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Status of the Energy Transition Sector in Morocco.

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Abstract
The economic, social and health situation in the world supports Morocco's decision to introduce an energy transition through renewable energies, which began about ten years ago. Morocco's energy transition towards renewable energies has marked significant progress, with major projects such as the Noor solar complex and the Tarfaya and Midelt wind farms illustrating the country's commitment. This movement, supported by international commitments such as the Paris Agreement, aims to reduce dependence on fossil fuels and improve the carbon footprint. However, challenges remain, including the integration of renewable technologies into existing infrastructure and the management of their intermittency. The future of this transition depends on the ability to overcome these obstacles while pursuing sustainability and energy security objectives. This analysis examines the current state of the energy transition in Morocco, assessing achievements, obstacles encountered and prospects for the future, with the aim of charting a path towards a more sustainable and resilient energy system.

Keywords: Energy transition, renewable energies, energy strategy, state of play.

Introduction

In 2009, Morocco adopted an ambitious energy strategy in response to political, economic and environmental imperatives, as well as to its Kyoto Protocol commitments. Implemented in an integrated, participatory and comprehensive manner, this strategy illustrates the country's commitment to the challenges and objectives of its national sustainable development strategy. Following COP 22 in Marrakech in 2016, Morocco has established itself as a leader in Africa in the development of renewable energies in the second decade of the 21st century. Committed to the global fight against greenhouse gas (GHG) emissions, the country signed and adopted the 2015 Paris Agreement, thereby complying with the European Union's (EU) carbon adjustment

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mechanism. Morocco has chosen to prepare for the post-oil era by investing massively in renewable energies, while aiming to improve its carbon footprint and meet its international climate commitments. Economic, social and environmental issues pose considerable challenges for the energy transition, requiring development objectives and far-reaching changes. This process requires a compromise between these dimensions, with forms and degrees of transition varying from continent to continent and country to country. Developed economies are focusing on renewable energies to enhance energy security and control environmental impacts. On the other hand, many countries are shifting their strategies towards more economical solutions. The MENA region, in particular, has attracted significant attention and recognition for its strategic options and energy transition scenarios. Morocco, for example, has very limited fossil energy resources, making it over 95% dependent on external sources, which account for 30% of total export revenues: A troublesome situation with serious repercussions on Morocco's balance of trade; heavily impacting the State's financial equilibrium. This energy production/consumption imbalance could act as a brake on the country's socio-economic development.

Section 1: Transition to renewable energies

1. Energy context in the world

Over the last three decades of the 20th century, growing international awareness has highlighted the need to transition away from fossil fuel-based energy systems, due to the depletion of these resources, their high cost, and their negative impact on climate change. To meet these challenges, it is imperative to adopt measures aimed at transforming current energy production technologies. Traditional methods of energy production have detrimental environmental effects, hence the urgent need for a gradual shift to renewable energies. Renewable energies are not only essential for mitigating climate impacts, they also represent a significant potential for economic growth and the diversification of economic sectors.

The global energy context is marked by a complex transition between dependence on fossil fuels and the rise of renewable energies. In 2024, fossil fuels will continue to dominate energy production, accounting for around 80% of the global energy mix, despite rapid growth in renewable energies such as solar and wind power. This transition is fuelled by growing concerns about climate change, fluctuating commodity prices and geopolitical issues. International policies, such as the carbon reduction targets of the Paris Agreements, are driving nations to diversify their energy sources and invest in cleaner, more sustainable technologies. However, challenges remain, including the investment needed to modernize energy infrastructures, the development of energy storage technologies, and managing inequalities in access to clean technologies between developed and developing countries. At the same time, energy security and infrastructure resilience in the face of geopolitical crises and natural disasters remain crucial priorities for ensuring an efficient and equitable energy transition on a global scale.

2. Literature review: The world energy balance.

The World Energy Balance Sheet is a comprehensive analysis of global energy production, consumption and trade. It covers various aspects such as energy sources, consumption trends, energy policies and their impacts environmental. Here is a structured overview of the global energy balance based on the most recent data and key trends:

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1. Energy Production

Main Sources of Production

Energies Fossils:

- Oil: About 31.5% of world energy production. Major producing countries include Saudi Arabia, the United States, and Russia.
- Coal: Accounts for about 27.5% of global energy production. The largest producers are China, India, and the United States.
- Natural Gas: Contributes about 24.5% of global production. Major producers are Russia, the United States, and Qatar.

Energies Renewables:

- Solar: Contributes increasingly to the overall energy mix, with an estimated share of 5% in 2023, a sharp increase compared to previous years.
- Wind: Accounts for about 6% of global energy production, with significant installations in China, the United States, and Europe.
- Energy Nuclear: Constitutes about 10% of global energy production. The main producers are the United States, France, and China.

2. Energy Consumption

Distribution by Sector

- Sector Industrial: Consumes about 40% of the world's energy, particularly in heavy industries such as metallurgy and chemicals.
- Sector Residential and Commercial: Represents approximately 30% of energy consumption, including heating, air conditioning, and electricity needs.
- Transportation: Uses about 30% of the world's energy, dominated by fossil fuels, especially oil.

