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MOROCCO AND ITS QUEST TO BECOME A REGIONAL DRIVER FOR SUSTAINABLE ENERGY

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Abdelghani El Gharras and Emanuela Menichetti[1]

Lack of fossil fuel resources, high energy import bill, and rising energy demand, electricity in particular, together with positive energy dynamics at the global level, especially the decreasing costs of renewable energy (RE) technologies and access to climate finance, have pushed Morocco to develop alternative, reliable and sustainable renewable energy. These dynamics have been translated by the adoption of an energy strategy, supported by royal willingness, putting renewables at the forefront of Morocco's energy policy (setting one of the highest RE objectives in the region), and thereby making of Morocco a regional leader in clean energy technologies. The deployment of renewables at a wider scale could potentially be an example for all countries in the region and elsewhere. Sharing best practices and know-how on renewables as well as making good use of energy trade and infrastructure opportunities embed Morocco both at the regional and the international levels.

1. CLEAN ENERGY GROWTH AND THE ROLE OF THE ELECTRICITY SECTOR

Unlike other countries in the Middle East and North Africa (MENA) region, especially the Gulf Cooperation Council (GCC) countries, Morocco is a net energy importer, with more than 90 per cent of its energy needs met through imports, thus putting pressure on its fuels-import bill. After four consecutive years (2012–2016) of decline, reaching 55 billion Moroccan dirhams (MAD) in 2016, net energy import bill increased by more than 25 per cent in 2017, reaching 69 billion MAD,[2] due mainly to increasing prices at the international markets. Morocco's energy mix is still heavily characterized by fossil fuels' predominance, with around 88 per cent of total primary energy demand is met through coal, oil and gas.[3]

Energy demand almost doubled between 2000 (11 megatonnes of oil equivalent, Mtoe) and 2015 (19 Mtoe). Energy demand has been driven by economic, population and urbanization growth coupled with improved standards of living and access to energy, and which continue to put upward pressure on energy demand. In perspectives, the energy demand upward trend is likely to persist in the long-run, thus having several energy policy implications. According to OME scenarios, the total energy demand is expected to reach 40.2 Mtoe under a business as usual scenario[4] by 2040.

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2 Morocco's Foreign Exchange Office, *Indicateurs mensuels des échanges extérieurs, Juillet 2018*, 31 August 2018, p. 4, http://www.oc.gov.ma/portal/sites/default/files/actualites/IEE%20JUILLET%202018.pdf.

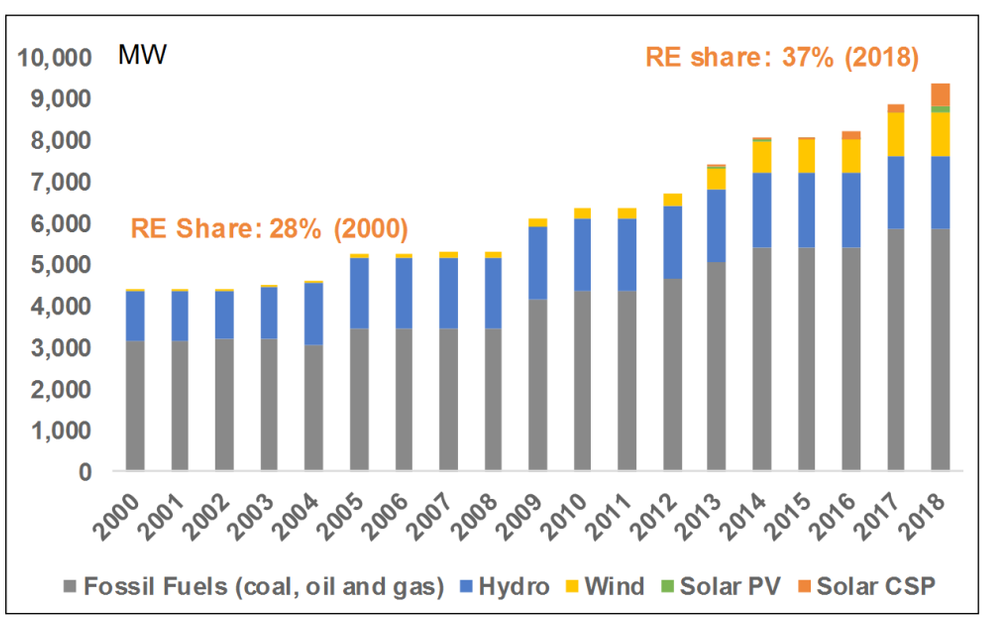
3 OME, *Mediterranean Energy Perspectives 2018*, Paris, OME, 2018.

