprises state that they don't need electricity (respectively 36.1 percent and 33.8 percent), while 48.5 percent of medium enterprises mention that they don't know the price. Overall, 24.2 percent mention that the landlord wouldn't accept. The highest rate of "won't accept the offer" is in the transportation and storage sector (40 percent).

Less than two-thirds (61.8 percent) of micro-enterprises have no access to information regarding changes in electricity tariffs, compared with 56.1 percent for small and 52.6 percent for medium enterprises. The wholesale sector has high access (62.5 percent), compared with the agriculture, fishing, or mining sector with the lowest access, where 68.2 percent have no access to this type of information.

5. Political, administrative and economic constraints to a RE market

The frequently cited challenge in the study's interviews involves cumbersome regulations, laws, and bureaucracy.

Table 21. MSMEs' knowledge about backup generator technology sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Do you have access to information regarding backup generation technologies?	Yes	35.5%	43.4%	40.8%
	No	64.5%	56.6%	59.2%
	Total	100.0%	100.0%	100.0%

Table 22. MSMEs' RE installments sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Rate of accepting different term financing for installments of RE tech	Six months	15.7%	17.2%	14.5%
	12 months	13.9%	25.3%	11.8%
	24 months or more	27.7%	23.2%	30.3%
	I won't accept	42.7%	34.3%	43.4%
	Total	100.0%	100.0%	100.0%

Table 23. MSMEs' access to information on variations in electricity tariffs sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Do you have access to information regarding changes in electricity tariffs?	Yes	38.2%	43.9%	47.4%
	No	61.8%	56.1%	52.6%
	Total	100.0%	100.0%	100.0%

The process of obtaining approvals for RE systems is marked by difficulties, pointing to a regulatory environment that may not fully support or facilitate the RE transition. Changes to previously established laws, such as the RE law, without proper implementation or adherence to the original vision, further complicate the situation.

Legal and technical barriers arising from long-standing agreements with fossil fuel energy producers necessitate a carefully strategized and gradual plan for integrating RE sources. This need aligns with the broader challenge of managing the transition's initial high costs, particularly for the requisite RE infrastructure. The potential job losses in traditional energy sectors highlight the critical need for retraining and skill development programs to ensure a seamless workforce transition to emerging RE roles. Even by the most conservative estimates, net jobs are set to increase with new energy sources.[38] In a decentralized network of energy providers the job creation benefits are bolstered. Moreover, reducing fossil fuel imports bears geopolitical implications, especially for countries heavily reliant on energy imports, potentially affecting relationships with traditional energy suppliers.

The transition's broader implications, including potential job losses in sectors related to fossil fuel-based energy generation and geopolitical tensions from reduced fossil fuel imports, emphasize the complex interplay of economic, social, and political factors in the shift toward RE. The restricted market entry for new players and innovations due to a complicated regulatory environment and insufficient support for energy service companies further signal the need for a more supportive framework to fully realize the RE transition.

Overcoming these challenges requires a concerted effort from governments, businesses, and the international community to streamline regulatory processes, ensure consistent policy implementation, and provide stable financial incentives. It also calls for strategic planning to address social and geopolitical implications, ensuring a just and equitable transition to a sustainable energy future.

5. Financial constraints and investment needs

The majority of MSMEs agree that RE technologies would reduce energy costs (86.5 percent for micro, 88.9 percent for small, and 85.5 percent for medium enterprises). The sector with the highest agreement is the transportation and storage sector (99 percent).

About two-thirds of MSMEs are planning to invest in RE technologies (63.2 percent for micro, 69.2 percent for small, and 63.1 percent for medium enterprises). The transportation and storage sector has the highest rate of planning to invest in RE technologies (72.7 percent).

There is a growing demand for enhanced government support to alleviate the financial strain on companies making the switch to RE. Such support could include tax incentives and subsidies, addressing the mismatch between current policies and the long-term nature of RE investments.

[38] Kis, Z., Pandya, N. and Koppelaar, R. (2018). Electricity Generation Technologies: Comparison of Materials Use, Energy Return on Investment, Jobs Creation and CO2 Emissions Reduction.