3. Energy Exchanges

International Trade

- Exporters Majors: Countries like Russia, Saudi Arabia, and the United States are major exporters of energy, especially oil and natural gas.
- Major importers: The European Union, China, and Japan are among the largest energy importers, due to their dependence on foreign energy resources.

4. Environmental Impact

Greenhouse Gas Emissions

- Oil And Natural Gas: Contribute significantly to global CO2 emissions, with major implications for climate change.
- Coal: Generates the most CO2 per unit of energy produced, although its use is declining in some developed countries due to climate policies.

Sustainable Development

- Energy Transition: The global trend is to reduce dependence on fossil fuels and increase the share of renewable energies in the energy mix, supported by policies such as the Paris Agreement.
- Technological Innovation: Advances in energy storage technologies, such as batteries and green hydrogen, are crucial to facilitating this transition.

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5. Policies and Regulations

International Agreements

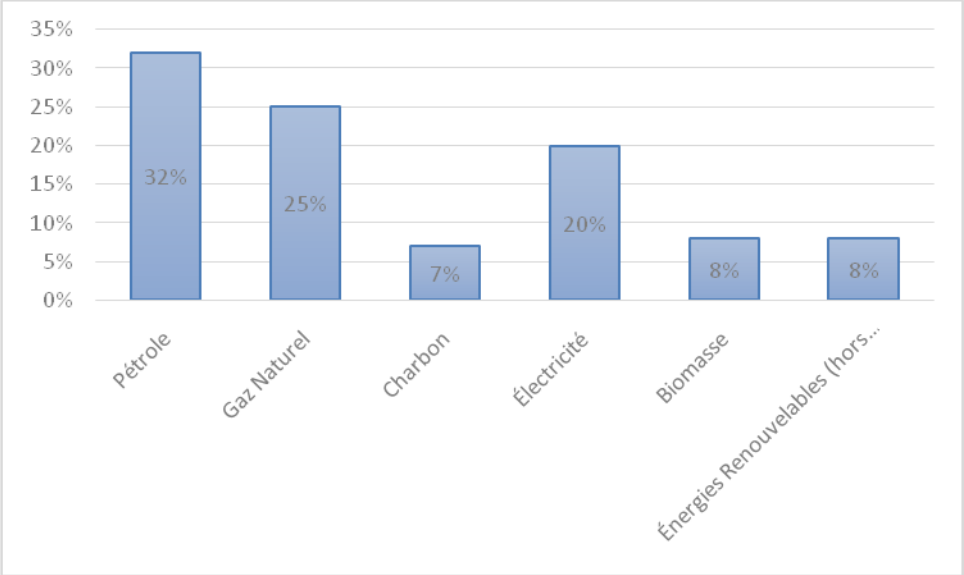
- Paris Agreement:Aims to limit global warming to less than 2°C above pre-industrial levels, with commitments to reduce greenhouse gas emissions.
- Sustainable Development Goals (SDGs): SDG 7 aims to ensure access to reliable, sustainable and modern energy for all.

Policies National

- Subsidies and Taxes:The Policies vary by country, with subsidies for renewable energy and taxes on carbon emissions being common tools to influence the energy mix.

The global energy balance is marked by a heavy reliance on fossil fuels, although renewable energies are gaining ground. The energy transition is a major challenge, with international policies and technological innovations aimed at reducing environmental impacts and securing a sustainable energy supply. Current trends indicate a move towards a more diversified and less polluting energy mix, but significant challenges remain to achieve the objectives climatic global .

Figure 1: Distribution of Consumption World Energy Final in 2023



Source: Agency International Energy Agency (IEA). *World Energy Outlook 2023.*

The pie chart above shows the distribution of final energy consumption worldwide in 2023. Here are the main observations:

- Oil is the most consumed energy source, accounting for 32% of global consumption. This reflects its dominant role in the transportation sector and industrial production.
- Natural Gas follows with 25%, indicating its growing importance as a source of energy transition due to its relatively lower carbon emissions compared to coal.
- Electricity accounts for 20% of final energy consumption, including a diversity of sources such as coal, natural gas, renewables and nuclear. The growing importance of electricity is related to its use in many sectors, including industry, transportation (electric vehicles), and