4 This scenario takes into account past trends, current policies and on-going projects. It notably incorporates the Nationally Determined Contributions, but it assumes that international financing and other aids will not be as forthcoming as expected.

Electricity demand, in particular, has been growing faster than overall energy demand. Electricity consumption more than doubled between 2000 and 2015 (moved from 13 terawatt hours or TWh to 30 TWh). In addition to increasing population, urbanization and improved standards of living, the increasing electricity demand could also, partly, be attributed to extending electricity access, especially under the *Programme d'Electrification Rurale Global* (PERG) that was initiated in 1996 as rural electrification rate moved from a very low base of 18 per cent in 1995 to 99.42 per cent in 2016.

The electricity sector is driving growth in renewables in Morocco, which occupies the leading position at the regional level in terms of increasingly integrating renewable energy sources in the country's power sector. As of 2017, renewables became the first generating source, reaching around 3 GW (around 34 per cent of total electricity installed capacity – 8,840 MW), and with the recent commissioning of projects under PV I phase (170 MW solar PV) and the expected commissioning of NOOR II (200 MW concentrated solar power, or CSP) and NOOR III (150 MW CSP) by end of this year, the RE installed capacity should reach 37 per cent of total installed capacity.

Figure 1 | Electric installed capacity (MW), 2000–2018*



*Note: the year 2018 includes also NOOR II and NOOR III that are under testing and are expected to be commissioned before the end of 2018.
Source: OME database and ONEE.

Moreover, Morocco is diversifying its energy mix through increasing the share of natural gas to meet both electrical and industrial sectors' needs. The availability of unconventional fossil fuels, shale gas in particular, and increasing role of liquefied natural gas (LNG) making global natural gas markets more liquid, has induced Morocco to explore the option to increase the role of natural gas[5] in its energy mix.

5 The Gas to Power project will be developed as an Independent Power Producer (IPP) and will be carried out by ONEE, with an estimated budget of 4.1 billion euro. The combined cycle power plants and the transmission network infrastructures are expected to be commissioned starting from 2027.

The development and deployment of locally available sources of energy at a wider scale will have a number of positive implications for Morocco, namely increased energy security, improved trade balance, generating a socio-economic impact while also reducing its carbon footprint. All these positive effects will position Morocco to be better integrated and embedded, especially through south-south cooperation by know-how transfer, experience, and best practices sharing.

2. RENEWABLES' DEPLOYMENT FRAMEWORK ENVIRONMENT

2.1 AN EVOLVING REGULATORY, POLICY AND INSTITUTIONAL FRAMEWORK

In 2009, Morocco has embarked on new initiatives to tap its renewable energy sources, especially solar and wind energy. Morocco has laid down the needed legal, regulatory and institutional frameworks, including a national energy strategy adopted in March 2009 with renewable electricity targets (a 42 per cent of renewable installed capacity by 2020).[6] This vision has been further revised upward with a new target of 52 per cent by 2030. Undoubtedly, by setting a 2030 target, this would give a clear positive signal to investors about the country's commitment to developing renewables.

The legal framework has been strengthened through adopting several laws promoting renewable energy investments, especially Law No. 13-09 on renewable energy and Law No. 58-15, amending and supplementing the Law No. 13-09.

The institutional framework for the promotion of renewable energy in Morocco has been evolving and is under consolidation with the restructuring of old entities and the creation of new ones. The former Renewable Energy Development Center (*Centre de Développement des Energies Renouvelables*, CDER) has been turned into an agency in 2010 focusing both on renewable energy and energy efficiency, thus becoming the National Agency for Development of Renewable Energy and Energy Efficiency (*Agence Nationale pour le Développement des Energies Renouvelables et de l'Efficacité Energétique*, ADEREE). Along the same lines, in 2010 the Moroccan Agency for Solar Energy (MASEN) and the Energy Investment Company (*Société d'Investissements Énergétiques*, SIE) were created in 2010. In 2017, reforms led to the empowerment of MASEN, which was renamed the Moroccan Agency for Sustainable Energy, enlarging its mandate to include all renewables. ADEREE's mandates have been limited to energy efficiency (mandates related to renewables for domestic use are maintained, however), becoming the Moroccan Agency for Energy Efficiency (*Agence Marocaine pour l'Efficacité Energétique*, AMEE).

