Arab Future™ Energy Index

AFEX 2023

RCREEE

Regional Center for Renewable Energy and Energy Efficiency

المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

Sweden Sverige

SDG-CLIMATE FACILITY

Human Security in the Arab States

UNDP

About AFEX

The Arab Future Energy Index (AFEX) is the first Arab index dedicated to monitoring and analyzing sustainable energy competitiveness in the Arab region. AFEX used to be published in two separate publications: AFEX Renewable Energy and AFEX Energy Efficiency. But, for the first time, this year's AFEX publication includes three components in one publication: Renewable Energy, Energy Efficiency and Energy Access. AFEX offers both quantitative and qualitative analysis for key renewable energy and energy efficiency market drivers. Countries are ranked under more than 40 indicators that illustrate key energy market aspects, including policies, institutional and technical capacities, strategies, socioeconomic data and investments. AFEX data is collected through both local and international resources to guarantee accuracy and transparency.

Previous AFEX ranks 20 Arab states and provides tailored recommendations for countries to help improve their transition towards sustainable energy pathways. Countries of assessment include: Algeria, Bahrain, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates (UAE), and Yemen.

AFEX is a product of the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), an independent not-for profit regional organization, which aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region. AFEX 2023 is produced with the support of United Nations Development Programme (UNDP).

Authors

Ali Habib, Maged Mahmoud, Sara Ibrahim, Akram Almohamadi and Rana El-Guindy

Contributors

Abdelhafiz Fadlalla Babikir, Electricity Regulatory Authority (ERA Sudan), Sudan
Ahmed Zaki, Ministry of Electricity and Energy, Yemen
Aicha Ben Youssef, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Amani Hamdan, Ministry of Energy and Mineral Resources, Jordan
Bassel Yassin, Palestinian Energy Authority (PEA), Palestine
Ehab Ismail Amin, New & Renewable Energy Authority (NREA), Egypt
Elaff Alfadel, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Eman Adel, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Fadwa Elatrach, Moroccan Agency for Energy Efficiency (AMEE), Morocco
Farah Maydal, Ministry of Energy and Mineral Resources, Djibouti
Fawzi ben Zaid, Ministry of Energy, Algeria
Hassen Agrebi, The National Agency for Energy Management (ANME), Tunisia
Hussam Al-Herafi, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Jemal Ahmed Mahmoud, Ministry of Petroleum, Energy and Mining, Mauritania
Mohamed Ebaid, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Mohamed Eltoum, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Mostafa Hassanen, Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Nadia Chioukh, Director of Cooperation & Communication, Algeria
Sorina Mortada, Lebanese Centre for Energy Conservation (LCEC), Lebanon
Yacoub Elias Marar, Ministry of Energy and Mineral Resources, Jordan

Reviewers

Kishan Khoday, Regional Team Leader - Nature, Climate and Energy, UNDP Regional Hub for Arab States,
Stephen Gitonga, Regional Energy and Environment Specialist, UNDP Regional Hub for Arab States
Denis Korchunov, Regional Energy Specialist, UNDP Regional Hub for Arab States
Benjamin Basmaci, Regional Climate Change Specialist, UNDP Regional Hub for Arab States

Design and layout by

Mohamed Emad Eldin

Disclaimer

This report was conducted by the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) in collaboration with the United Nations Development Programme. The opinions expressed in this report do not necessarily reflect those of RCREEE, or the United Nations Development Programme, or their member states. Reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement for it. Further, RCREEE makes no warranties or representations, expressed or implied, as to the fitness for a particular purpose or merchantability of any product, apparatus, or service, or the usefulness, completeness, or accuracy of any processes, methods, or other information contained, described, disclosed, or referred to in this report. RCREEE makes no representation that the use of any product, apparatus, process, method, or other information will not infringe privately owned rights and will assume no liability for any loss, injury, or damage resulting from, or occurring in connection with, the use of information contained, described, disclosed, or referred to in this report. Opinion whatsoever on the part of the United Nations Development Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The boundaries and names shown, and the designations used on the maps do not imply official endorsement or acceptance by the United Nations, UNDP or partner countries. The United Nations Development Programme does not warrant that the information contained in the publication is complete and correct and shall not be liable whatsoever for any damages incurred as a result of its use.

This product is one of the outputs of the Sustainable Development Goal (SDG) -Climate Facility: Climate Action for Human Security' project. With financial support from the Swedish International Development Agency (Sida), the project is a multi-partner platform focusing on the impacts of climate change on human security in the Arab region, especially in the context of countries in crisis. It brings together the League of Arab States (LAS), Arab Water Council (AWC), United Nations Development Programme (UNDP), United Nations Environment Programme - Finance Initiative (UNEP FI), World Food Programme (WFP), United Nations Office for Disaster Reduction (UNDRR), and United Nations Human Settlements Programme (UN-Habitat), to deliver climate-oriented solutions that address climate challenges and bring co-benefits across the SDGs. In doing so, it aims to scale up access to and delivery of climate finance, including through innovative partnerships with the private sector.

Arab Future Energy Index™ (AFEX) 2023

Regional Center for Renewable Energy and Energy Efficiency (RCREEE)

RCREEE
Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

Arab Future Energy Index 2023 RCREEE Foreword

Sustainable energy is a crucial input for socioeconomic and sustainable development in the Arab region. Securing good access to affordable energy is essential for alleviating poverty and enhancing economic activities. Renewable energy and energy efficiency are essential measures to mitigate climate change, reduce fossil fuel consumption and improve energy security as well as energy access, especially in the less electrified countries.

Arab countries are endowed with huge untapped renewable energy resources as well as plenty opportunities for energy efficiency. At the same time, the costs of energy from renewable energy sources are declining rapidly, while the efficiency of the technologies are also continually advancing. During the last few, many Arab countries set ambitious targets for renewable energy and energy efficiency.

The share of installed capacity for renewable energy project is increasing in many Arab countries. Apart from the hydropower, is the largest share of energy generation in specific Arab countries, the three top technologies are photovoltaics, wind energy and concerted solar power (CSP), which have more deployment and major contribution in diversifying the energy mix in the Arab countries.

As the energy sector is the major contributor to greenhouse gas emissions, adopting plans for global energy transition becomes necessary to cut out harmful emissions and phase out fossil fuel. This will not be possible unless there is a high-level commitment to the to the deployment of more renewable energy and energy efficiency solutions. To make optimal use of renewable energy sources, there is also a need to develop and upgrade electricity infrastructure to accommodate the additional capacities of renewable energy sources.

For the first time, and in light of the long lasting partnership with the UNPD, this edition of AFEX covers the three pillars of sustainable energy for all: Renewable Energy, Energy Efficiency and Electricity Access, assessing the progress in 20 Arab countries, under more than 40 indicators focused mainly on policies and strategies, institutional and technical capacities, and investment environment. AFEX is becoming an effective tool for the policymakers in the Arab region to evaluate and compare the progress of their countries with the other countries in the region and make the necessary reforms to progress and achieve their national targets.

I believe that our continuous cooperation with the UNDP and our Member States, will continue to make a significant contribution to the efforts of assessing energy transition processes in the Arab region.

Dr. Jauad El Kharraz
Executive Director, RCREEE

Arab Future Energy Index 2023
UNDP Foreword

Climate change presents the single biggest threat to sustainable development and could well lead to a reversal of development gains by mid-century. But climate action also stands as a major opportunity for countries to transition to a low carbon, sustainable energy economy. This is particularly important for the Arab region. While holding the world's highest levels of solar radiation, the region to date has made only modest progress in expanding the share of renewable energy in its energy mix, currently standing at around 7%. This is starting to change, with positive momentum across the region in advancing new energy transition policies, resulting for example in a 400% increase in renewable energy installed capacity and investments over the past decade.

Countries across the region are increasingly prioritizing an acceleration of actions the achievement of Sustainable Development Goal (SDG) 7 on Energy and the Nationally Determined Contributions (NDCs) under the Paris Agreement. UNDP is proud to have supported the enhancement of NDCs across the region in recent years, a process that catalyzed greater levels of ambition in many countries for an energy transition. The national NDC climate plans, alongside national energy transition policies, serve now as platforms for action, as countries seek a larger role for clean energy investments as a means to diversify their economies, generate new high-tech knowledge-based jobs, and reduce the energy intensity of growth. In the oil exporting economies of the region, the energy transition is being harnessed as a means of economic diversification, reducing the energy intensity of growth and high per capita carbon footprints. In many other countries, energy transition policies and low carbon technologies are helping accelerate local development goals, building resilience of poverty reduction efforts, while in conflict affected communities access to decentralized solar solutions is helping close the energy gap for critical services, powering basic needs, schools and clinics and enabling restoration of lives and livelihoods.

The United Nations Development Programme (UNDP) is expanding its role as a provider of technical assistance across the Arab region to support countries in these efforts. UNDP serves as the UNs largest implementer of grant assistance for a green transition, with over $300 million of local action projects across the region today. These capacity development initiatives support innovation and scale up finance to implement the SDGs and NDCs in an integrated manner, shifting the trajectory of development towards a more sustainable and resilient future. The road to the 28th Conference of the Parties to the UN Framework Convention on Climate Change (COP28) in the UAE represents an important opportunity to further profile the unique energy transition challenges and opportunities in the Arab region on the global stage, and build on this important forum to scale up strategic partnerships for accelerating results.

As part of this effort on the road to COP28, UNDP is pleased to partner with the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) in producing this latest edition of the Arab Future Energy Index (AFEX) report. Having supported the production of AFEX reports since 2015, it has emerged as a leading state of energy report across the region, produced by the region and for the region. AFEX uses over 50 indicators to rank country annual progress on regulatory and institutional structures, financial innovations, policy frameworks and public and private investments as a means of chronicling progress made by countries across the region, and making recommendations for further accelerating actions towards the vision of SDG 7 and the Paris Agreement. This year's report highlights trends across three targets of SDG 7: universal access to clean energy, expanding the share of renewable energy in the energy mix and increased energy efficiency. In particular, the report highlights important examples of how innovative policy solutions and institutional capacities are being advanced across the region to de-risk the environment for scaled up investments in sustainable energy by public and private investors. The region is now seeing an unprecedented shift towards new local carbon sustainable energy solutions.

UNDP and our regional and countries stand ready to further accelerate and scale up this process. Seizing new levels of ambition in the region towards NDC implementation and local climate action and supporting the acceleration of new policies and investments for the energy transition, not only helps to protect the planet, but it also builds the social and economic resilience of communities and empowers countries to transition from conventional extractive modes of development to new nature based pathways.

Khaled Abdelshafi
Director, UNDP Regional Hub for Arab States

About UNDP

The United Nations Development Programme (UNDP) is the United Nations' global development network, working in over 170 countries and territories to achieve the eradication of poverty, and the reduction of inequalities and exclusion. UNDP helps countries to develop policies, leadership skills, partnering abilities, institutional capabilities and build resilience in order to sustain development results. Through UNDP's extensive work at global, regional and national levels, UNDP has learned that tackling climate change and expanding access to sustainable energy and water must be central to efforts to make results of development sustainable and resilient. UNDP is the UNs largest implementer of assistance on climate change, with over $3 billion of grants to countries around the world. In support of the new Paris Agreement on Climate Change and Sustainable Development Goals, UNDP helps countries transition to a low-carbon, climate-resilient development future. Support to countries is led by UNDPs extensive system of Country Offices and five UNDP Regional Hubs, guided globally by the UNDP Climate Hub and the UNDP Sustainable Energy Hub.

In the Arab region, UNDP has been present supporting development for over 50 years, including the past 30 years of experience supporting countries locally on climate change, energy and environment agendas. UNDP support in the region has helped establish new policies and regulations to scale-up energy efficiency in key sectors like buildings and transport; new public-private partnerships for scaling up renewable energy technologies like solar and wind; new institutions and centers of excellence for low-carbon, sustainable energy solutions; and has helped expand access to renewable energy for the poor including those displaced by conflict. UNDP has played an important role at the regional level, including strategic partnerships with the League of Arab States, the Regional Center for Renewable Energy and Energy Efficiency, the Arab Water Council, the OPEC Fund for International Development, International Renewable Energy Agency and the Islamic Development Bank.

UNDP Regional Hub for Arab States

11 Abu Bakr Siraj Al-Din Street, Amman, Jordan

www.undp.org
www.facebook.com/UNDP
www.twitter.com/undp
www.youtube.com/undp

About RCREEE

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) is an intergovernmental organization with diplomatic status that aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region. RCREEE teams with regional governments and global organizations to initiate and lead clean energy policy dialogues, strategies, technologies and capacity development in order to increase Arab states' share of tomorrow's energy.