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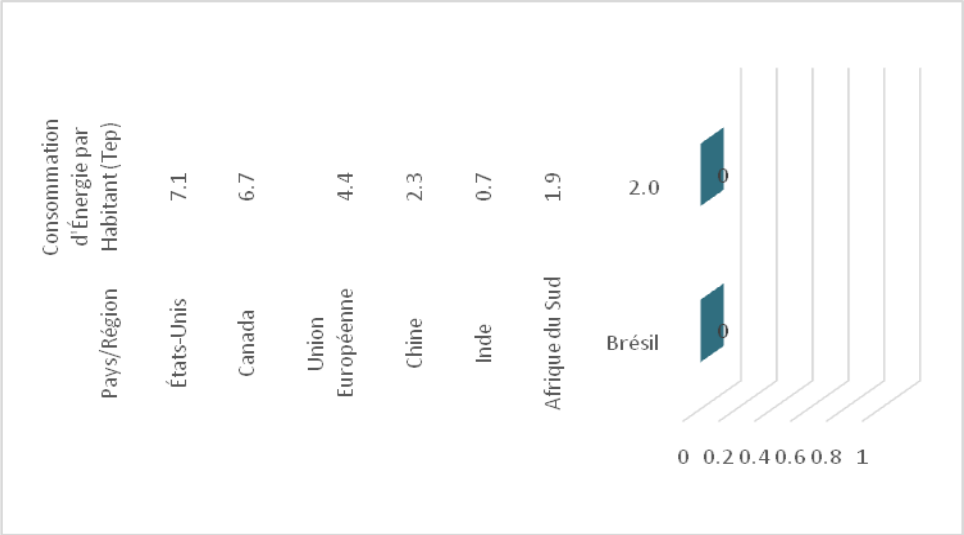
homes.

- Coal is at 7%, showing a decrease from previous years due to the transition to cleaner energy sources and policies aimed at reducing carbon emissions.
- Biomass and Renewable Energy (excluding biomass) each account for 8%. Although these sources are growing, they still represent a modest share of total global energy consumption. Biomass is used primarily for thermal energy production, while renewable energy includes solar, wind , and hydroelectric .

This chart illustrates the distribution of different energy sources in global final consumption in 2023. It is observed that oil and natural gas remain the main sources , representing more than half of consumption world , while that the energies renewable , good what about growth , still represent a modest share of the total.

Figure 2: Consumption Energy per Capita in Tep (2020)



Source: Agency International Energy Agency (IEA). World Energy Outlook 2020.

This chart illustrates the energy consumption per capita in different countries and regions for the year 2020, measured in tonnes of oil equivalent (TOE). The main observations are:

- The United States and Canada have the highest levels of energy consumption per capita, at 7.1 and 6.7 TOE, respectively. This is due to an energy-intensive lifestyle, high vehicle use, and high reliance on fossil fuels.
- The European Union consumes 4.4 TOE per capita, showing a more moderate consumption compared to North American countries, thanks to energy policies favoring energy efficiency and renewable energies.
- China, with 2.3 TOE per capita, and Brazil, with 2.0 TOE, show intermediate levels , reflecting rapid economic growth with increasing energy demand but still below the levels of developed countries.
- South Africa has a consumption of 1.9 TOE, and India, with 0.7 TOE, have the lowest levels. These figures illustrate the challenges associated with limited access to modern energy sources and a still high dependence on renewable energy sources. less effective .

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This graph highlights disparities important in consumption energy per capita among developed countries and developing countries . Developed countries , with a more developed energy infrastructure and higher standards of living , consume much more energy per capita than developing countries . The data reflect also the impact of policies energetic national , available technologies and consumption habits .

3. The international energy transition.

The international energy transition is a global process aimed at replacing fossil energy sources, such as coal, oil and gas, with renewable energy sources and cleaner, more sustainable technologies. This movement is primarily driven by the need to combat climate change, reduce greenhouse gas emissions and decrease dependence on non-renewable energy resources.

The various energy crises and upheavals (political, social, economic and environmental) of the last decades of the 20th century, triggered by oil shocks, have led to a worldwide awareness of the urgency of the energy transition. Energy-consuming countries have turned their attention to a palliative for polluting fossil fuels: renewable energies. Today, the availability and control of both fossil and renewable energies has been a major concern for countries over the last 20 years. Indeed, energy is a key factor in development, and has played a fundamental role in the evolution of civilizations. The opportunistic and inevitable emergence of renewable energies is an essential and necessary option for coping with the continuing growth in energy consumption and the volatility of fossil fuel prices. Market instability due to cyclical economic crises, and tensions and conflicts around the world, have led to a crisis in the Western development model:

- New industrial technological revolution.
- Increase in CO2 emissions (greenhouse effect) main cause of climate change, environmental degradation.
- Fossil fuels are declining and becoming more expensive...

Geostrategic challenges and new international realities have forced both state and private decision-makers to revise their development strategies in the direction of a new energy orientation, focused on the development of renewable energies. Countries with no fossil fuel resources and trying to reduce the financial impact of their bills on the national economy are looking to diversify their sources of energy supplies. These and other factors have prompted industrialized countries to look for new sources of energy supply.

4. Impacts of clean energy on sustainable development.

The energy transition has significant **environmental impacts,** which are generally positive, as it aims to reduce the negative impact of greenhouse gas emissions and pollution generated by fossil fuels. Below are the main environmental impacts of the energy transition:

1. **Reducing greenhouse gas emissions:** One of the main objectives of the energy transition is to reduce greenhouse gas emissions, such as carbon dioxide (CO2), methane (CH4) and nitrogen dioxide (NO2). By replacing fossil energy sources with renewable energies such as solar, wind, hydro and biomass, greenhouse gas emissions are significantly reduced, helping to mitigate climate change.
2. **Improved air quality:** Renewable energies and clean technologies used as part of the

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energy transition produce fewer air pollutants such as sulfur oxides (SOx), nitrogen oxides (NOx) and fine particles. This leads to a significant improvement in air quality, reducing the health problems associated with air pollution.