Nevertheless, the creation of several institutions and agencies makes the electricity market more complex, and coordination efforts challenging. Thus, the establishment of an independent energy regulator responsible, among others, for licensing and setting tariffs, overseeing the electricity market, and enforcing regulations is of high importance. In this direction, Morocco finally gave its green light for the establishment of an independent electricity regulator – the National Authority for Electricity Regulation (*Autorité Nationale de Régulation de l'Électricité*, ANRE) in August 2018.

In terms of policy support instruments, the tendering scheme has been used for renewable energy projects, which has been very effective in driving more investments in renewable energy

6 Wind, solar and hydro each accounting for 14 per cent (or 2 GW each) of total installed electric capacity.

and driving costs down with some of the lowest bids in the world.[7] In order to open the market to private investors, the "EnergiPro" programme[8] is another important mechanism through which Morocco has promoted self-generation by private producers.

2.2 A DIVERSIFIED FINANCING STRUCTURE

Several financing sources exist for renewable energy investments in Morocco. An Energy Development Fund (FDE)[9] with a starting capital of 1 billion US dollars was created in 2010 to support energy projects, including renewable energy. Through its subsidiary MASEN Capital, MASEN is also contributing equity finance to renewable energy projects.

International financial institutional, multilateral development banks and donors (including grants and concessional loans providers), in particular, have played an important role in financing renewable energy projects in Morocco. The first phase of Ouarzazate NOOR I (160 MW CSP) attracted several key actors, including the World Bank Clean Technology Fund (CTF), the European Investment Bank (EIB), KfW Development Bank and the African Development Bank (AfDB), etc. With very attractive financing conditions, the involvement of such institutions has contributed in bringing the price down.

Climate finance also plays a role in deploying low carbon technologies. In particular, the CTF has contributed in financing RE projects.[10] A CTF CSP MENA Investment Plan was initiated in 2009 and is implemented jointly by the World Bank and the African Development Bank with a contribution of 750 million US dollars from the CTF, providing concessional financing. In Morocco, the fund is financing a number of projects, including Ouarzazate solar power projects NOOR I, II and III.

A very promising and innovative financing tool MASEN has been able to bring onboard is access to financial markets through green bonds. In November 2016, MASEN issued the country's first ever Green Bond of 1,150 million MAD (106 million euro)[11] to finance solar power projects Noor Laayoune, Noor Boujdour and Noor Ouarzazate IV. According to MASEN, the fact that the green bond being underwritten by a State guarantee has allowed MASEN to ensure an optimized interest cost.

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7 The 850 MW integrated wind project set a record for wind energy with an average 30 USD/MWh price. Important price decreases were also observed for the concentrating solar technologies between the first phase of Ouarzazate Noor I (1.62 MAD/KWh) and the following phases II (1.36 MAD/KWh) and III (1.42 MAD/KWh). PV technology also set one of the lowest prices with 0.44 MAD/KWh (Noor IV).

8 Launched in 2006 by ONEE, the concept is to allow big energy consumers to meet their own demand through self-production. The energy produced could be consumed by the producer or sold to a designated user, and the surplus is to be sold to ONEE (through high voltage only) with a guaranteed tariff. The maximum installed capacity for auto-producers has been increased from 10 MW to 50 MW.

9 Funds are channelled through the Energy Investment Company as a shareholder in renewable energy projects. Sources of the fund are: Saudi Arabia (500 million US dollars), UAE (300 million) and Hassan II Fund for Economic and Social Development (200 million).

10 The fund is a multi-billion (5.5 billion US dollars) set up in 2008 for climate change mitigation and managed by the World Bank. It is based on the following principles: repayment over 40 years, grace period of 10 years, a service fee of 0.25 per cent.

11 The bond issue was done through private placements to the following investors: Al Barid Bank, Attijariwafa Bank, the Caisse Marocaine des Retraites, and the Société Centrale de Réassurance.

2.3 OVERCOMING THE CHALLENGES IS KEY TO FULLY EXPLOITING OPPORTUNITIES

Several risks have been identified that could be a challenge for the wider scale deployment of renewables in Morocco.