Table 24. MSMEs' belief that RE tech would reduce energy costs sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
RE technologies would reduce our energy costs	Disagree	5.7%	3%	3.9%
	Neutral	7.9%	8.1%	10.5%
	Agree	86.5%	88.9%	85.5%
	Total	100.0%	100.0%	100.0%

Table 25. Do MSMEs plan to invest in RE technology sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Plan to invest in RE technology	Disagree	20.6%	13.2%	19.8%
	Neutral	16.3%	17.7%	17.1%
	Agree	63.2%	69.2%	63.1%
	Total	100.0%	100.0%	100.0%

Traditional banking systems and financial institutions may be hesitant to provide loans for RE projects due to perceived risks or a lack of familiarity with the sector. This issue is compounded by the need for financial products tailored to the unique characteristics of RE investments, such as longer payback periods and initial high costs. The legislative and regulatory framework plays a pivotal role in either facilitating or impeding RE investments, with frequent policy changes, regulatory ambiguity, or overly restrictive laws serving as deterrents to potential investors and innovators in the field.

Investments in storage technologies are emerging as a critical step toward maximizing the potential of RE, addressing the intermittency issues of renewable sources and ensuring a stable energy supply. Furthermore, the energy infrastructure needs upgrades and expansion to support the integration of RE, including grid improvements and the adoption of smart grid technologies. Investments in education, training, and capacity building are also necessary to prepare the workforce with essential skills for the RE sector, encompassing both technical expertise and financial and regulatory knowledge.

A notable gap exists in programs specifically aimed at assisting MSMEs in securing financing for green transitions, including investments in RE systems for various applications. Skepticism about the economic viability, fueled by a weak awareness of the benefits of RE and concerns over long recovery periods for investments, hampers demand. The overall economic climate further influences the hesitance of businesses to invest in new systems, since they are wary of uncertainties in the labor market and the extended ROI period. Terms of financing, such as monthly installments and total payback periods, are crucial considerations as they make the prospect of RE investments less attractive for some despite the clear long-term financial and environmental gains.

6. Notable Examples of successful energy transition implementation with MSME involvement

The insights provided by the experts highlight the varied landscape of the RE transition across different countries and regions, with a particular focus on the involvement of MSMEs. The success stories and challenges encountered point toward several key factors that influence the effectiveness of energy transition efforts.

Despite being an oil-rich nation with low electricity costs, Saudi Arabia is setting green economy standards that influence manufacturing and export practices in neighboring countries, including Jordan. This suggests a strategic move toward sustainability standards, which can impact regional markets and encourage MSMEs to adopt green practices to maintain competitiveness. Additionally, oil-producing countries are beginning to reduce oil production to maintain oil prices while expanding alternative energy sources, signaling a deliberate shift away from fossil fuel dependency. Though Jordan does not have the same financial opportunities, it can analyze the

regulatory frameworks used, and it has potential trans-regional partnerships in these countries.

In Europe, the reliance on renewable sources such as wind energy brings to light the challenges related to geographical and climatic conditions. The continent's recent energy crisis, exacerbated by geopolitical tensions, has highlighted the critical need for energy security and diversification, prompting an accelerated transition to RE sources.[39] Energy independence is a powerful political driver in energy transitions and increases sovereignty while insuring against international supply-side shocks that can have a massive economic impact. Jordan has begun a path of interdependence with Iraq in exchanging electricity through connected grids but remains highly dependent on imports for 90 percent of its energy.[40]

Countries like Germany, Denmark, Kenya, and the US, and states like California, demonstrate various approaches to incorporating MSMEs into the RE sector. Germany's energy policy,[41] Denmark's community and MSME involvement in wind energy through cooperative models and government-backed financing, Kenya's emphasis on geothermal and solar energy supported by accessible financing, and California's aggressive RE targets and PACE programs, all showcase the importance of financial incentives, feed-in tariffs, and supportive legislation in fostering a robust market for MSMEs in the renewable industry.

7. Lessons learned and best practices from successful cases

The majority of MSMEs agree that recommendations would encourage them to adopt RE technologies (75.9 percent for micro, 81 percent for small, and 81.5 percent for medium enterprises). The agriculture, fishing, or mining sector has the highest agreement among sectors (81.8 percent).