3. **Protecting biodiversity:** The energy transition also helps protect biodiversity by reducing the degradation of natural habitats caused by extractive activities linked to fossil fuels. For example, mining and oil extraction can destroy sensitive ecosystems, threatening flora and fauna.
4. **Reducing dependence on non-renewable resources**: Renewable energies used as part of the energy transition are generally based on abundant and renewable natural resources, such as sun, wind, water and biomass. By reducing dependence on non-renewable resources, the energy transition helps to preserve finitefossil fuel reserves and avoid the depletion of these resources.
5. **Adapting to climate change:** The energy transition helps build resilience to the effects of climate change. By investing in renewable energies and implementing energy efficiency practices, companies can better adapt to the impacts of climate change, such as extreme weather events, droughts and water stress.
6. **Preserving marine and terrestrial ecosystems:** The production and use of fossil fuels can lead to oil spills, oil slicks and significant environmental damage to marine and terrestrial ecosystems. The energy transition reduces these risks by favoring cleaner, less environmentally damaging energy sources.

The energy transition has significant **social impacts**, which can be both positive and negative, depending on the policies put in place and the way it is managed: some of the main social impacts of the energy transition:

1. **Creating green jobs:** The energy transition is stimulating job creation in the renewable energies, energy efficiency and clean technologies sectors. This can help reduce unemployment and improve job prospects for workers in these emerging fields.
2. **Changes in employment:** The energy transition may also lead to changes in the labor market, particularly for workers in fossil fuel-related industries. Some jobs in these sectors may decline, which may lead to adjustment challenges for the workers concerned.
3. **Fair transition:** It is important to ensure that the energy transition is fair and equitable for all members of society. This means that measures must be taken to support workers and communities affected by the transition (negative impacts), by offering vocational training, retraining opportunities and social safety nets.
4. **Access to energy:** The energy transition can influence energy accessibility, particularly in disadvantaged or remote communities. It is essential to ensure that all individuals have access to reliable and affordable energy sources during the transition.
5. **Citizen participation:** The energy transition can encourage citizen participation in energy-related decision-making, notably by promoting the development of community or cooperative renewable energy projects.
6. **Health and well-being:** Reducing air pollution through the energy transition can have significant public health benefits by reducing pollution-related respiratory and cardiovascular disease.

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7. **Environmental justice:** The energy transition can help promote environmental justice by reducing the negative environmental impacts that often disproportionately affect disadvantaged and vulnerable communities.
8. **Energy costs:** The energy transition can influence energy costs for consumers. Although renewable energies may become cheaper in the long term, the implementation of green infrastructure and technologies may lead to additional costs in the short term.

The energy transition generates a series of **economic impacts**that can vary depending on the policies implemented and how they are managed. These impacts can be both positive and negative, and their magnitude depends largely on the strategic choices adopted.

1. **Job creation and growth in key sectors:**Description: A policy favorable to energy transition can lead to significant job creation, particularly in the renewable energy and energy efficiency sectors. In addition, it can stimulate the growth of cleantech-related industries.
2. **Emissions reduction and healthcare cost savings:** Description: A well-managed energy transition can lead to a reduction in greenhouse gas emissions, thereby reducing the costs associated with the impacts of climate change. In addition, reducing air pollution can lead to significant savings in healthcare costs.
3. **Cost reduction and technological innovation:**Description: Sound policies and investment in research and development can lead to a reduction in the cost of renewable energy technologies. In addition, this encourages technological innovation, thus promoting economic growth.
4. **Infrastructure investment and skills development**: Description: Effective management of the energy transition can generate substantial investment in energy infrastructure, notably the power grid. It can also encourage the development of skills and expertise in energy-related sectors.
5. **Diversification of energy sources and reduction of dependence:** Description: A policy favoring diversification of the energy mix can reduce vulnerability to fluctuations in fossil fuel prices, while reducing dependence on energy imports. This can reinforce national economic stability.

The energy transition, under the impetus of well-designed policies and adequate management, offers significant economic opportunities. It can stimulate growth, create jobs, and contribute to long-term economies. However, it is crucial to consider the various aspects and carefully monitor the implementation to maximize the benefits and minimize the potential risks.

Section 2: State of play of renewable energies in Morocco

I. The energy context in Morocco: State of play

Morocco has adopted, under the High Guidance of His Majesty and King Mohammed VI, May God Assist Him, an energy strategy, based essentially on the rise of renewable energies (RE), the development of energy efficiency and the strengthening of regional integration.

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This strategy has been broken down into specific programs and accompanied by targeted legislative and institutional reforms. The objective of this strategy is to increase the share of renewable energy to 42% in 2020 and to 52% by 2030.

At the beginning of 2017, the installed capacity of renewable sources was 2747 MW, including 797 MW of wind, 180 MW of solar and 1770 MW of hydro.