- Grid access: Despite the enactment of Law No. 58-15 (amending and supplementing Law No. 13-09 on renewable energy), the private producers still do not have access to medium voltage and low voltage, due to the pending implementing regulations. Regardless of grid integration challenges, opening this market segment will help induce more renewables' deployment in the country.
- Grid integration: The massive uncontrolled integration of renewables in the grid might impact the safety of the electrical systems. Thus, accurate resource forecasting coupled with developing storage as well as flexible generating units like combined cycle gas power plants would undoubtedly unlock this potential.
- Financing: Benefitting from the momentum created at the international level, especially, by international financial institutions and multilateral development banks, Morocco has been able to attract concessional loans with attractive terms thereby making renewables a viable energy alternative. Still to engage are commercial banks, including local banks, whose implication in financing renewable energy projects is limited.
- Volatility of oil and gas prices and the issue of subsidies: The issue of price volatility could have mixed effects on the energy situation and economy in Morocco. Higher prices at the international markets would mean an upward pressure on fuels-import bills and thus misallocation of resources (increased subsidies, especially for butane gas), and the contrary is true with low prices. Because of the gradual phase out and the liberalization of oil products (i.e. diesel and gasoline), such efforts have fallen short of their expected results, and thus gave way to several boycott movements in the country against rising prices at the pump. The high prices, however, could provide an opportunity to massively develop domestically available sources of energy, mainly solar and wind. In particular, promoting alternatives such as solar PV for water pumping and solar water heaters for water heating could potentially help the country in continuing its subsidy reform efforts.

3. LEVY FOR A GROWING REGIONAL INTEGRATION AND EMBEDDEDNESS THROUGH DIFFERENT MEANS

Strategically located at the cross-roads between Africa and Europe, Morocco is arguably the most embedded energy player in the international and regional system of the MENA region. In addition to its relations with Europe and the rest of the world, south-south cooperation is at the forefront of Morocco's diplomatic and economic relations with African countries. This vision towards Africa is translated also by the return of Morocco to the African Union in 2017, after a 33-year absence. With the same spirit of reinforcing South-South cooperation, especially towards Africa, Morocco is holding talks with the Economic Community of West African States (ECOWAS)[12] to potentially join the organization and thereby becoming a key player in this economic community. According to the

12 ECOWAS is an intergovernmental organization of west African countries created in 1975, whose members are Benin, Burkina Faso, Cap Verde, Ivory Coast, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Senegal, Niger, Nigeria and Togo.

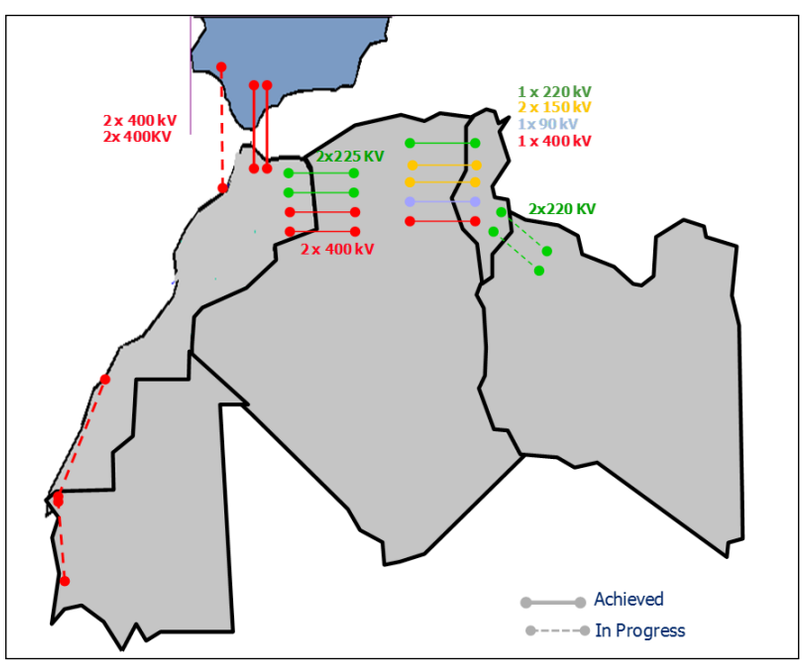
Africa Regional Integration Index,[13] Morocco ranks in the 1st position in the Arab Maghreb Union (AMU) and in the 9th position in the Community of Sahel-Saharan States (CEN-SAD). Overall, it is performing fairly well in terms of regional integration with still other aspects that could be further improved, especially in terms of free movement of persons.