Successful cases demonstrate the significant economic benefits and cost savings that RE systems can offer to businesses and households alike, particularly in reducing electricity and transportation costs. Also, the enactment of supportive laws, such as the RE Law, is crucial. However, effective implementation and clarity in regulations are necessary to avoid discouraging investment and innovation. In addition, tailored financial products and services, alongside technical support, are essential to overcome the initial investment barriers and perceived risks associated with RE projects.

The economic feasibility, coupled with environmental benefits, presents a compelling case for the adoption of best practices in RE technology implementation. Jordan can continue to harness its RE potential, reduce its dependence on imported fuels, and achieve greater economic and environmental sustainability by using shared knowledge from regions that have successfully utilized RE.

8. Technological limitations and infrastructure requirements

The rate of agreement with "we have access to the necessary infrastructure to adopt RE tech" between MSMEs is close (53.6 percent for micro, 56 percent for small, and 56.6 percent for medium). The agriculture, fishing, or mining sector has the highest rate of agreement (68.1 percent).

Similarly to Table 27, the rate of agreement is close, with 42.4 percent of micro, 43 percent of small, and 47.4 percent of medium enterprises agreeing that the availability of RE tech providers in their areas is sufficient. The transportation and storage sector has the highest "agree" rate among sectors (63.7 percent).

The significant costs associated with purchasing and maintaining batteries (particularly lithium ones) due to customs and material costs, pose considerable barriers. The reliance on batteries for off-grid solutions and their limited lifespan further complicates these issues. A notable gap in understanding and accepting RE technologies among financiers and regulators impedes the financing of innovative projects and the expansion of RE loans. Moreover, the current infrastructure and regulatory frameworks are ill-equipped to support the seamless integration of RE systems, especially for setups aiming to utilize daytime renewable generation alongside night-time grid consumption. Comparative insights from regions like Saudi Arabia highlight the advantages of adopting more flexible regulatory approaches.

[39] Crowley-Vigneau et al. (2023). What Motivates the 'Green' Transition: Russian and European Perspectives.

[40] Jordan Times (2024). Jordan-Iraq Electricity Interconnection to Go Live on Saturday.

[41] Tsafos, N. (2020). In Defense of the Energiewende.

Table 26. Would expert recommendations encourage MSMEs to adopt RE technologies sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
Recommendations would encourage us to adopt RE technologies	Disagree	5.6%	5%	3.95
	Neutral	18.5%	13.6%	14.5%
	Agree	75.9%	81%	81.5%
	Total	100.0%	100.0%	100.0%

Table 27. MSMEs' access to RE supporting infrastructure sorted by workforce sizes of micro (<6), small (6-19), and medium (20-99)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
We have access to the necessary infrastructure to adopt RE tech	Disagree	19.5%	15.2%	15.8%
	Neutral	27.0%	28.8%	27.6%
	Agree	53.6%	56%	56.6%
	Total	100.0%	100.0%	100.0%

Table 28. MSMEs' opinion on the availability of RE tech providers sorted by workforce sizes of micro (<6), small (19-6), and medium (99-20)

		Less than 6 Workers	6 to 19 Workers	20-99 Workers
The availability of RE tech providers in our area is sufficient	Disagree	26.7%	26.8%	23.7%
	Neutral	30.9%	30.3%	28.9%
	Agree	42.4%	43%	47.4%
	Total	100.0%	100.0%	100.0%

For Jordan to fully harness the potential of RE, the grid infrastructure and legislative framework must evolve to accommodate these systems efficiently, particularly those relying on battery storage for off-grid or hybrid applications. This includes updating legislation to reflect technological advancements in RE and streamlining the approval processes for system installations, ensuring a smoother transition to renewable sources by addressing key issues like surplus energy calculation and storage solution approvals.

Chapter Seven: Conclusions and Recommendations

1. Conclusion

Jordan is pivotal in its energy transition, moving from reliance on fossil fuels—with their associated economic, environmental, and security challenges—toward a greener, more sustainable energy framework that taps into its significant RE resources and capabilities. This transition is especially vital for MSMEs, which, despite facing potential challenges like new taxes and regulatory restrictions, can greatly benefit in terms of cost savings, enhanced competitiveness, and sustainability. Nonetheless, the journey toward fully embracing RE is beset with hurdles such as bureaucratic and financial constraints as well as infrastructural deficits, highlighting the urgent need for creative and forward-thinking government policies.