Through its solid alliance with the League of Arab States, RCREEE is committed to tackle each country's specific needs and objectives through collaborating with Arab policy makers, businesses, international organizations and academic communities in key work areas: capacity development and learning, policies and regulations, research and statistics, and technical assistance. The center is also involved in various local and regional projects and initiatives that are tailored to specific objectives.

Having today 17 Arab countries among its members, RCREEE strives to lead renewable energy and energy efficiency initiatives and expertise in all Arab states based on five core strategic impact areas: facts and figures, policies, people, institutions, and finance.

We, the Regional Center for Renewable Energy and Energy Efficiency, are the strategic partner for the Arab countries driving energy transition for the prosperity of all our people.

Regional Center for Renewable Energy and Energy Efficiency (RCREEE)
Hydro Power Building (7th Floor)
Block 11 - Piece 15, Melsa District
Ard El Golf, Nasr City, Cairo, Egypt
Tel: +202 2415 4755
Fax: +202 2415 4661
info@rcreee.org
www.rcreee.org

Table of Contents

Renewable Energy

Energy Efficiency

Energy Access

Introduction – Decarbonizing Development

As highlighted during debates on the road to the 2023 SDG Summit and Climate COP28, the biggest challenge of our time is to ensure that the transformation of the global energy market towards a low-carbon and net-zero emissions pathway is fast enough to achieve the Paris Agreement and Sustainable Development Goals (SDGs) and leave no-one behind. The intensifying impacts of the climate emergency, the ongoing energy crisis faced by many countries in the world, the continued fall out from the COVID-19 pandemic and global economic uncertainty together must be the turning point to accelerate an energy transition. This means an energy transition that simultaneously supports sustainable energy's role in powering recovery from the global crisis, in accelerating NDC implementation and in achieving poverty reduction, health, gender equality and other SDG priority outcomes.

As the world community comes to grips with the converging demands to re-energize the economy and combat climate change, a strong momentum has emerged to diversify beyond the fossil fuel economy, accelerate the transition to renewable energy and energy-efficient solutions, and harness these solutions to close the energy gap for poor and crisis affected communities in particular, so that no one is left behind.

The continued expansion of the renewable energy market, in particular, has been a bright spot, the only segment of the energy market to experience notable growth even during the past few years of global crisis, building on its cost-effectiveness and strategic value for increasingly carbon-constrained economies. Despite this trend, the protracted nature of socio-economic impacts from the COVID-19 crisis, the global implications of the war in Ukraine and continuing economic uncertainty generated by both, brings risks to the clean energy transition, with potential fragility in foreign investment, public budgets and private finance in the renewable energy sector.

In the Arab region, continuing momentum on the energy transition can build on the success countries have achieved in recent years. Since the last major economic crisis of 2008–2009 and the uprisings of 2011, many countries have expanded renewable energy investments as part of their recovery strategy. Solar and wind energy capacities rose 10-fold in the decade that followed, from a combined capacity of around 0.5 gigawatts (GW) in 2008 to about 7.2 GW by 2018 and continuing their ascent in 2019–2020 as elaborated in this year's AFEX report. Still, only about 7 percent of overall energy today remains from renewables, and only 1 to 2 percent from solar and wind. Thus, despite the region's position as the largest recipient of solar radiation, capacities for capitalizing on this strategic asset are still in many ways at a nascent stage. But, the upward trajectory over the past decade has been unprecedented and offers a base from which to build a more ambitious energy transition in coming years.

Countries in the region have set a cumulative target of 190 GW of renewable energy capacity by 2035, which is expected to account for as much as 30 percent of global growth in renewable energy. An important foundation for achieving this dramatic expansion will be the National Renewable Energy Action Plans (NREAPs) enacted in recent years and related institutional and financing systems to implement them. As seen in the analysis to come below, across the region ambitious targets and innovative policies now form a base for attracting private investment, reforming energy subsidies and establishing renewable energy institutions and renewable energy development zones.

The growth of renewable energy capacity in recent years advances the aspirations of many countries in the region, particularly energy import-dependent economies, to move beyond the fossil fuel-based model of development, reduce the carbon intensity of growth and expand energy access for poor and crisis-affected communities. However, maintaining this strong momentum will require additional measures so that the economic fragility facing many countries in the region does not result in the loss of hard-won gains in solar energy expansion.

The energy transition is a continuing process requiring long-term energy strategies and planning, with a country-tailored focus on developing required institutional capacities, energy technologies and private partnerships. We know that an energy transition pathway will be more successful if trade-offs in energy supply and demand are acknowledged and mitigated. This means an integrated, people-centred approach, in which all available policies and technologies play their important role in transforming local and national systems. Such an agenda integrates action with results for poverty reduction, enhanced governance, social protection and gender equality as nexus areas for which sustainable energy can bring strong co-benefits.

Through strategic partnership between governments, multilateral agencies, the donor community, the private sector, philanthropy and civil society, new capacities can be developed to support interventions with a clear potential to accelerate the achievement of SDG7 and NDCs under the the Paris Agreement. Such partnerships will be key to modernize and decarbonize energy infrastructure, through innovation and new business models. This will be accompanied by new financial mechanisms and policy de-risking approaches to channel public and private climate finance where it is most needed and impactful. Scaling up new investments can create millions of new jobs, promote a new form of green growth, and close access gaps to electricity for the poor.

In doing so, a particular priority for the Arab region must be to leave no one behind. As noted in this edition of AFEX, many communities in the region face serious challenges in closing the energy gap. Women and girls, and other vulnerable groups, are often disproportionately impacted by these access gaps, often becoming trapped in cycles of poverty and inequality. Not least are the unique and serious challenges faced by displaced and conflict affected communities, for whom a lack of energy access is among the greatest barriers to stability and recovery. The energy transition must thus also focus on providing reliable, affordable energy to communities affected by conflict and crises - addressing basic household energy needs, restoring power to clinics, schools and other public services, fueling water systems for agriculture and basic needs, and empowering micro, small and medium enterprises so communities can regain livelihoods and a decent way of life.

Ultimately, efforts to support an energy transition in the region need to be integrated across all dimensions, supporting climate change, development and crisis recovery goals within countries of the region. The changing energy landscape in the region and the opportunities it affords calls for renewed commitment and partnerships across all stakeholder in the region to expand access to sustainable energy options, leverage technology and finance innovations, and put in place new policies that realize co-benefits of sustainable energy across the SDGs for empowerment of local communities.

Today's climate, energy, and development challenges are interconnected and dynamic and require systemic and innovative solutions. Building on the findings of AFEX 2023, a number of integrated action points can be envisaged, each offering entry points for countries across the region.

- Rethink energy to drive systems-level change and embrace opportunities for an integrated agenda. Countries should adopt a holistic approach to transform energy systems, with a focus on both energy supply and demand enhancements, supporting the role of sustainable energy for development policies and crisis recovery goals, decarbonizing the energy sector and shifting to sustainable energy consumption patterns based on a reduction of energy intensity and an increase in efficiency.

- Harness the role of sustainable energy for social protection, livelihoods, gender equality and women's empowerment. This includes enabling access to energy in a way that enhances livelihoods and powers essential services such as healthcare and schools, and mitigating the complex social impacts of the energy transition.

- Unlock large-scale public and private renewable energy investments through de-risking measures and redirecting finance to where it is most impactful. A need exists to channel new levels of public and private energy finance to communities who lack energy access and to countries seeking to shift beyond fossil fuel based model of development, through innovative financial mechanisms and alternative business models.

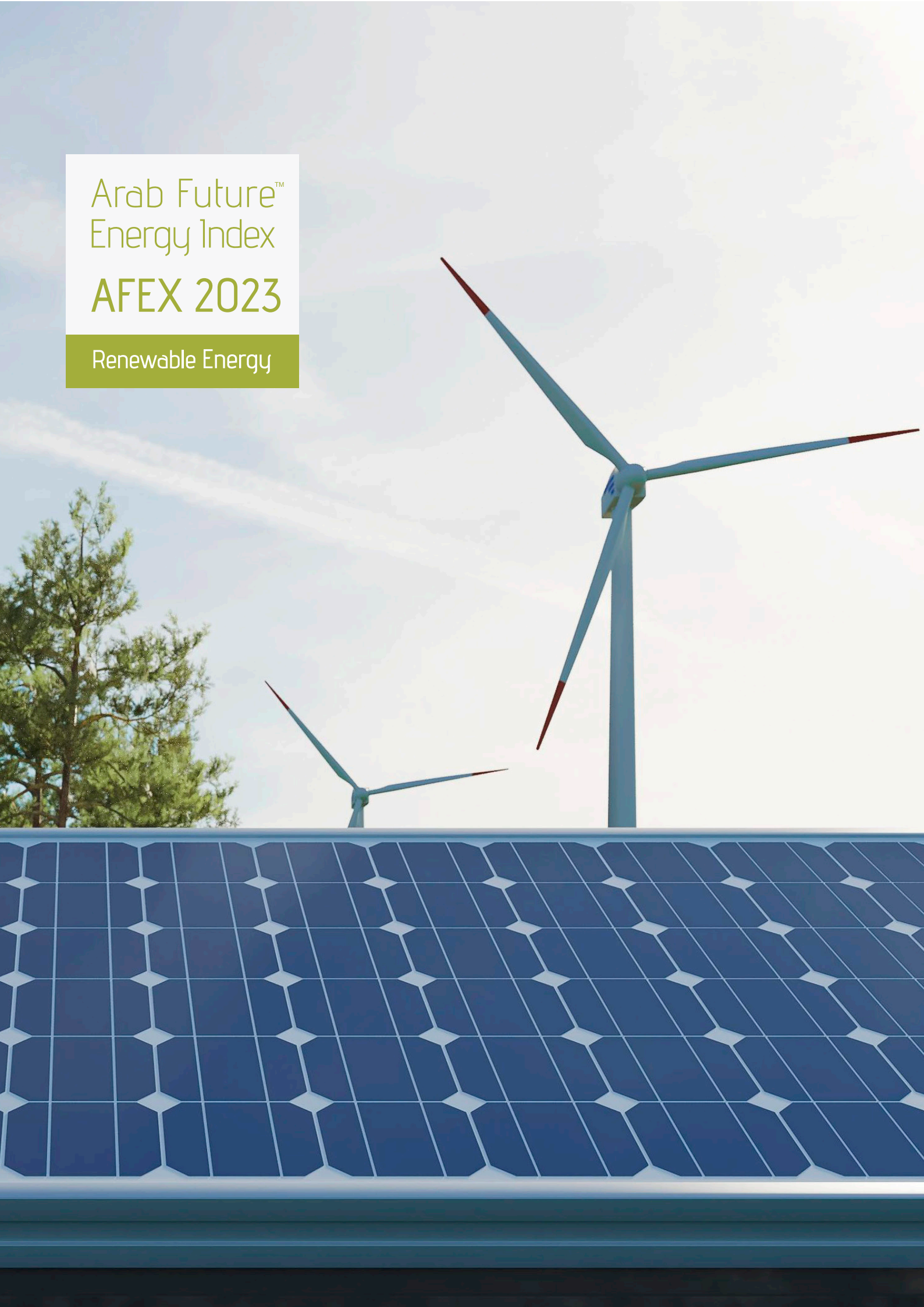
- Mobilize partnerships and creating networks. No entity can do it alone. Strong partnerships are what will enable countries to create new systems, bringing the power of private innovation and role of civil society to bring clean power to homes, hospitals, and schools, many for the first time – and provide new opportunities for millions of people across the region.

- Enhance energy governance. In advancing an energy transition a key will be inclusive and effective institutions and decision-making processes for an enabling environment to promote sustainable energy alternatives to the status quo, encourage a private sector role, catalyze and harness innovation and mobilize the role and contribution of women, youth, displaced communities and others who are often excluded from energy policymaking, but are most impacted by it. This will be critical to ensuring transformative action that is just and inclusive.

Arab Future™ Energy Index

AFEX 2023

Renewable Energy



Executive Summary

AFEX Renewable Energy 2023 exhibits a comprehensive assessment of five areas that impact renewable energy implementation and deployment in the Arab States. The assessed areas are market structure, policy framework, institutional capacity, finance and investment, and newly introduced carbon emissions and monitoring. Each area is evaluated based on selected factors that can reflect the status quo area and the development since the last AFEX RE edition.

For market structure, strong development and shift of powers are seen in the utility supply area. Several mega scale and even giga scale projects are under development and construction. The gulf area leads these developments specially in Kuwait, Oman, Qatar, Saudi Arabia, and UAE. In north Africa, the development is led by Egypt, Morocco, and Tunisia.