From an energy perspective, energy infrastructure, including cross-border electric interconnections, pipelines, and knowledge-sharing are other facets for integration and cooperation, making Morocco embedded in the international order.

Cross-border interconnections: This embeddedness is exemplified by the following existing and future interconnections.

- *Morocco-Spain*: Morocco is connected to Spain with two lines; the first commissioned in 1997 and the second one in 2006 with a total capacity of 1,400 MW. ONEE has been the fourth operator in the Spanish market since 1999. A third interconnection (700 MW) is planned between the two countries. Between 15 and 20 per cent of Morocco's electricity demand is imported from Spain.
- *Morocco-Algeria*: Morocco is also connected with Algeria with four lines with an exchange capacity of 1,500 MW. Two lines were commissioned in 1988 and two others in 2008. Contrary to the one connecting Spain, not many electrons are exchanged between the two countries, however.

Figure 2 | Cross-border electric interconnections



Source: ONEE.

13 The Africa Regional Integration Index is designed to measure the extent to which each country in Africa is meeting its commitments under the various pan-African integration frameworks, such as Agenda 2063 and the Abuja Treaty. The index, which is a joint project of the African Development Bank, the African Union Commission and the Economic Commission for Africa, covers the following dimensions: free movement of persons, trade integration, productive integration, regional interconnections and infrastructure, and macroeconomic policy convergence. See the Africa Regional Integration Index website: https://www.integrate-africa.org/rankings/country-profiles/country/morocco.

Other potential interconnections are also under study.

- *Morocco-Portugal*: Two lines with Portugal are foreseen and for which the feasibility study is in progress.
- *Morocco-Mauritania*: This is also under study. As a first step, the Laayoune-Dakhla line is under construction.

Having a South-South and North-South interconnection grid will definitely help creating a regional electricity market and further embeddedness of the countries at the regional level.

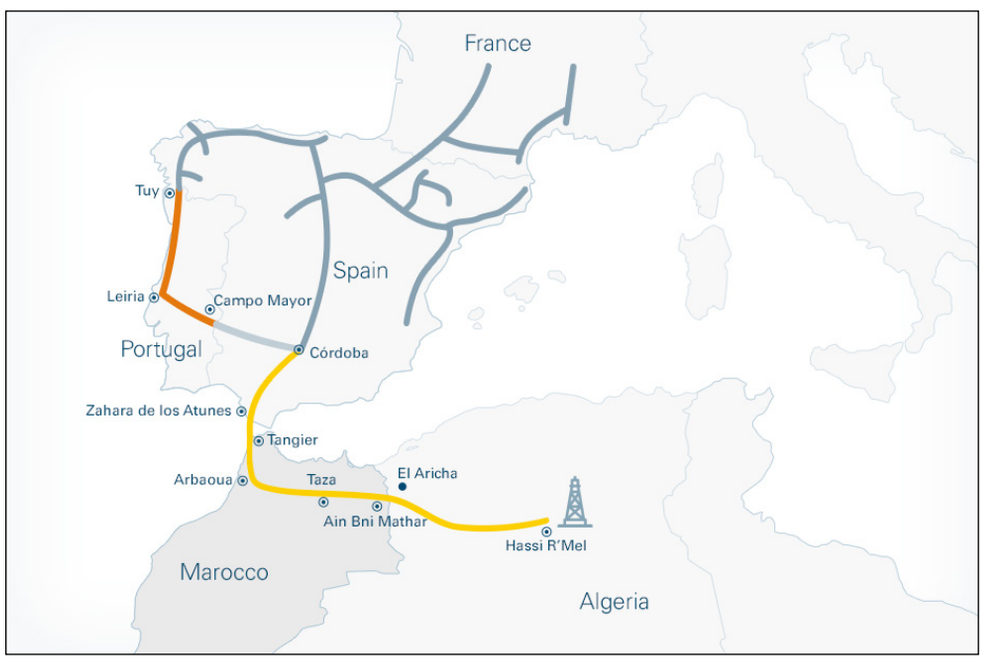
Pipelines: This strategic choice has been first inaugurated with the Maghreb-Europe Gas Pipeline exporting Algerian gas to Europe, and could also be further strengthened through the ambitious plan to construct another pipeline transporting Nigerian gas to Morocco, passing through west African countries, and eventually connecting to Europe.