Achievements Review: *April 2017- December 2018*

Wind Energy: *Morocco Has Broken The World Record In Terms Of Kwh Cost With A Great Involvement Of The Private Sector*

For wind energy, the total installed capacity reached 1015 MW by 2018 (ie 11.5% of the total installed power), including 420 MW by the private sector within the framework of law n°13-09 relating to renewable energies, in addition to 200 MW in the test phase.

For the wind sector, the capacity installed by the private sector under law no. 13-09 represents approximately 60% of the total installed capacity.

In February 2018, the company CME WINDFARM SAFI was authorized to build the Sali wind farm with a capacity of 200 MW and an estimated investment of 3.2 billion DH.

The JbelKhalladi wind farm with a capacity of 120 MW and an investment of 1.7 billion DH, carried out by the private sector within the framework of law 13-09, has been completed and entered the testing phase for obtaining the final authorization before its official commissioning.

Thus, the Aftissat wind farm project of 200 MW has been authorized and entered the testing phase for commissioning at the end of 2018 with an investment of 4 billion DH.

Table 1: Situation of wind capacities

PROGRESS STATUS				
	ACCOMPLISHED	IN PROGRESS OF IMPLEMENTATION	UNDER DEVELOPMENT	TOTAL
Installed capacity (MW)	1060	216	1040	2316
Investment (MDH)	18900	2522	18000	39422

Solar energy: Completion of construction works on the Noor Ouarzazate Solar Complex, the largest of its kind on an international scale:

Concerning solar energy, the installed power currently reached 180 MW (ie 2% of the total installed power) after the commissioning of the Noor Ouarzazate I Solar power plant of 160 MW with an investment of 7 billion DH.

The Noor PV1 solar photovoltaic project of 170 MW and investment of more than 2 billion Db H is composed of the Noor Laayoune and Boujdour power plants of 100 MW and Noor Ouarzazate 4 with a capacity of 70 MW whose construction work was launched on April 1, 2017, by His Majesty King Mohammed VI May God Assist Him. These projects are in the testing phase to be commissioned at the end of 2018.

The Noor Ouarzazate II and III thermal power plants with a total capacity of 350 MW and an investment of 17 billion DH have been completed and are injecting into the electricity network in the testing phase for commissioning scheduled for the end of 2018.

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For the Noor Midelt project, combining CSP and PV technologies with a power of about 800 MW and an investment of about 20 billion DH and after the pre-qualification phase, the offers for the first phase of this project are currently being evaluated. The Bid Evaluation Commission held its last meeting on December 11, 2018 to select the consortium that will develop the project.

Regarding the Noor Tafilalat solar project (120 MW), the project sites (Erfoud - Mysour-Zakoura) have been identified and the company to carry out the project. As for the Noor Atlas solar project (200 MW), the sites for the development of this project (Budnib - Bouanan - OutatElhaj -Anil- Ain Blessed Mathar - Tata es Tan Tan) have been identified and the preliminary studies necessary for the preparation of the documents relating to the call for tenders have been completed.

Table 2: Status of solar capacities

PROGRESS STATUS				
	ACCOMPLISHED	IN PROGRESSOFIMPLEMENTATION	UNDER DEVELOPMENT	TOTAL
Installed capacity (MW)	800	200	800	1800
Investment (MDH)	27365	3000	20000	50365

Hydroelectric Energy: Flexible and Modular Energy. Attractive for New Investments

Regarding hydroelectric energy, the installed electrical capacity in 2018 is 1770 MW (ie 21.5% of the total installed power), including 460 MW in the form of STEP.

The selection of the consortium for the construction of the 350 MW Abdelmoumen Pumped Storage Energy Transfer Station (STEP) was carried out, with an investment of 3.2 billion DH for a planned commissioning in 2022.

Since April 2017, the Department of Energy and Mines has authorized the construction of 12 micro hydroelectric power plants with a total capacity exceeding 193 MW with an investment of more than 5 billion DH, within the framework of Law No. 13-09 relating to renewable energy energies, as amended and supplemented by Law No. 58-15.

More than 73% of the total power to be developed under Law No. 13-09 was authorized during the period 2017-2018.

Table 3: Status of hydroelectric capacities

PROGRESS STATUS				
	ACCOMPLISHED	IN PROGRESS OFIMPLEMENTATION	UNDER DEVELOPMENT	TOTAL
Installed capacity (MW)	1770	614	748	3132
Investment (MDH)	-	9560	7380	16940

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Today, our country is well on its way to energy transition. The share of renewable energies is around 35% in the electricity mix with an installed capacity of more than 2965 MW.

New Challenges of Massive Integration of Renewable Energies, New Projects

In 2008, and in order to contain the challenges linked mainly to the strong growth in energy demand and the delay in the commissioning of certain means of production, it was crucial to find, first, an investment model capable of providing an adequate solution to the demand of a rapidly expanding electricity consumption market, to act on both supply and demand and to implement significant and targeted reforms at the legislative, regulatory and institutional levels.

Today, Morocco is engaged in an energy transition which is already reflected in a very satisfactory electricity reserve margin and a reduction in energy dependency from 98% in 2008 to around 93% currently, mainly due to the rise of renewable energies, which generate new challenges for the national electricity system, linked in particular to their intermittent nature.