For policy framework category, some changes are noticed in the Arab countries renewable energy targets. For example, Algeria changed the target to install 15GW of photovoltaic technology by 2035. In Jordan, the target has been raised in the updated Energy Strategy for the Energy Sector 2020-2030 from 21% in 2020 to 31% share for renewables in total power generation capacity and 14% of the total energy mix by 2030. Currently, two Arab countries have 100% RE targets: Djibouti by 2035, and Morocco by 2050. Morocco also has a 2030 target of 52% of RE share. In terms of installed capacity, Saudi Arabia has the most ambitious target of 58.7 GW by 2030 followed by Egypt that has a target of 59.7 GW (CSP 8.1 GW, PV 31GW, and 20.6 GW) by 2035. These targets represent 30% and 42% share of national installed capacity respectively. The Egyptian RE strategy is under revision to be updated in order to reach more than 50% by 2035.

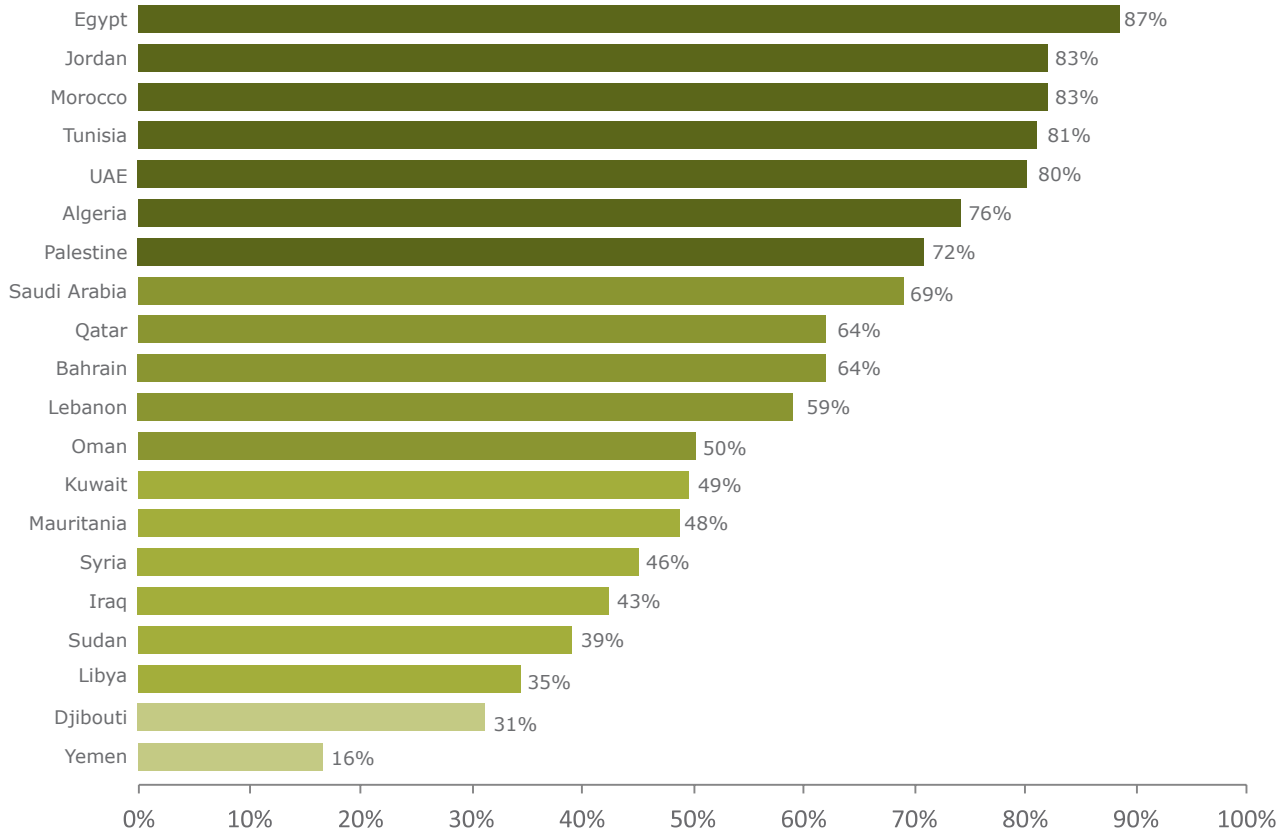
The renewable energy share in the installed capacity reached in 2020 approximately 7%, a small increase from the last AFEX 2019 edition. The dominated technology is still photovoltaic followed by wind energy with percentages of 59.8% and 31.6% respectively (without accounting hydropower capacity). Hydropower still has the largest installed capacity with approximate capacity of 11.1 GW. The other technologies combined capacity has surpassed the installed hydropower capacity for the first time with a total capacity of 12.3GW.

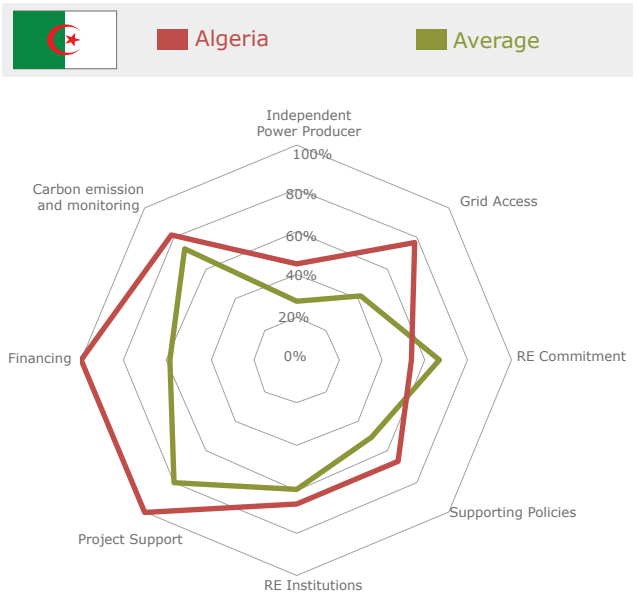
Currently there are more than 13GW under construction. A massive amount of RE capacities that shows the commitment of Arab region towards the transition to cleaner energy production. PV technology is dominating the RE projects under construction accounting for approximately 80% of the projects. Wind projects come second with approximately 13%. It can be observed that several countries with low installed RE capacities are developing large scale projects. For example, Qatar, is developing 800 Megawatt (MW) solar projects. It is the same case for Iraq (has more than 2GW of RE projects under development).

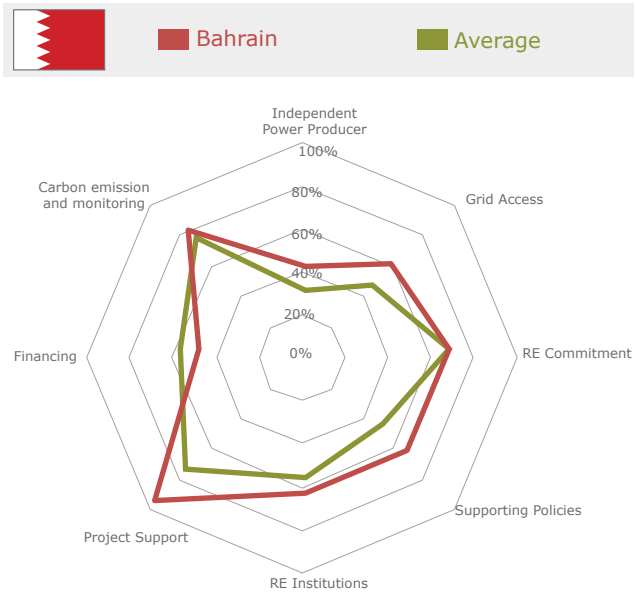
Renewable energy investment showed substantial increase in the last decade. The annual investment leapt form 2.2 billion USD in 2010 to 10.9 billion USD in 2020, representing nearly 400% increase. And from 4 countries in 2010 that had a renewable capacity above 50MW, to nearly all Arab countries in 2020.

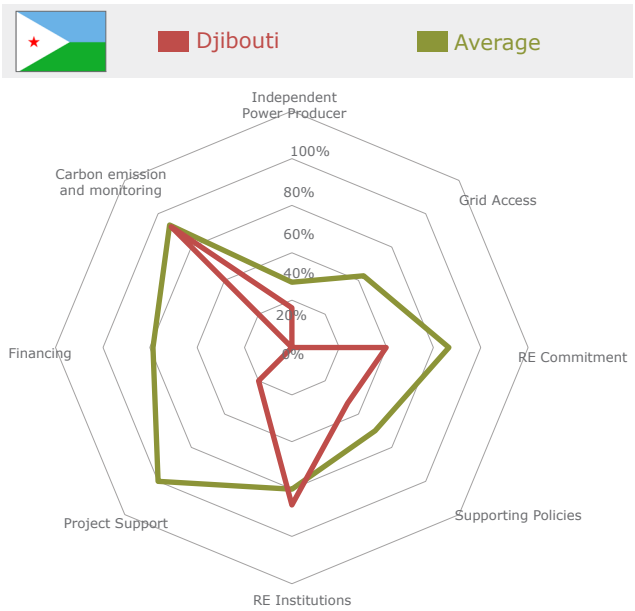
The following graph represents the final ranking for the AFEX RE 2023. Egypt is in the first place followed by Jordan and Morocco with the same score. UAE has the highest score among Gulf countries. The spider web figure exhibits the strength and weakness of each country in most important indicators.

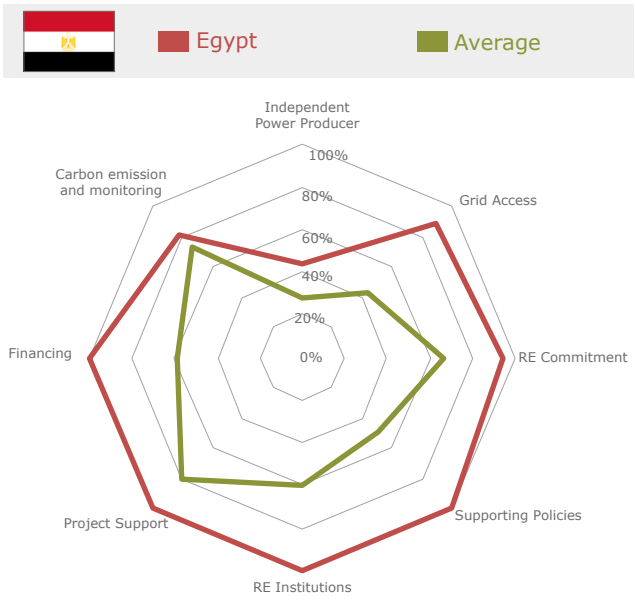
Figure 1: Final ranking of Arab countries