- *Algeria-Morocco-Europe*: Morocco is connected to Europe through the Maghreb-Europe Gas Pipeline. The pipeline carries natural gas from Hassi R'Mel in Algeria to Spain and Portugal. On average 30 per cent of natural gas consumed in the Iberian Peninsula is transported through this section.

Figure 3 | Maghreb-Europe Gas Pipeline

Source: Europe Maghreb Pipeline Ltd (EMPL) website: *The Gas Pipeline*, http://www.emplpipeline.com/en/the-gas-pipeline.

Figure 4 | Maghreb-Europe Gas Pipeline connection with Europe



Source: EMPL website: *The connection with Europe*, http://www.emplpipeline.com/en/the-gas-pipeline.

This South-South orientation for regional cooperation and integration of Morocco can be demonstrated through the ambitious initiative of the Moroccan-Nigerian gas pipeline.

- *Moroccan-Nigerian Gas Pipeline* crossing six other countries, to export Nigerian gas to Morocco and potentially to Europe.[14] Once completed, the pipeline would allow Morocco to diversify its energy mix, reduce its dependence on Algerian gas; eventually improve the European countries energy security thus becoming less dependent on Algerian and Russian gas; increase energy access in west African countries; and potentially create an integrated economic zone with West Africa.

Terminals and LNG regasification plant: Morocco imports energy from a number of countries, including Algeria, Russia, Saudi Arabia, Spain, the United Kingdom, the United States and others. In terms of ports, Morocco has well established ports infrastructures for import-export activities. For hydrocarbons trade, the main ports for imports are Mohammedia and Jorf Lasfar ports. Other ports include those of Agadir, Nador, Laayoune, Tan Tan and Dakhla. To diversify energy imports, Morocco launched in 2014 a plan to construct an LNG terminal at Jorf Lasfar port (close to El Jadida). Once in place, the LNG terminal foresees a regasification unit in Jorf Lasfar and a pipeline infrastructure supplying gas to Tangier and Casablanca.

14 The pipeline is to stretch over 5,660 km from the existing West African Gas Pipeline (WAGP) between Nigeria and Ghana. In May 2017, the National Office of Hydrocarbons and Mines (ONHYM) and the Nigerian National Petroleum Company signed an agreement to conduct a feasibility study in this regard. The onshore-offshore option has been chosen as the ideal route of the pipeline in June 2018.

CONCLUSIONS

Heavily dependent on foreign energy sources, Morocco's energy security (less dependent on foreign sources of energy) as well sustainable economic growth (local development, job creation, creation of industry value chain, etc.), trade balance, and the country's carbon footprint could be improved by exploiting locally available renewable energy sources.

The energy dynamics discussed reflect Morocco's commitments to a low carbon energy sector transition. An enabling environment has been put in place to boost investments in renewable energy, including, among others, an energy strategy, laws and regulations allowing for private producers, long-term renewable energy objectives (among the most ambitious in the region), and policy support mechanisms, as well as an evolving institutional energy framework, etc.

Morocco's renewable energy vision is already translated into the realization of large scale renewable energy projects, well positioning the country to play a leading role in the region. With several wind and solar projects commissioned, under development and/or in the pipeline, Morocco is advancing well in its ambitions to a low-carbon energy transition.

Despite the progress made at the different levels, several challenges are still ahead. In particular, overcoming challenges related to grid access, RE integration, the issue of subsidies and financing could eventually unlock the renewables' potential.

Through wider scale deployment of renewables and know-how, experience and best practices sharing, infrastructure, energy infrastructure in particular, including electric cross-border interconnection and pipelines, Morocco is performing fairly well in terms of integration and embeddedness. These dynamics will undoubtedly position Morocco to play a leading regional role in energy transition.

Middle East and North Africa Regional Architecture: Mapping geopolitical shifts, regional order and domestic transformations (MENARA) is a research project that aims to shed light on domestic dynamics and bottom-up perspectives in the Middle East and North Africa amid increasingly volatile and uncertain times.

MENARA maps the driving variables and forces behind these dynamics and poses a single all-encompassing research question: Will the geopolitical future of the region be marked by either centrifugal or centripetal dynamics or a combination of both? In answering this question, the project is articulated around three levels of analysis (domestic, regional and global) and outlines future scenarios for 2025 and 2050. Its final objective is to provide EU Member States policy makers with valuable insights.

MENARA is carried out by a consortium of leading research institutions in the field of international relations, identity and religion politics, history, political sociology, demography, energy, economy, military and environmental studies.

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