On this subject, the MEMDD launched in 2014 a roadmap for the development of liquefied natural gas which is currently being developed.

In September 2018, ONEE launched the creation of a platform for the optimization, management and supervision of renewable energies, the first in Africa, consisting of setting up a dispatching dedicated to the management and supervision of the production of renewable energies allowing the forecasting of intermittent production. This project will ensure real-time management of the production flows of renewable energies, the display of information concerning the state of the network, by offering the necessary decision-making tools.

The effort also focuses on strengthening the electricity network to further develop the reception capacity in order to evacuate the energy produced from renewable sources.

In the same vein, Morocco continues its active participation in the Joint Declaration on Sustainable Electricity Exchange and hosted, on September 7, 2017, the launch meeting of the Steering Committee aimed at producing a roadmap for the sustainable electricity exchange between Morocco and Europe, in which all the partner countries of this project participated, including France, Spain, Portugal. Germany, as well as the institutions that support it, namely the World Bank, the Union for the Mediterranean and the European Commission.

Morocco is also working to strengthen its electrical interconnections with its neighbors.

Furthermore, Morocco was one of the first countries in the Euro-Mediterranean region to introduce Pumped Storage Energy Transfer (PSE) technologies by building the Afourer PSE with a capacity of 460 MW, given their role in reducing the intermittency of renewable energies.

Project for the Redesign of the Legislative and Regulatory Framework

In April 2018, the MEMDD launched a broad consultation process aimed at improving the legislative and regulatory framework governing renewable energies to implement the High Royal Guidelines on improving the investment climate and taking into account the changes that

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this sector has undergone. This overhaul aims, among other things, to simplify and dematerialize investment procedures, strengthen transparency, and balance operators in the national electricity system. The objective of this overhaul is also to improve the bankability of renewable energy projects and develop a national ecosystem in the field of renewable energies and EE to accelerate the process of developing a local industry.

The MEMDD was supported by a specialist consultant who led a broad consultation program with the various operators, both public and private, with a view to agreeing on the main areas of reform.

A first restitution workshop, chaired by the Minister of Energy, Mines and Sustainable Development, in the presence of the Chairman and CEO of the Moroccan Agency for Sustainable Energy (MASEN), the Director General of the National Office of Electricity and Drinking Water (ONE), the Governor Director of Authorities and Concessioned Services, and the Presidents of Federations and representatives of professional federations related to renewable energies in Morocco, was held on May 14, 2018 and brought together approximately 70 public and private operators in the renewable energy sector.

This workshop was followed by a thematic workshop dedicated to HT/THT held on June 25, 2018 and brought together manufacturers, operators and various institutional partners operating in the renewable energy sector, to discuss the main technical issues raised during the consultation workshop held on May 14, 2018 and agree on the main areas of revision of Law No. 13-09.

Today, a draft amendment to Law No. 13-09 is being prepared based on the results of the consultation process and is being sent to the operators concerned for their final comments before introducing it into the approval process.

Royal Satisfaction With The Progress Of Renewable Energy Projects.

As part of the regular monitoring by the Sovereign of the effective and operational deployment of renewable energies. HIS MAJESTY KING MOHAMMED VI, May God Assist Him, chaired, on April 26, 2018, a working session devoted to examining the progress of renewable energy projects carried out by MASEN. Following the results presented, His Majesty the King, May God Assist Him, expressed his satisfaction with the progress recorded on all components of the national renewable energy plan and gave his High Instructions to maintain and strengthen the mobilization of all stakeholders in order to make this sector a true economic locomotive of the Kingdom.

A second working session was chaired by His Majesty the King, May God Assist Him, and was held on 1 November 2018, who gave his High Instructions to revise upwards the initially projected ambitions in terms of renewable energies, which are thus called upon to exceed the current objective of 52% of the national electricity mix by 2030, and gave its High Guidelines to densify and encourage the exemplary force of the public administration. Public buildings will

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have to set an example by using renewable energies as much as possible, thereby maximizing energy efficiency and achieving significant savings.

Similarly, the Sovereign stressed the need to adopt an additional integrated program aimed at supporting all the planned water desalination plants with renewable energy production units to ensure their autonomy and energy savings, or even the exploration of new energy sources such as the energy transformation of waste (Biomass) in large cities such as the Casablanca metropolitan area.

Regional and International Partnership, Lever of Cooperation for a Successful Energy Transition

Since the launch of the twinning project on May 8, 2018 in Rabat, which is dedicated to supporting the strengthening of the energy sector, 11 expert missions and 5 training sessions have been held in the field of renewable energy and energy efficiency. This project includes 37 activities, including 30 activities concerning the renewable energy and energy efficiency sector and will mobilize more than 80 EU expert missions to Morocco and training sessions, as well as 6 study visits to France and Germany.

As part of the Moroccan-German Energy Partnership (PAREMA), which aims to support Morocco in the implementation of its national energy policy, an exchange of technical and legal expertise was organized within the framework of regular meetings of the working groups. PAREMA successfully ensured the holding of workshops, study trips and meetings of the working groups in Morocco and Germany with the participation of representatives of Ministries, public institutions and the private sector:

In March 2017, a high-level Moroccan delegation attended the BETD (Berlin Energy Transition Dialogue) conference.