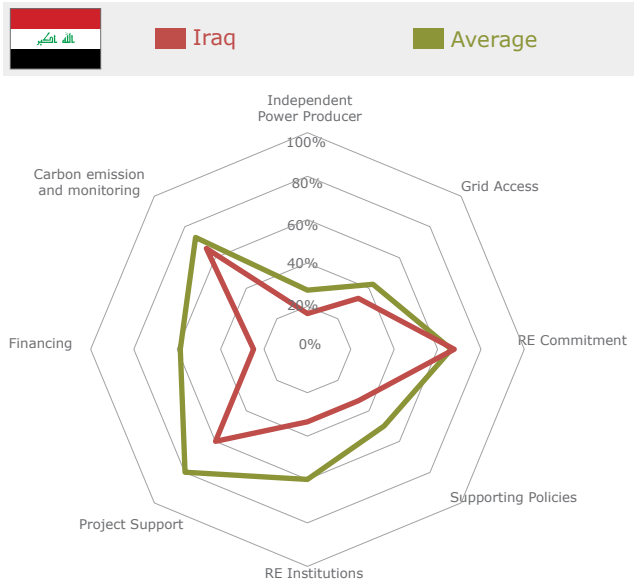


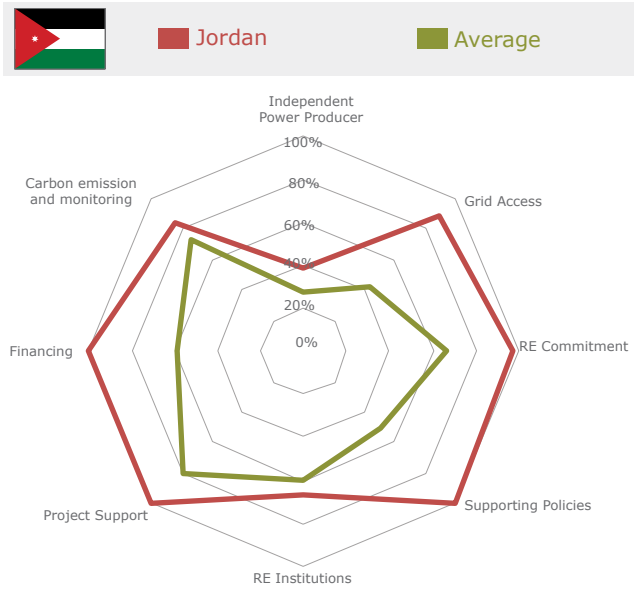


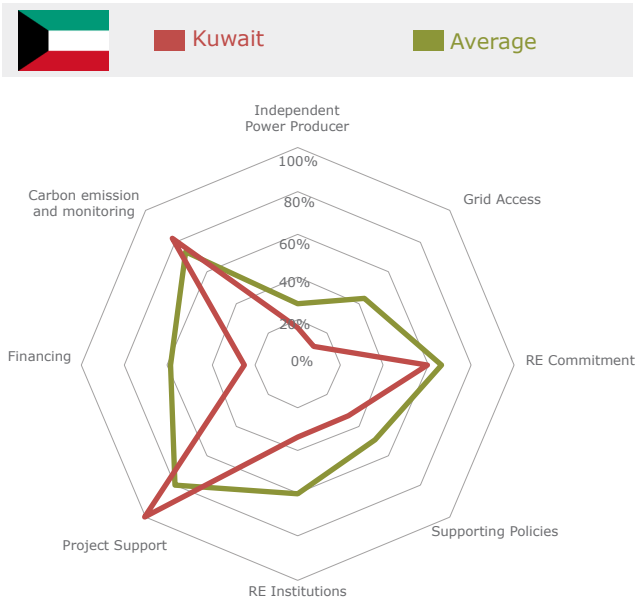


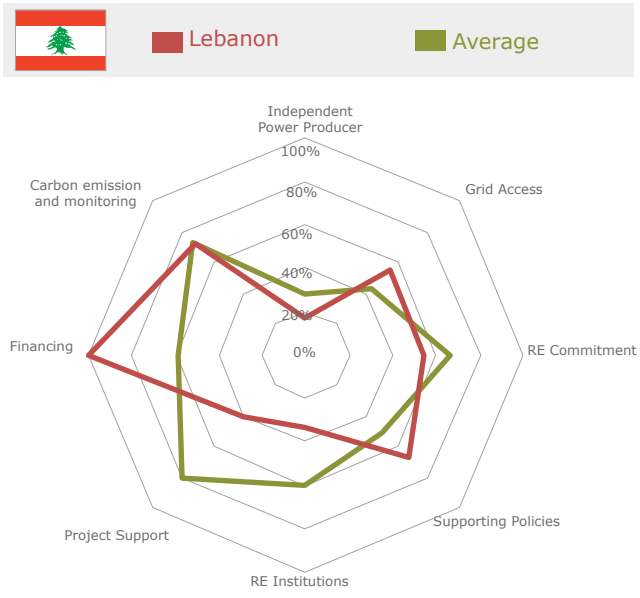

Djibouti
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

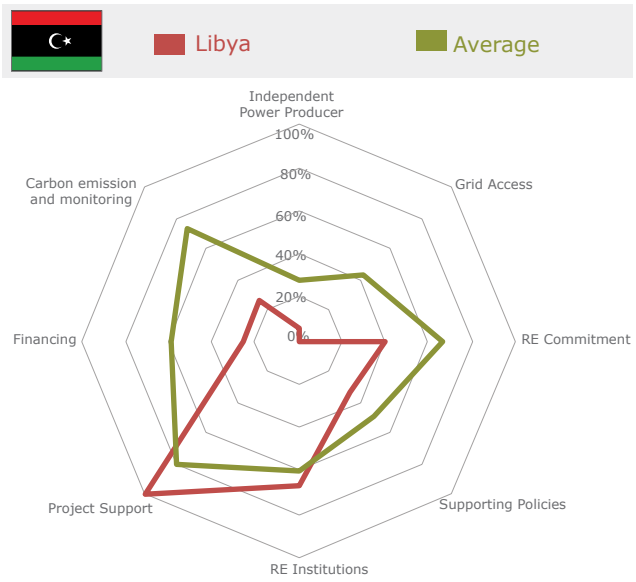

Egypt
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

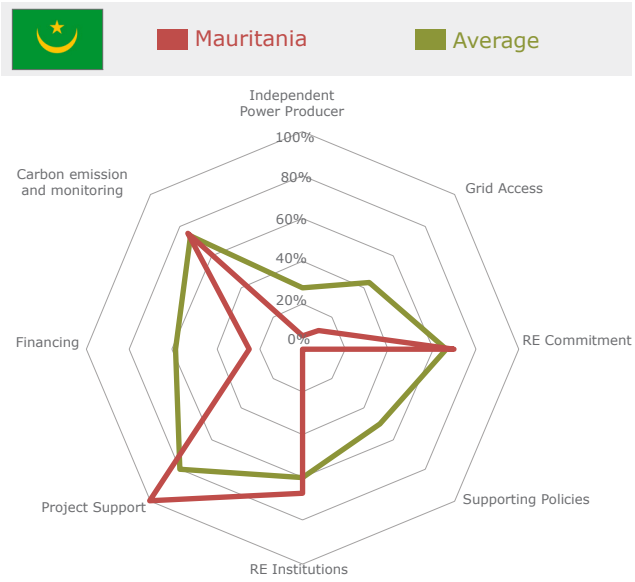

Iraq
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

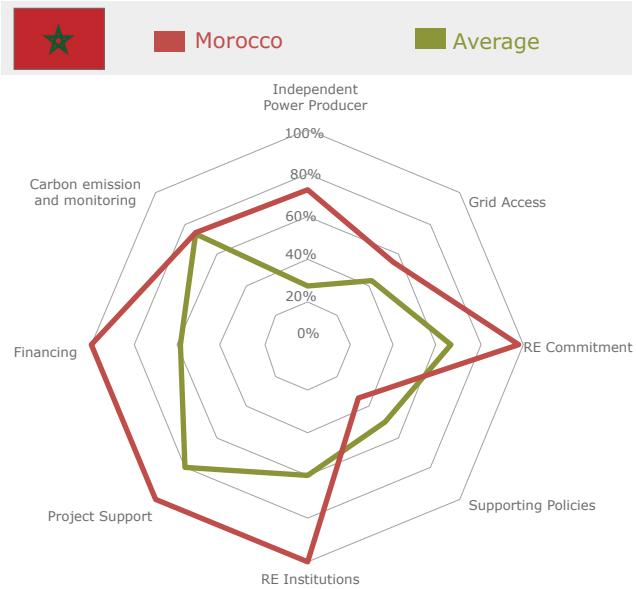

Jordan
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

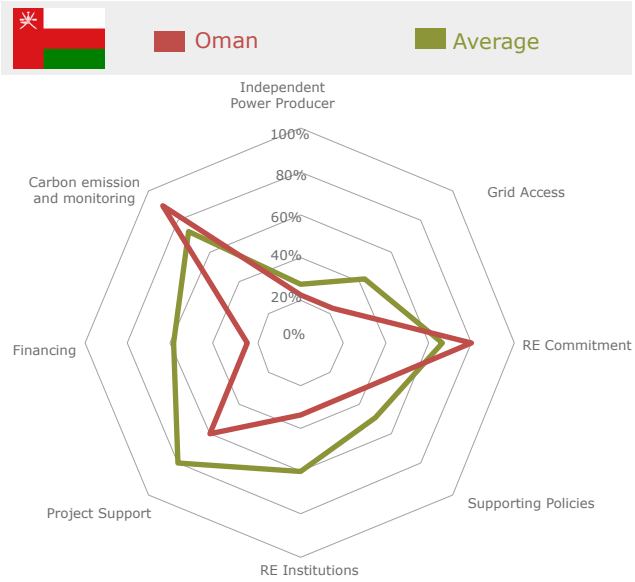

Kuwait
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

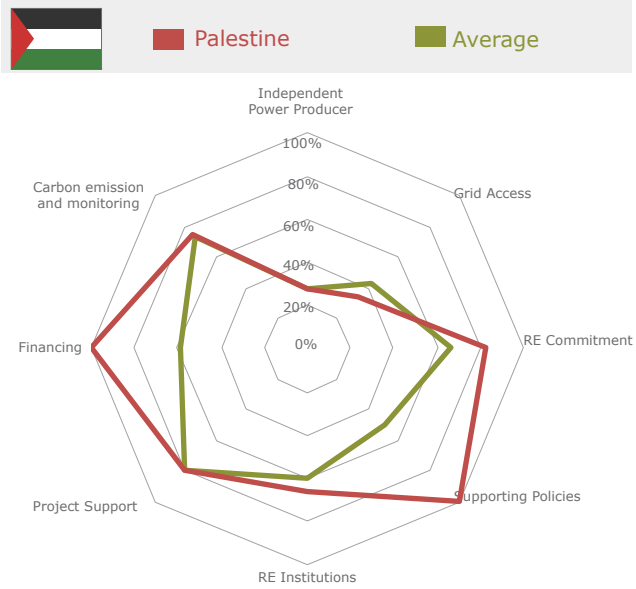

Lebanon
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

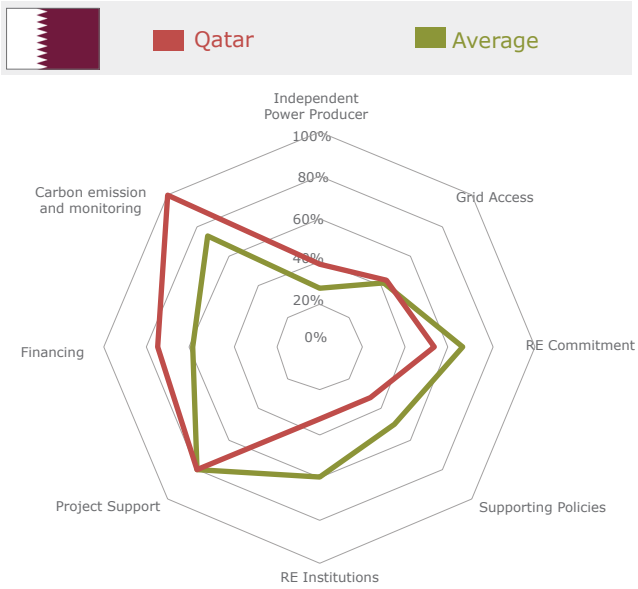

Libya
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

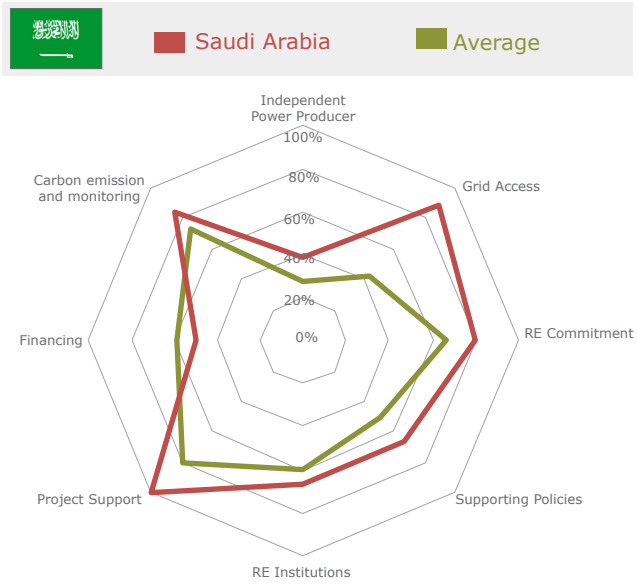

Mauritania
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

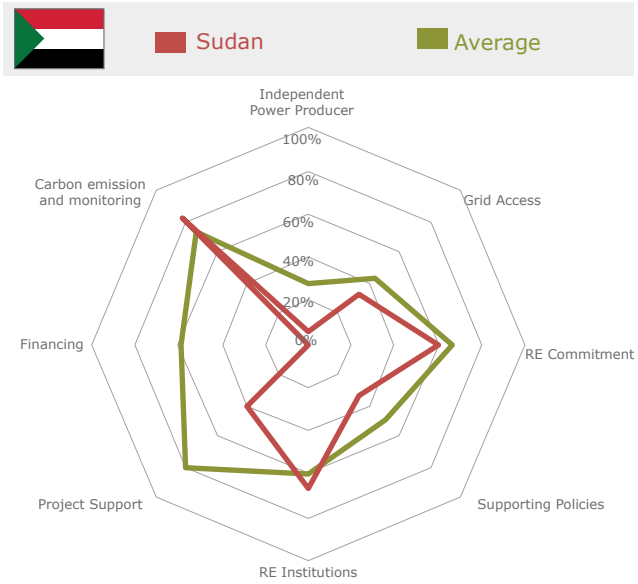

Morocco
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

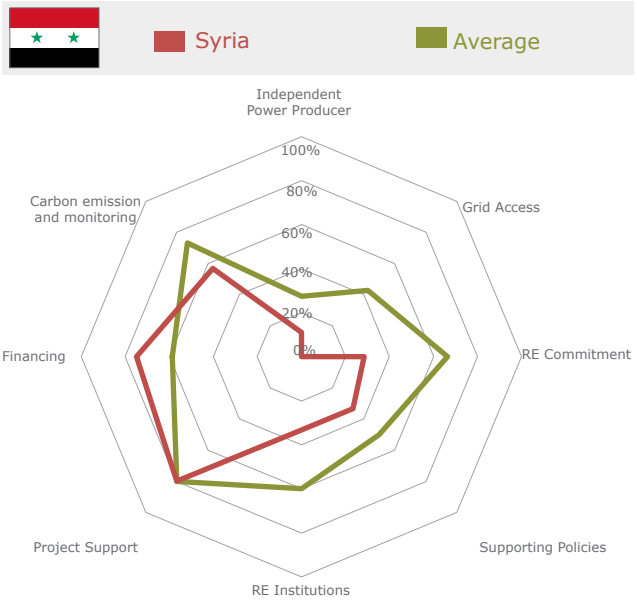

Oman
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

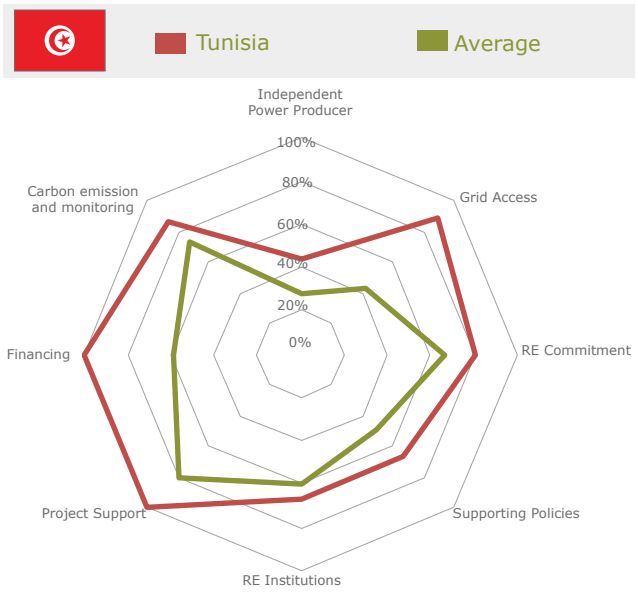

Palestine
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

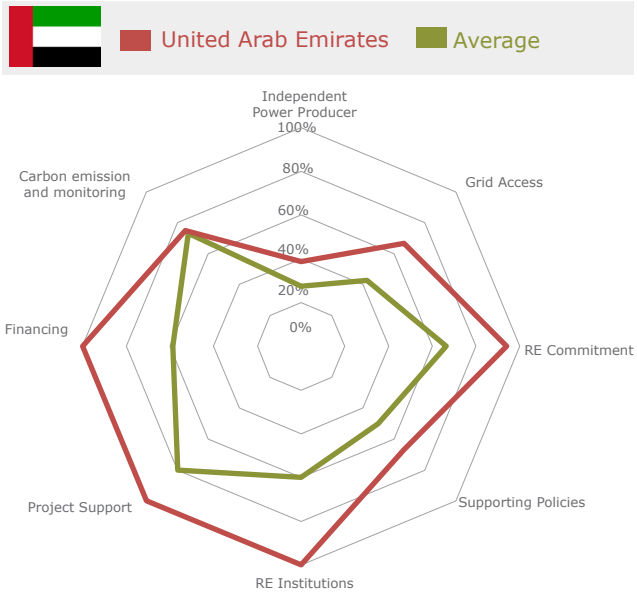

Qatar
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

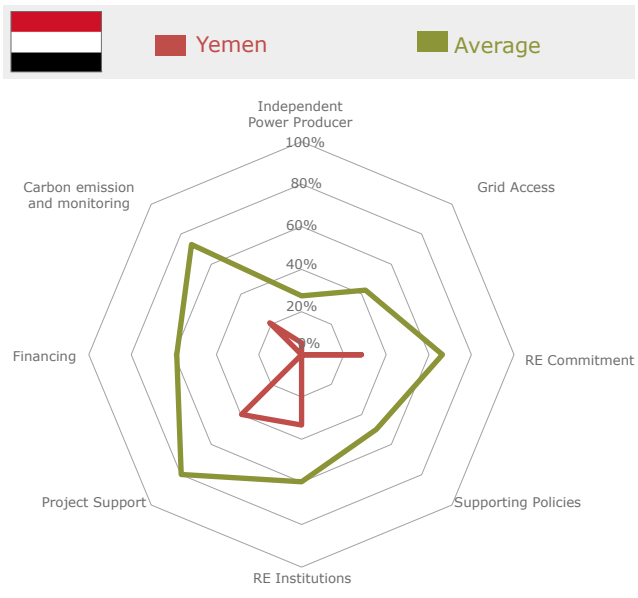

Saudi Arabia
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%


Sudan
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%


Syria
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%


Tunisia
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%


United Arab Emirates
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%


Yemen
Average
Independent Power Producer
Grid Access
RE Commitment
Supporting Policies
RE Institutions
Project Support
Financing
Carbon emission and monitoring
100%
80%
60%
40%
20%
0%

1 Introduction

AFEX Renewable Energy aims to provide a comprehensive assessment of the current investment climate for renewable energy (RE) development, and to formulate targeted recommendations on improving regulatory and institutional frameworks for RE investments. AFEX benchmarks countries' performance in creating better conditions for RE investment, highlighting key developments and progress made by each country towards RE since the previous edition of AFEX in 2020.

1.1 Scope of Assessment

AFEX Renewable Energy is designed to embrace the perspective of private investors and as such, focuses on barriers and challenges they may face in the various phases of RE deployment in Arab countries. The conceptual framework of AFEX Renewable Energy is presented in Table 1. It consists of five evaluation categories relating to the index's objectives and scope of assessment:

1. Market Structure: assesses the ease of accessing the power generation market for private investors, including grid access.

2. Policy Framework: assesses the level of political commitment to pursue the development of RE, which includes setting RE targets with detailed action plans, formulating supporting policies to encourage investment in RE, and phasing out fossil fuel subsidies.

3. Institutional Capacity: measures institutional capacity of Arab states to design and formulate RE policies and, most importantly, provide institutional support for private developers in RE deployment.

4. Finance and Investment: assesses financial incentives available to private RE developers and measures private investment growth in RE.

5. Carbon Emissions and Monitoring: assesses the current emissions from electricity grid and the status of NDC submitted by each country. The section ends by investigating the carbon emission reduction target by each country.

For each of those five categories, eight factors were evaluated and broken into sets of quantitative and qualitative indicators. AFEX Renewable Energy measures the existence of policies, their implementation and most importantly, their effectiveness. The focus of AFEX Renewable Energy is on power generation from renewable sources, thus biofuels and the use of RE for cooling and heating purposes currently remain outside the scope of the assessment. AFEX Renewable Energy also does not assess countries' theoretical natural potential for power generation from renewable sources, although this factor is surely an important element for investors' decision-making. Another aspect that is left out of this report is the level of maturity of the supply chain. The current state of the grid infrastructure in each country and the potential of grid interconnections between various countries, while having an impact on the development of the RE market, won't be included in this report until comprehensive data become available.

1.2 What's New in AFEX 2023

In this AFEX RE a new section was introduced. The section is intended to investigate the carbon emission released from the electricity grid during electricity production. In addition, the latest status of the Arab countries commitment to reduce carbon emissions is presented by analyzing the NDC submitted and its target.

Table 1: AFEX renewable energy conceptual framework

Category	Factors	Indicator	Score/Measuring Unit
Market Structure	Independent Power Producers	Utility Suppliers	Utility supply authorized by law. Utility suppliers exist in practice. Utility suppliers of RE exist in practice.