The integration of new renewable technologies and addressing the immediate impacts of moving away from fossil fuels, including job displacement and geopolitical concerns, necessitate thoughtful planning and supportive strategies. There is a gap within the MSMEs in terms of their desire and awareness of what is needed to realize the benefit of the energy transition in the long run. This means that not only governments' actions matter; the responsiveness and the capacity within the targeted enterprises matter as well. It is a challenge on both the demand and supply sides. Technology—and, accordingly, cost and efficiency—are rapidly changing within the RE sector; therefore, stability and a long-term view are crucial in motivating MSMEs to embark on an energy transition.

Some success stories can be used to motivate skeptical enterprises to embrace RE initiatives; the road ahead is still long but as time passes, MSMEs' awareness will continue to evolve toward using RE for environmental and competitiveness reasons. This would have positive social outcomes in terms of creating jobs; thereby instilling new skills and capacity building in the RE sector, which is expected to soon become a leading sector.

2. Summary of MSME surveys and interviews

Concerning priorities during the transition to RE, maintaining national order is considered the most critical factor for 37.5 percent of micro, 29.8 percent of small, and 36.8 percent of medium enterprises. Awareness of government policies supporting RE technology adoption varies across the surveyed enterprises, with more than two-thirds of MSMEs acknowledging fair awareness, while sectors like transportation and storage (63.6 percent) show higher levels of awareness. A significant majority of MSMEs believe in subsidizing electricity costs, with 91.2 percent of micro, 94.9 percent of small, and 97.4 percent of medium enterprises in favor, especially those in the food industry sector (95.6 percent). When it comes to RE, a vast majority of enterprises across all sizes support the subsidy for electricity from renewable sources.

As for the impact of RE technologies, most MSMEs view them positively in terms of environmental impact and operational enhancement. Nevertheless, the adoption and maintenance of these technologies pose challenges, including financial implications, grid stability, and the need for backup power sources. Access to information on backup generation technologies and changes in electricity tariffs is limited for a considerable number of MSMEs.

Finally, while a significant portion of MSMEs recognize the importance and benefits of RE technologies, including cost reduction and positive environmental impact, challenges such as access to information, financial constraints, and grid stability issues persist. Encouragingly, most MSMEs plan to invest in RE technologies, highlighting a growing commitment to sustainable practices. However, for a more effective transition, there's a clear need for improved access to information, supportive policies, and infrastructure to facilitate the adoption of RE technologies across various sectors.

3. Recommendations

The pillars of the transition revolve around the desire to change on the side of the MSMEs; regulatory framework; access to finance; awareness and ability to execute; the capability to adopt new technologies; and infrastructure readiness. As such, we propose the below recommendations:

1. Enhance RE Financing: Attract investment from both the public and private sectors into renewable projects like solar and wind energy, capitalizing on Jordan's natural resources. Additionally, it is important to explore innovative financing models such as developing green corridors and encouraging the creation of innovation ecosystems to boost investment and collaborative efforts in the RE sector, including public-private collaboration.
2. 2. Refine Policy Frameworks and Regulations: Develop and implement policies to ease RE adoption, streamline regulatory procedures, and offer

incentives and subsidies to encourage participation from businesses and households. This would bolster MSMEs' participation in the green economy, fostering public-private cooperation and favorable financing conditions. The government also can simplify regulatory frameworks and coordinate policy execution across sectors to strengthen MSMEs' role in the green economy.

3. Invest in Capacity Building and Raise Public Awareness: Focus on professional training and public education to foster a culture of RE utilization and understanding.
4. Implement Monitoring and Adaptation Measures: Develop robust systems for tracking RE progress and integrating climate adaptation strategies, such as water conservation and sustainable farming practices to enhance resilience.
5. Upgrade Infrastructure for Renewable Integration: Improve the grid and other infrastructures to support RE integration and expand technical assistance services, thereby increasing the sector's competitiveness.
6. Develop Sector-Specific Strategies: Provide strategies catered to the unique energy demands of different sectors, complemented by capacity-building and information-sharing initiatives to ensure broad support for energy efficiency and renewable resource adoption. Micro-enterprises are less aware and lack the capability of engaging in the energy transition, which requires some specific measures such as energy audits that might precede the full energy transition.

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