In June 2017, PAREMA organized a study trip to the largest international solar industry exhibition "INTERSOLAR", for the benefit of institutions as well as Moroccan companies in the energy sector and in particular solar energy. A business to government round table was organized, on the sidelines of the exhibition, to present the Moroccan solar market to German and international players.

In September 2017, PAREMA organized the first “Moroccan-German Energy Day”. This event brought together recognized experts from the main energy institutions of the two countries, think tanks, representatives of industry and civil society as well as more than 350 participants.

In September 2017, the 6th meeting of the working groups took place, several themes were discussed including the creation of the energy prospective analysis center, monitoring and modeling in the field of energy, the launch of a macroeconomic study of the long-term energy transition and the launch of a reflection on the identification of needs for potential support for the wind sector.

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A workshop was organized in Casablanca on May 10, 2018 on the theme: "the wind industry in Morocco: what value chain for what industrial integration?" This workshop was attended by all stakeholders, including institutions, developers, companies, and associations operating in the wind sector.

As in previous years, a Moroccan delegation was accompanied by PAREMA to participate in the "Intersolar 2018" conference, from June 20 to 22, 2018 in Munich (Germany). This conference was an opportunity to strengthen the skills of Moroccan participants, particularly in the field of renewable energy and storage technologies.

In July 2018, a summer school on "the involvement of civil society in the energy transition" was organized for 30 representatives of Moroccan Civil Society Organizations (CSOs), in order to share the major concepts and trends in energy, the challenges and opportunities of the energy transition, the characteristics of different energy sources, particularly renewable ones, and energy efficiency.

In December 2018, a workshop was organized in Casablanca in collaboration with AMEE and AMISOL for the launch of the TaqaPro label which aims to guarantee the quality of photovoltaic installations.

Key Elements of Integrated Energy Development, R&D, Training and Industrial Integration Are at the Heart of the Various Projects Carried Out Within the Framework of the National Energy Strategy

As part of supporting the national energy strategy, the Solar Energy and New Energies Research Institute supports applied research, the development of national expertise and the creation of a stimulating environment for innovation. Thus, the institute finances applied various research projects and implements a number of programs.

The institute continues to fund research projects in the field of new energies and energy efficiency. To date, 183 research professors, 366 doctoral students and interns, 55 companies from the industrial sector are involved and 6 university laboratories and national research institutes are equipped with the necessary latest generation equipment. About 38 international partnerships have been concluded and nearly 230 articles have been published in international journals.

MASEN has also initiated an R&D approach that meets a dual ambition: Building a Moroccan technological fabric in the field of solar energy by adopting two strategic objectives covering both Photovoltaic and CSP, and setting up research excellence in the field of solar energy capable of supporting and perpetuating industrial activity.

By offering real and optimal testing conditions, the MASEN R&D demonstration platform will allow researchers and manufacturers to stay and develop all of their work with a view to reaching commercial maturity. Ultimately, the ambition is to drive an ecosystem conducive to innovation

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in the solar sector, by contributing to the creation of value through pioneering activities.

Beyond contributing to meeting its future energy needs, the Kingdom of Morocco aims, through its ambitious renewable energy and energy efficiency programs, to master promising technologies and create a local industrial fabric. As part of the international call for tenders for the 850 MW Integrated Wind Project with an investment of approximately 14.7 billion DH, the Siemens Wind Power group has committed to manufacturing a large part of the wind turbine components locally with the installation of the first blade manufacturing plant in Morocco. The plant began operating in October 2017.

Concerning the photovoltaic solar industry, 4 companies specialized in the field of photovoltaic module assembly have been set up in Casablanca, Kenitra ,Temara and El Hoceima with an annual production capacity ranging from 5 MW to 30 MW for each industrial unit.

II. The energy transition in Morocco: Assessment and perspectives

Morocco's energy transition is characterized by a strong commitment to the diversification of energy sources and environmental sustainability. Since the launch of its National Energy Strategy in 2009, the country has implemented ambitious initiatives to reduce its dependence on fossil fuels, which still make up a significant proportion of its energy mix. In particular, Morocco has invested in large-scale renewable energy projects, such as the Noor solar park in Ouarzazate, one of the world's largest solar thermal complexes, and wind power projects like those in Tarfaya and Midelt, which harness the country's wind power potential.

Morocco aims to achieve 52% of its electricity generation capacity from renewable sources by 2030, with a particular focus on solar, wind and hydroelectric power. At the same time, the country is implementing measures to improve energy efficiency in the building and transport sectors, and is developing storage and grid management infrastructures to better integrate intermittent energies. This transition is supported by favorable policies, international partnerships and foreign investment, positioning Morocco as a regional leader in renewable energies. However, challenges remain, particularly with regard to managing production fluctuations, optimizing infrastructures and ensuring equitable access to technologies for local communities.