		Third-party Suppliers	RE supply to third-party authorized by law RE suppliers to third-party exist in practice
		Direct Export	Direct export of RE authorized by law Direct exporters of RE exist in practice
	Grid Access	Guaranteed Access to Grid	Priority access guaranteed by law Priority access guaranteed in practice Priority dispatch guaranteed by law Priority dispatch guaranteed in practice
		Grid Code for RE	Technical guidelines to connect small scale PV systems to low voltage grid adopted Technical guidelines to connect medium to large scale PV systems to medium and high voltage grid adopted Technical guidelines to connect medium to large scale wind systems to medium and high voltage grid
Policy Framework	RE Commitment	RE Targets	RE targets are officially adopted as part of RE strategy or action plan by higher political authorities; RE targets are defined, but not officially adopted yet by higher political authorities or scattered in various documents; No targets are adopted
		RE Share	Percentage of total installed capacity (MW)
		RE Projects Under Construction	Percentage of total installed capacity (MW)
	Supporting Policies	Competitive Bidding	Resources identified for private development; tenders announced; Power Purchase Agreement (PPA) signed (MW)
		Direct Proposal Submission	Policy adopted by law; proposals selected for private development; PPA signed (MW)
		Feed-in tariff/Net metering	Officially adopted; RE projects implemented through feed-in Tariffs (MW installed)
	Supporting Policies	Residential Electricity Subsidies	Percentage of Palestinian residential retail prices (benchmark).
		Commercial Electricity Subsidies	Percentage of Palestinian commercial retail prices (benchmark).
		Industrial Electricity Subsidies	Percentage of Palestinian industrial retail prices (benchmark).
Institutional Capacity	RE Institutions	Independent Regulator	Established by law; under establishment; nonexistent
		RE Agency	Established by law; under establishment; nonexistent
	Project Support	Resource Quality Assessment	Detailed wind atlas published and available to public; detailed solar atlas published and available to public
		Land Access	Land allocated for private development of large-scale wind projects; land allocated for private development of large-scale solar projects.
Finance and Investment	Financial Support	Fiscal and financial Incentives	Number of fiscal and financial incentives for RE projects
		Mechanism to cover incremental costs of RE	Mechanism established by law; sources of financing are clear; disbursement procedure is clear; Operational
Carbon Emission and Monitoring	Carbon Emission and Monitoring	Grid Emission Factor	The value of Grid Emission Factor
		Nationally Determined Contribution (NDC), Intended Nationally Determined Contribution (INDC)	The existence of NDC or INDC submitted to UNFCC
		Carbon Reduction Targets	Target to reduce carbon emissions in the Power sector

2 Market Structure

This section is intended to assess the openness of electricity markets to private generation of RE across the Arab region as the ultimate objective of the market structure category. Although the power sectors in many Arab countries were traditionally characterized by a high degree of vertical integration and state control, a gradual but slow transition towards competitive power market status is observed in some countries through unbundling vertically integrated power utilities. Two key issues are addressed in this chapter: (1) Independent Power Producers (IPPs); and (2) grid access. Those are further measured by a set of qualitative indicators as shown in Table 2.

Table 2: Power market structure evaluation factors and indicators

Category	Factors	Indicator	Score/Measuring Unit
Market Structure	Independent Power Producers	Utility Suppliers	Utility supply authorized by law Utility suppliers exist in practice Utility suppliers of RE exist in practice
		Third-party Suppliers	RE supply to third-party authorized by law RE suppliers to third-party exist in practice
		Direct Export	Direct export of RE authorized by law Direct exporters of RE exist in practice
	Grid Access	Guaranteed Access to Grid	Priority access guaranteed by law Priority access guaranteed in practice Priority dispatch guaranteed by law Priority dispatch guaranteed in practice
		Grid Code for RE	Technical guidelines to connect small scale PV systems to low voltage grid adopted
			Technical guidelines to connect medium to large scale PV systems to medium and high voltage grid adopted
			Technical guidelines to connect medium to large scale wind systems to medium and high voltage grid

2.1 Independent Power Producer

Independent Power Producers (IPPs) are those typically building, owning, and operating power generation facilities to sell electricity either to the utility or directly to a third-party through a Power Purchase Agreement (PPA). IPPs also can have the forms of direct export, and partial self-consumption. Exclusive self-consumption is not typically defined as IPPs, although some of the literature include this form among the IPP schemes. IPPs sales to the utility are the common practice in the Arab region, while third-party sales can be considered as an emerging supply option particularly appealing for larger industrial and commercial actors with high electricity needs and reluctant to become auto-producers of electricity.

With the advent of renewable energy and decreasing costs, IPP projects are getting more popular and the number of IPP projects is continually increasing.

Currently Gulf area is leading in terms of the world lowest prices with several PPA price records achieved. In Saudi Arabia, a price level of 1.04$c/kWh was achieved for 600MW Fasiliyah PV independent power producer (IPP) project. In UAE, 1.35$c/kWh was recorded for the 2GW Al Dhafra Solar PV project. Moving to Qatar where it managed to materialize a price of 1.567$c/kWh in 800MW solar tender. In early 2020 Bahrain, Kuwait, Oman have several IPP projects in the pipeline.

Besides Gulf area, Algeria, Egypt Jordan, Lebanon, Morocco, Palestine, and Tunisia, have shown a track record in IPP projects. Egypt have signed PPAs for several PV and wind energy IPP projects with prices 2$c/kWh for the 500 MW solar plant and 2.85$c/kWh for 1,100 MW wind power plant. Tunisia launched 500MW PV project that resulted in the success of three consortiums. Morocco has announced several hybrid projects combining PV and solar thermal technologies. Besides leading countries, several countries that started its journey towards installing considerable renewable energy capacity are using IPP scheme. As an example, Iraq tendered several PV projects with capacities between 30MW to 300MW on Build-Own-Operate (BOO) basis.

2.1.1 Utility Supply

Competitive bids, auctions, and direct proposal submission schemes have proved to be very successful in attracting private local and international investments. 12 Arab countries allow for public competitive bidding either under IPP or Engineering Procurement and Construction (EPC) tendering procedures based on government calls for tenders. Jordan, Palestine and Egypt opted for direct proposal submissions.

In Algeria, the Ministry of Energy Transition and Renewable Energy has launched in late 2021 a bidding for 1GW solar PV capacity project. It has been divided into lots ranging from 50 to 300 MW each.

A 100MW solar PV power project is announced in **Bahrain**. The project is expected to enter commercial operation in 2023. The power generated from the project will be sold to Electricity & Water Authority under a power purchase agreement. The power will be sold at the rate of $0.039/kWh for a period of 20 years. Recently, Bahrain announced a tender for 3MW solar park under 20-years PPA agreement. The produced electricity will be sold to the local grid. The project will be Build-Own-Operate-Maintain (BOOM) grid tied that will be installed at the country's Formula 1 circuit. In addition, the Solar Energy Unit of Bahrain and the United Nations Development Programme launched a 3 MW tender for solar arrays at eight locations containing 66 government buildings.

The construction of the first IPP wind project in **Djibouti** is under way at a 60MW wind farm in the Goubet region. The project has been under development since 2017 and signed a power purchase agreement with Electricité de Djibouti in 2019 under 25-year agreement.

In **Egypt**, new private solar plants in Kom-Ombo will add 200 MW and 500 MW to the grid respectively. The Egyptian Minister of Electricity and Renewable Energy announced the development of a wind energy complex with a total capacity of 2,800 MW. The complex will be located in the Gulf of Suez, governorate of the Red Sea. Several wind power projects reached financial close with capacities ranging between 250 MW, 500 MW and 1,100 MW for each project.

Iraq announced in 2019, 750MW solar IPP program that will be divided into seven projects. The projects will be in 5 provinces with different capacities for each project. The largest plant with a capacity of 300 MW will be installed in Karbala. The solar plants will be connected to Iraq transmission grid under a Transmission Connection Contracts (TCC). The Ministry of Electricity would be the off-taker under PPA from the special purpose vehicle (SPV) established by the appointed developers for each project. In addition to the above program, a strategic agreement between UAE's Masdar and Government of Iraq to develop five solar photovoltaic projects with a combined capacity of 1GW. An implementation agreement with Iraq's Ministry of Electricity and the National Investment Commission to develop a number of projects including, a 450MW plant in the Dhi Qar Governate in southern Iraq, a 100MW and a 250MW plant, both located in Ramadi in central Iraq, a 100MW plant in Mosul in the north and a 100MW plant in Amarah in the southeast.

Kuwait had plans for a giga scale PV project with a capacity of 1GW or 1.5GW. However, these plans were canceled. Currently, after Kuwait Authority for Partnership Projects (KAPP) – which has taken over the tender for the gigawatt-scale solar field from the Kuwait Petroleum Corp (KPC) – revived the plans of the giga scale project. Kuwait is drawing up plans to develop a 2GW solar and wind projects through cooperation with private sector.

In **Morocco**, The Moroccan Agency for Sustainable Energy (Masen) and the National Office for Electricity and Drinking Water (ONEE) have signed the final contracts with the developer consortium for the 270MW Jebel Lahdid wind independent power producer (IPP). The project is developed under Morocco's 850MW integrated wind energy program and one of the five wind projects to be developed under this program across Morocco.

Oman is developing Ibri 2 500MW utility-scale solar PV Independent Power Project – the Oman's largest IPP PV project- on Build Own Operate (BOO) basis. The offtake contract duration is 15 years. There is a plan for 100MW solar PV based plant with a large-scale battery storage for the first time in Oman.

In **Qatar**, an agreement to develop the 800MW solar power plant in Al Kharsaah has been signed. The Solar PV IPP plant will be Qatar's first large-scale solar power plant once completed. Commercial operation is expected to be in 2023. The energy generated by the solar plant will be supplied to Kahramaa corporation under a 25-year power purchase agreement (PPA).

In **KSA**, the 300MW Sakaka IPP project was connected to the grid in 2019 and inaugurated in 2021. The Public Investment Fund (PIF) - which will be responsible for implementing 70% of targets of National Renewable Energy Program (NREP) – awarded the Kingdom's largest renewable energy project, the 1,500MW Sudair solar PV independent power project (IPP) to a team led by the local utilities developer ACWA Power. In addition, Seven PV IPP projects with a total capacity of 1,47GW were awarded in 2021.

In **Libya**, the construction of a 100MW solar photovoltaic power plant in Kufra in south-eastern Libya has commenced.

Tunisia completed the first renewable energy IPP project in 2017. Currently Tunisia has four wind projects with a capacity of 30MW for each project under construction. The Tunisian government has given the green light to several solar projects with a combined output of 500 MW and a total investment of USD 408m. The projects were awarded as part of the country's concession system in 2019 and will be located in the governorates of Kairouan (100 MW), Tataouine (200 MW), Tozeur (50 MW), Sidi Bouzid (50 MW) and Gafsa (100 MW). There are also 12 solar projects under construction with a capacity of 10MW each was awarded by government of Tunisia to private companies.

In **UAE**, the world largest solar power plant (Al-Dhafra Solar PV plant) is being developed and under construction. The 2GW project IPP PV project is expected to be commercially operational in 2023. The 1 billion USD project will have an additional option to build on the existing battery capacity of 108MW, which is operational in the current electricity storage system of Abu Dhabi. The plant will use innovative bifacial solar technology in addition to the latest crystalline technology.

2.1.2 Third Party Supply of RE

Six Arab countries (Algeria, Egypt, Morocco, Palestine, Syria, and Tunisia) are currently having the regulatory framework to allow third parties to sell electricity to the customers. Bahrain, Qatar, and Saudi Arabia allow third party supply as a conventional IPP. Morocco has third party supply in practice through NAREVA Holding Company: Three wind projects of 200MW total capacity supply power directly to large industrial customers. In Egypt small and medium scale projects of capacities ranging from a few hundreds kilowatts up to 20MW are implemented through direct PPAs between the solar companies and the clients in industrial and commercial sectors.

2.1.3 Direct Export of RE

Four countries have the legal basis for RE direct export: Algeria, Jordan, Morocco, and Tunisia. Renewable energy is boosting Morocco electricity production allowing Morocco the possibility to become a net exporter of electricity through the interconnection with Spain. In Morocco, Law 13-09 permits the export of RE-produced electricity by using the national grid and interconnections with specific authorization by the state-owned utility ONE. In Algeria, Law 02-01 allows for export. Tunisia Law 12 for 2015 has specified some conditions for exporting RE sourced electricity. In Jordan, the General Electricity Law specifies that subject to the Council of Ministers approval, import and export will be handled on a case-by-case basis.

Table 3 summarizes the status of the above three indicators: RE utility supply, RE third party access, and RE direct export.

Table 3: Status of IPPs producing RE in the Arab countries

Country	RE Utility Supply		RE Third Party Supply		RE Direct Export	
	Legal basis to operate as IPP and sell power to utility	Implemented	Legal basis to operate as IPP and engage in third-party supply	Implemented	Legal basis to operate as IPP and engage in direct export	Implemented
Algeria	Executive decree No. 17-98 of 26 February 2017, Law No 02-01 (2002) on Electricity and Distribution of Gas, Article 26; Decree No 13-218 (2013) on Feed-in tariffs for Renewables	Yes[1]	Law No 02-01 (2002) on Electricity and Distribution of gas[2] Decree 06-429 of 2006, article 4	-	Law No 02-01 (2002) on Electricity and Distribution of Gas[3]	-
Bahrain	Legislative Decree No. 1 of 1996 with respect to Electricity and Water	Yes	-	-	-	-
Djibouti	Law No 88 (2015) on Regulation of the Activities of the Independent Electricity Producers	Yes	-	-	-	-

[1] The IPP and sell power to utility is underway through the 1GW PV Project tender.

[2] The Law 02-01 (2002) does not differentiate between export of power produced from conventional sources and renewables.

[3] The Law 02-01 (2002) does not differentiate between export of power produced from conventional sources and renewables.

Country	RE Utility Supply		RE Third Party Supply		RE Direct Export	
	Legal basis to operate as IPP and sell power to utility	Implemented	Legal basis to operate as IPP and engage in third-party supply	Implemented	Legal basis to operate as IPP and engage in direct export	Implemented
Egypt	Law No 100 (1996); Law No 89 (1998) on Competitive Bidding. Renewable Energy Law No 203 (2014)	Yes	The Periodical Book No. 3 for year 2018 issued by "The Electric Utility and Consumer Protection Regulatory Agency"	Yes	Yes	-
Iraq	Economic Affairs Commission Decree No S.L. 614, August (2008)	Yes	-	-	-	-
Jordan	Law No 13 (2012) on Renewable Energy and Energy Efficiency Law, Article 5 (competitive bidding), Article 6 (Direct Proposal Submission)	Yes	-	-	General Electricity Law 64[4]	-
Kuwait	IPP Law No 39-10 (2010)[5]	Yes	-	-	-	-
Lebanon	Law 462 and its amendments	-	-	-	-	-
Libya	REAOL Decree on Establishing RE Private Investment Promotion Co. (2018)	-	-	-	-	-
Morocco	Law No 13-09 (2009) on Renewable Energies	Yes	Article 26 of the Law 58-15 (2015) revision Law No 13-09 (2009) on Renewable Energies.	Yes	Law 13-09 (2009) on Renewable Energies	-
Mauritania	Under preparation and planned to be issued in March 2023		Under preparation and planned to be issued in March 2023		Under preparation and planned to be issued in March 2023	
Palestine	Decision of the Cabinet for motivations package for the purpose of encouraging investment in the use of RE technologies (2017). Renewable Energy Efficiency Law No 14 (2015) General Electricity Law No 13 (2009)	Yes	Renewable Energy Efficiency Law No 14 (2015)	Yes	-	-
Qatar	Law No 10 (2000) on the Establishment of KAHRAMAA [6]	-	-	-	-	-

[4] The General Electricity Law No 64 regulates issues of export and import but does not specify the situation for renewables.

[5] The IPP Law No 39-10 (2010) does not specify situation for renewables.

[6] The law authorizes KAHRAMAA to formulate and enter power and water purchase agreements and provide necessary technical and corporate support for establishment of generation and desalination ventures

[7] The Royal Order authorizes KACARE to develop, lead and implement clean energy projects in the Kingdom.

Country	RE Utility Supply		RE Third Party Supply		RE Direct Export	
	Legal basis to operate as IPP and sell power to utility	Implemented	Legal basis to operate as IPP and engage in third-party supply	Implemented	Legal basis to operate as IPP and engage in direct export	Implemented
Sudan	Electricity Act (2001) Chapter II Article 3.2	-	-	-	-	-
Syria	Law No 32 (2010), Article 30.	-	Article 30 of the Law 32 (2010).	-	-	-
Tunisia[8]	Law No 1996-27 (1996); Decree 1996-1125 (1996).	Yes	Law No 74/2013, (adopted in April 2015)	Yes	Law No 74/2013, (adopted in April 2015)	-
UAE	Article (3) of the Decree No. (1) (1992), amended by Article (1) of Decree No. (9) (2011).[8]	Yes	No	-	-	-
Yemen	Electricity Law No 1 (2009).	-	-	-	-	-

[9] Authorizes Dubai Water and Electricity Authority to purchase electricity from any entity at the prices and under conditions it deems appropriate.