At the same time, Morocco, like other countries, is implementing a strategy to develop renewable energies. Plusieursobjectifs pertinent ontétéfixés : 52 % du mix électrique qui étaitfixé pour 2030 serontréalisésen 2025. Récemment, plusieursmesuresontétéentreprises pour développer la biomass énergie, l'hydrogènevert et peut-êtremême le nucléaireafin de satisfaire la demandeintérieurecroissanted'énergie.

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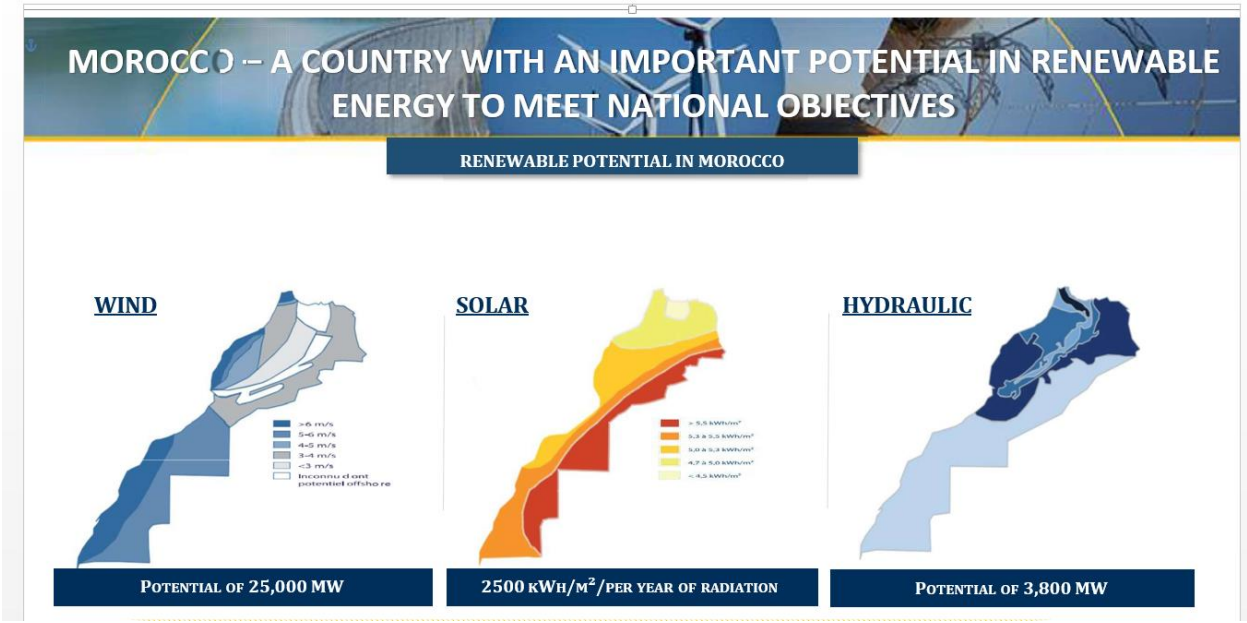

Source: Masen

Conclusion

Renewable energies are considered as sustainable and saving alternatives for the success of the future energy transition. Morocco must invest in research and development, innovation, offer adequate training in the energy fields, encourage young people to undertake in the fields of renewable energies, The promotion of the research / and development sector in the field of renewable energies, will constitute a structuring orientation that must breathe a strong dynamic into the State / Private complementarity, collage of the successful experiences of leading countries in the field (for example: Germany, China etc ...).

So, despite all the constraints that can hinder its large-scale development currently; it has largely achieved the objectives set. In addition, Morocco is integrating through this strategy like other countries; towards green energy. Several relevant objectives have been set: 52% of the electricity mix, which was set for 2030, will be achieved in 2025. Recently, several measures have been undertaken to develop biomass energy, marine energies and green hydrogen, and perhaps even nuclear power to meet the growing domestic demand for energy.

Case of Morocco: it continues to confirm and raise its ambitions to exceed the objectives set (42% for 2020 and 52% for 2030 for the production of renewable energies). This development, however, requires substantial and multi-demented support: appropriate legislation (investment code), financial (financing too expensive: random "Return on investment"); maintenance of sites too costly; cleaning of solar panels and repowering of wind turbines.

To achieve the objectives of this strategy we suggest the following actions:

- The updating of our research topic is confirmed during the Russo-Ukraine war, because they are both producers and exporters of fossil fuels (oil and gas). Which has generated a dizzying rise in the prices of these energies. The impact is heavily felt by countries that do not

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produce these energies, such as Morocco, which confirms its accuracy and opportunism in establishing its renewable energy strategy.

- Morocco must continue to invest in people through training young people (machining of components relating to the energy sector), and establishing courses in the renewable energy sector.
- It has all the ingredients to achieve technological sovereignty in the long term and continue to innovate across the entire sector, creating significant economic dynamics; all the more so as Morocco benefits from an attractive operational environment (significant investments in underlying infrastructure).
- The investment code conferring competitive advantages, targeted measures to promote investments through exemptions and tax advantages.
- Morocco, through the promotion of the renewable energy sector as a lever for socio-economic development, could provide a very significant economic boost.

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