2.2 Grid Access

2.2.1 Priority Access and Dispatch

Transparent and clear regulations for grid access are a prerequisite for private investments in renewable energy in any country. Among the required regulations are RE priority access and dispatch which are effective consolidation measures that promote the competitiveness of the RE projects and increase the RE market attractiveness. It is important that all renewable electricity producers are treated in a non-discriminatory way. A regulated grid-transporting tariffs combined with an unbundled power sector can contribute to guaranteeing non-discriminatory access for all producers. The above-mentioned conditions are a common approach to specify grid access technical details in national-level regulations and grid codes referenced in the PPA, helping to avoid case-by-case negotiations.

Algeria, Egypt, Jordan, Palestine have regulations that either ensure priority of renewable electricity to be injected to the grid or to purchase all produced electricity from RE plants. In Morocco, Act No. 13–09 was amended and supplemented by Act No. 58–15 for the private development of projects to allow renewable energy project developers access the national grid at all voltage levels. In case of Saudi Arabia, RE projects have a guaranteed access to the grid instead of priority access. Thus, in situations such as low demand or high renewable electricity production, they will not have any priority over fossil fuel-fired generators. The following Table 4 shows examples of grid access conditions for selected countries.

Table 4: Examples of RE grid access conditions in the Arab region

Country	RE Guaranteed Access to the Grid	RE Priority Access/ Dispatch
Algeria	Executive decree No. 17-98 of 26 February 2017, Executive decree No. 06-428 of 26 November 2006, Executive decree No. 06-429 of 26 November 2006, and the order of 21/02/2008.	Priority dispatch once a RE system is connected.
Egypt	Egyptian Electricity Transmission Company (EETC) and distribution companies (DCs) are required to expand their networks to accommodate all renewable energy supply and purchase all electricity that has been produced from renewable energy power plants at the price adopted by the Cabinet of ministers.	The Egyptian Electricity Transmission Company (EETC) has taken this further and specifies priority dispatch for RE in its network access contracts with power producers.
Jordan	Non-discriminatory guaranteed access foreseen by the Law No 13 (2012) on Renewable Energy and Energy Efficiency, Article 8C.	PPA contracts with National Electric Power Company (NEPCO) stipulates the take or pay concept with IPPs under Direct Proposal Submission Scheme
Morocco	Act No. 13–09 was amended and supplemented by Act No. 58–15 for the private development of projects guarantee renewable energy project developers the access to the national grid at all voltage levels	No.

2.2.2 Grid Code or Connection Guidelines

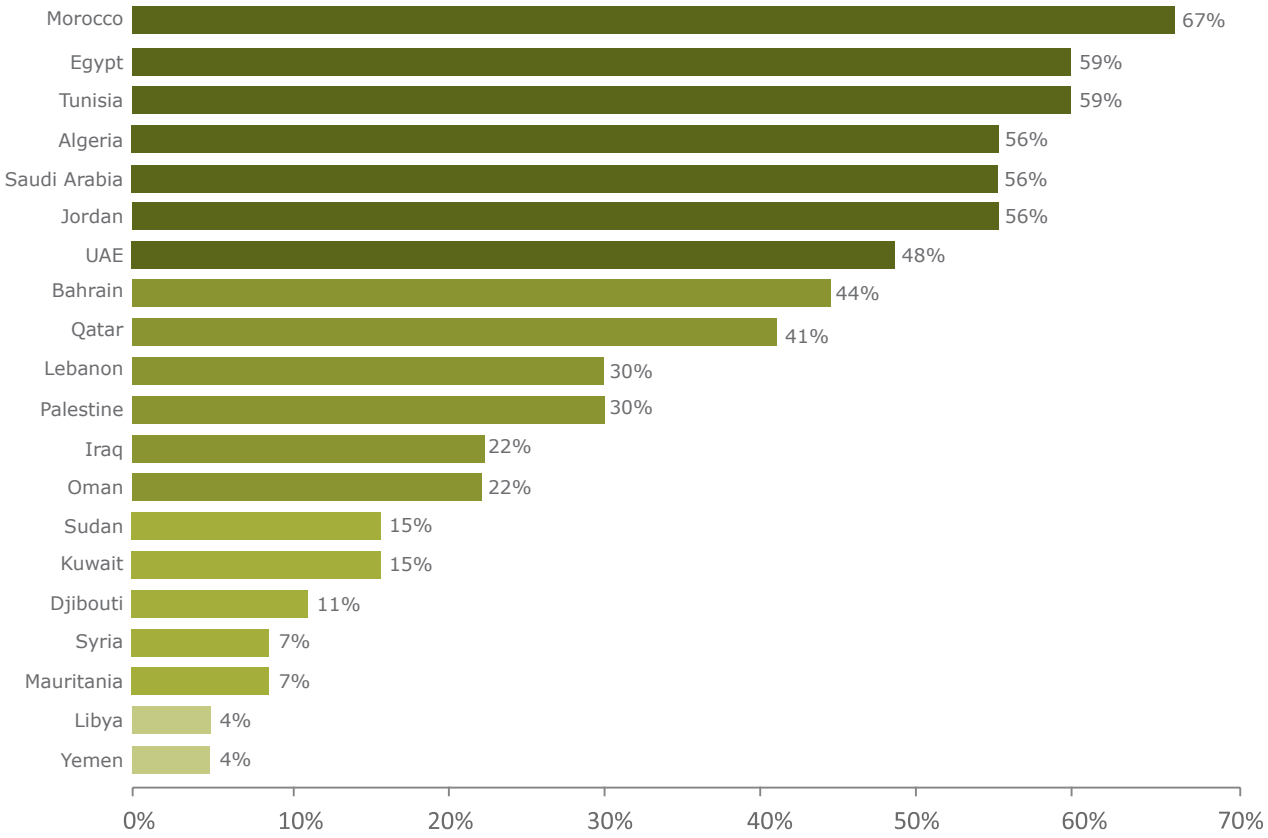
The technical specifications that state the general conditions of how different power generation installations connect to the grid as well as the management and functioning of the electricity grid and system services are called grid or network codes. The technical specifications of the grid code apply to all generation facilities feeding to the grid, whether large utility scale power plants or decentralized solar rooftop systems. Grid codes must clarify which technical rules govern access to the grid for all types of RE projects. Furthermore, the grid code defines specific conditions for plants to receive pre-qualification and participate under different supporting schemes such as net metering or bids/auctions. The following Table 5 exhibits the existence of grid codes in Arab countries.

Table 5: Grid connection code in Arab countries

Country	Technical Guidelines Adopted to Connect		
	Small Scale PV Systems to Low Voltage Grid	Medium- to Large-Scale PV Systems to Medium and High Voltage Grid	Medium- to Large-Scale Wind Systems to Medium and High Voltage Grid
Algeria	Under Preparation	Yes	Under preparation
Bahrain	Yes	Yes	-
Egypt	Yes	Yes	Yes
Iraq	Under preparation	Under preparation	Under preparation
Jordan	Yes	Yes	Yes
Kuwait	-	-	-
Lebanon	Yes	Under preparation	Under preparation
Libya	-	-	-
Morocco	Under preparation	Under preparation	Under preparation
Palestine	Yes	-	-
Qatar	Yes	-	-
Saudi Arabia	Yes	Yes	Yes
Sudan	Yes	-	-
Syria	-	-	-
Tunisia	Yes	Yes	Yes
UAE	Yes	Yes	-
Yemen	-	-	-

2.3 Market Structure Final Scores and Ranking

Figure 2: Countries ranking in market Structure dimension



3 Policy Framework

The third chapter will assess the maturity of renewable energy policies and political commitment to enable RE development in Arab countries. Two factors were assigned to assess policy framework categories: RE commitment and supporting polices adopted. The first factor has three indicators: RE targets, RE share, and RE projects under construction. The second factor has four indicators that discuss the implemented RE polices: PPA bidding or public competitive bidding, direct proposal submissions, feed in tariffs (FiTs), and net metering. Table 6 summarizes the above factors and indicators.

Table 6: Framework evaluation factors and indicators

Category	Factors	Indicator	Measuring Unit
Policy Framework	RE Commitment	RE Targets	RE targets are officially adopted as part of RE strategy or action plan by higher political authorities; RE targets are defined, but not officially adopted yet by higher political authorities or scattered in various documents; No targets are adopted
		RE Share	Percentage of total installed capacity (MW)
		RE Projects under Construction	Percentage of total installed capacity (MW)
		RE Projects under Tendering	Percentage of total installed capacity (MW)
	Supporting Policies	PPA Bidding or Public Competitive Bidding	Resources identified for private development; tenders announced; PPA signed (MW)
		Direct Proposal Submission	Policy adopted by law; proposals selected for private development; PPA signed (MW)
		Feed-in Tariffs	Officially adopted; RE projects implemented through feed-in Tariffs (MW installed)
		Net Metering	Officially adopted; RE projects implemented through net metering scheme (MW)

3.1 RE Commitment

3.1.1 RE Targets

To attract in the investment in the renewable energy sector, countries should demonstrate political commitment. This political commitment could be shown in simple procedures for investors, allocating land for RE projects, and national RE targets. Most Arab countries have announced ambitious RE targets. The announced targets are different and vary from as low as 15% to as high as 100%. Solar PV and wind are the dominant technologies across all countries in the region, together with some shares of CSP technology. Biomass and geothermal represent minor share in RE generation mix, except for Djibouti that is planning to depend to great extent on geothermal power.

For the first time, two Arab countries have 100% RE targets: Djibouti by 2035, and Morocco by 2050. Morocco also has a 2030 target of 52% of RE share. In terms of installed target capacity, Saudi Arabia has the most ambitious target of 58.7 GW by 2030 followed by Egypt which has a target of 59.7 GW (CSP 8.1 GW, PV 31GW, wind 20.6 GW) by 2035. These targets represent 30% and 42% share of national installed capacity respectively. The Egyptian RE strategy is under revision to be updated to reach more than 50% by 2035.

Iraq recently announced to increase the share of renewable energy to 33% by 2030. This target is driven by the recent solid expansion in solar projects. To reach this target, Iraq aims to install 12GW of solar projects. This represents a giant leap from the previously announced target of installing 2.24GW by 2025.

Jordan is considered a front runner in renewable energy. The share of electricity from renewables in Jordan grew from 0.7% in 2014 to over 13% in 2019. This achievement encouraged Jordan to raise the target in the updated Energy Strategy for the Energy Sector 2020-2030, developed by the Ministry of Energy and Mineral Resources (MEMR), from 21% in 2020 to 31% share for renewables in total power generation capacity and 14% of the total energy mix by 2030.

Mauritania had a target of 50% of overall electricity generation from renewable sources by 2020. Mauritania achieved a significant progress in the diversification of its production sources by building and exploiting solar, wind and hydro power plants. These achievements spur the efforts of the government of Mauritania to set a target of 100% of overall electricity generation from renewable sources by 2050.

Morocco is on the right path to achieve the announced target of 52% of its electricity needs from renewable sources by 2030. In 2019, Morocco met 35% of its electricity needs with renewables. Morocco plans to do more to achieve 100% by 2050 in its 2050 Morocco vision. The expected energy mix will come from rooftop solar 29.1%, solar plants 10.5%, CSP 4.8%, 41% from onshore wind, offshore wind 10.5%, wave energy 1%, and finally 3.1% from hydropower.

The National Energy Strategy for Oman has set an ambitious target to derive 20% of electricity from renewables by 2027. The renewable energy plan aims to secure at least 2,660 MW, with solar PV share of 79% and wind share of about 21%. In the 2040 vision, there is an ambitious target to raise the penetration of renewable energy in the energy mix to 20% in 2030 and up to 35-39% in 2040.

Table 7: RE targets in Arab countries

Country	RE Strategy/Action Plan/Program that has these targets	RE Targets							Target Date
		Wind MW	PV MW	CSP MW	Biomass MW	Geothermal MW	Total		
							MW	%	
Algeria	Government Action Plan	-	15,000						2035
Bahrain	National Energy Action Plan (NREAP) Adopted in 2017	50	200		5	-	255	5	2025
		300	400		10	-	710	10.3	2035
Djibouti	National Program for Development of Renewable Energy and Energy Efficiency	300	200		0	500	1,000	100	2035
Egypt	National RE Strategy 2020 adopted in 2008, updated in 2012; Egyptian Solar Plan;	7,200	At least 2,300				9,500	20	2023
	SE Action Plan for the Power Sector (2018)	21,000	31,000	8100			59,759.7	42	2035
Iraq	PV Solar Plan 2017-2020 by the Ministry of Electricity		2240				2240		2020-25
			12000					33	2030
Jordan	The updated Master Strategy for the Energy Sector 2020-2030						3,200	31	2030
Kuwait	Kuwait Energy Security Vision						4266	15[10]	2030
Lebanon	Updated Policy Paper 2019	1000	2500	100	13			30[11]	2030
Libya	Strategic Plan for Renewable Energies 2018 - 2030	850	3350	400			4,600	22	2030
Mauritania								40[12]	2030
								50[11]	2050
Morocco	Morocco INDC submission to CoP 21.	4200	4560				10,090	52	2030
								100	2050
Oman	2nd NDC	560	2100				2660	20	2027
	Oman Vision 2040	-	-	-	-	-	-	35-39[13]	2030
Palestine	National Energy Strategy (2012-2020); Palestinian Solar Initiative.	44	45	20	21		130	10	2020
	NREAP 2018	50	400		50		500	25	2030
Qatar		-	-	-	-	-	1800	20	2030
Saudi Arabia	REPDO RE Plan 2019	7000	20000	300			27,300		2023
	Saudi Arabia's Renewable Energy Strategy	16,000	40,000	2,700			58,700	30	2030
Sudan	Sudan's Renewable Energy Action Plan Study.	1,650	1,350	50	270	-	3,320	14[12]	2035
Syria	The 11th Five-Year Plan for 2011-2015	1,000	2,000	1,300	250		4,550	30	2030
Tunisia	National Renewable Energy Action Plan 2018.	1755	1510	450	100		3815	30[14]	2030
UAE	Energy Strategy 2050							44	2050
Yemen	National RE and EE Strategy adopted in 2009	400	8.25	100	6	160	714.25	15	2025

Source: RCREEE Focal Points

[10] 15% of energy consumption
[11] Of electricity consumption
[12] Excluding Hydropower
[13] In energy mix
[14] Electricity production

3.1.2 RE Share

The second indicator is the most popular one and is usually used to assess the country's efforts to apply RE policy. Renewable energy share in the energy mix is always used to have an overall view on energy situation in a country and its commitment towards renewable energy. However, this indicator should be used in combination with other indicators, such as the progress compared to the past years and the RE projects in the pipeline.

As for the region, the RE share changed slightly from the last AFEX edition in 2019 and increased to 7% (Figure 3). Excluding hydro, it is noted that PV technology increased its share in the energy mix and scored 60% to prove its position as the favorite technology in the region. This is followed by wind energy which represents 31% of the renewable energy mix. CSP technology is present only in 6 countries and exhibit a share of 6%. Bioenergy has a minor share or 2.6%. Figure 4 exhibits the share of each technology, excluding hydro.

Figure 3: RE share in Arab countries

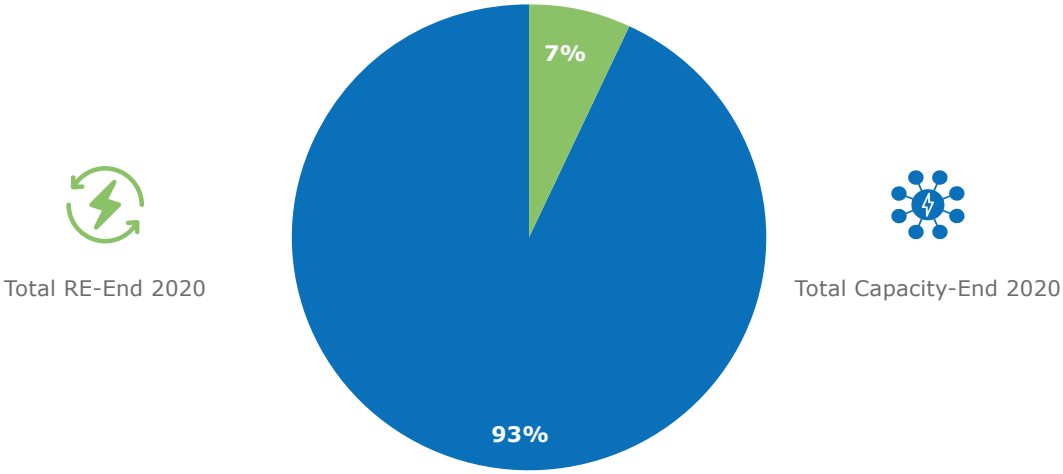
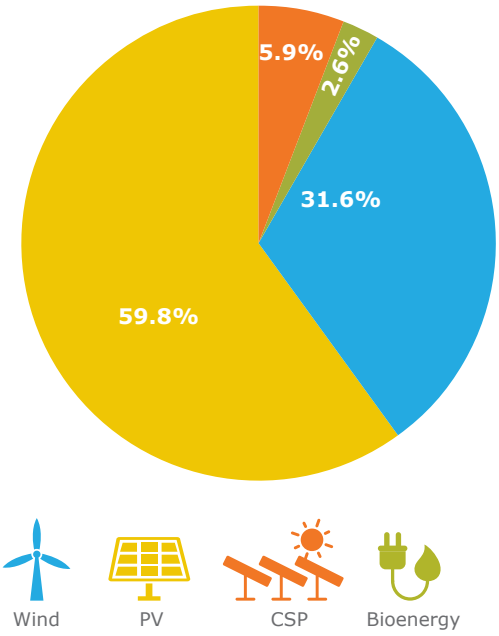
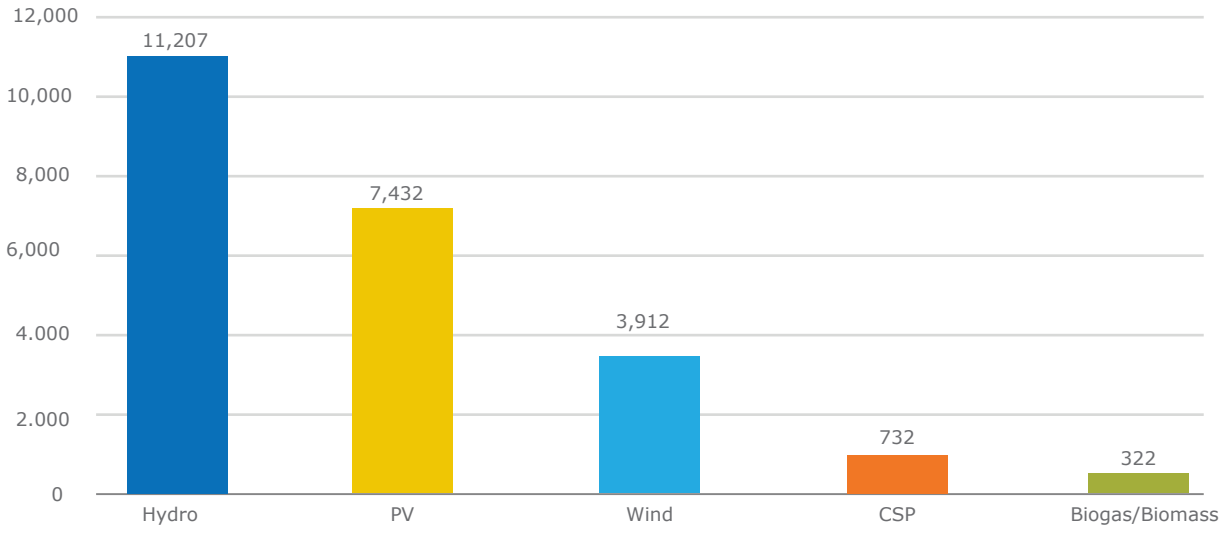


Figure 4: RE technologies shares (excluding hydropower)



Hydro power still has the largest installed capacity with a total of 11.2GW followed by PV solar power with 7.4GW. Figure 5 exhibits the installed capacity by the end of 2020 for different RE technologies. The added installed capacity in 2020 is nearly equal to the total renewable energy capacity in 2018 which indicated a huge leap in RE installed capacity and in particular PV technology. In fact, PV capacity has more than doubled and increased from 3.2GW by the end of 2018 to 7.4GW by the end of 2020. Wind energy and CSP have had minor increase in the installed capacity.

Figure 5: RE technologies installed capacities (MW) (2020)



The RE share in the Arab region is around 3.6% without accounting for hydro power. Hydro power is the same as in 2018 without any addition in installed capacity. The total installed RE capacity is 23.6GW. A total of 5.1GW have been added in just 2 years to the RE portfolio in the Arab region. Moving from the regional level to the country level, Table 8 shows the installed capacity for each RE technology per country and the RE percentage in the total installed capacity[15].

On country level, Sudan has the highest RE share (52%) taking into account hydro power followed by Mauritania, Morocco and Jordan. If hydro power to be excluded, the ranking will be different, as Jordan will claim the first place followed by Mauritania and Palestine. In terms of installed capacity, Egypt will take the first place followed by Morocco, Iraq, and UAE. If, again, the hydro power is excluded, Egypt will also keep first place followed by UAE, Morocco, and Jordan.

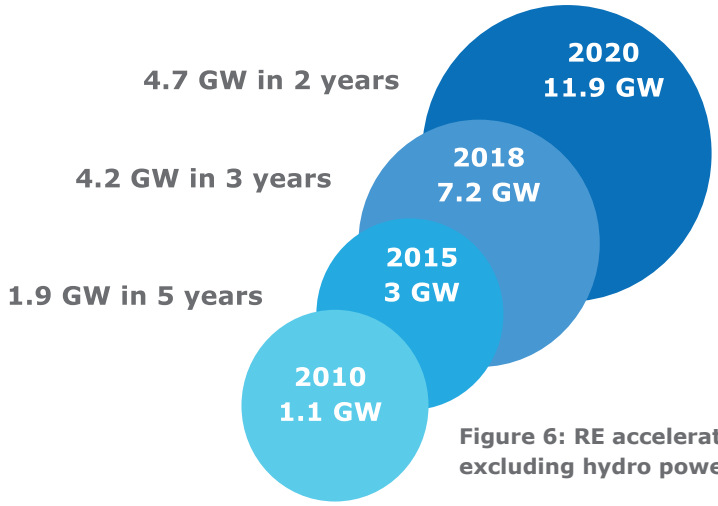


Figure 6: RE accelerated deployment in Arab countries, excluding hydro power.

[15] Focal points, Renewable Capacity Statistics 2021, IRENA, Renewable Capacity Statistics 2021 (irena.org)

Table 8: Renewable energy installed capacity in the Arab countries

State	Wind (MW)	PV (MW)	CSP (MW)	Geothermal (MW)	Biogas/ Biomass/ W2E (MW)	TOTAL RE w/t hydro (MW)	Hydro (MW)	TOTAL RE - End 2020 (MW)	Fossil Fuel Based - End 2020 (MW)	Total Capacity- End 20202 (MW)	Share of RE in Installed Capacity - End 2020 (%)	Share of RE in Installed Capacity w/o Hydro - End 2020 (%)
Algeria	10	423	25	-	-	458	228	686	22,978	23,664	2.90%	1.94%
Bahrain	1	10	-	-	-	11	-	11	8,771	8,782	0.13%	0.13%
Djibouti	-	-	-	-	-	-	-	-	145	145	0.00%	0.00%
Egypt	1,635	1,623	20	-	54	3,332	2,832	6,164	53,626	59,530	10%	5.2%
Iraq	-	37	-	-	-	37	2,514	2,551	24,300	26,851	9.50%	0.14%
Jordan	515	1,541	-	-	8.3	2,064	6	2,070	4,242	6,312	32.80%	32.70%
Kuwait	12	93	-	-	-	105	-	105	20,153	20,258	0.52%	0.52%
Lebanon	-	90	-	-	8	98	286	384	2,740	3,124	12.29%	3.14%
Libya	-	5	-	-	-	5	-	5	13,727	13,732	0.04%	0.04%
Mauritania	34	88	-	-	-	122	83	205	334	539	38.03%	22.63%
Morocco	1,405	206	530	-	7	2,148	1,770	3,918	7,140	11,058	35.43%	19.42%
Oman	50	109	7	166	-	166	-	166	12,330	12,496	1.33%	1.33%
Palestine	1	36	-	-	-	37	-	37	140	177	20.90%	20.90%
Qatar	-	5	-	-	38	43	-	43	10,171	10,214	0.42%	0.42%
Saudi Arabia	3	359	50	-	-	412	-	412	81,723	82,135	0.50%	0.50%
Sudan	-	18	-	-	199	217	1,928	2,145	2,013	4,158	51.59%	5.22
Syria	1	2	-	-	7	10	1,494	1,504	8,625	10,129	14.85%	0.10%
Tunisia	254	95	-	-	-	340	66	406	6,342	6,748	6.02%	5.04%
UAE	-	2,439	100	-	1	2,540	-	2,540	32,644	35,184	7.22%	7.22%
Yemen	-	253	-	-	-	253	-	253	1,694	1,947	12.99%	12.99%
Regional	3,912	7,432	732	0	322	12,398	11,207	23,605	313,838	337,443	7.00%	3.67%

Figure 7: RE share in installed capacity

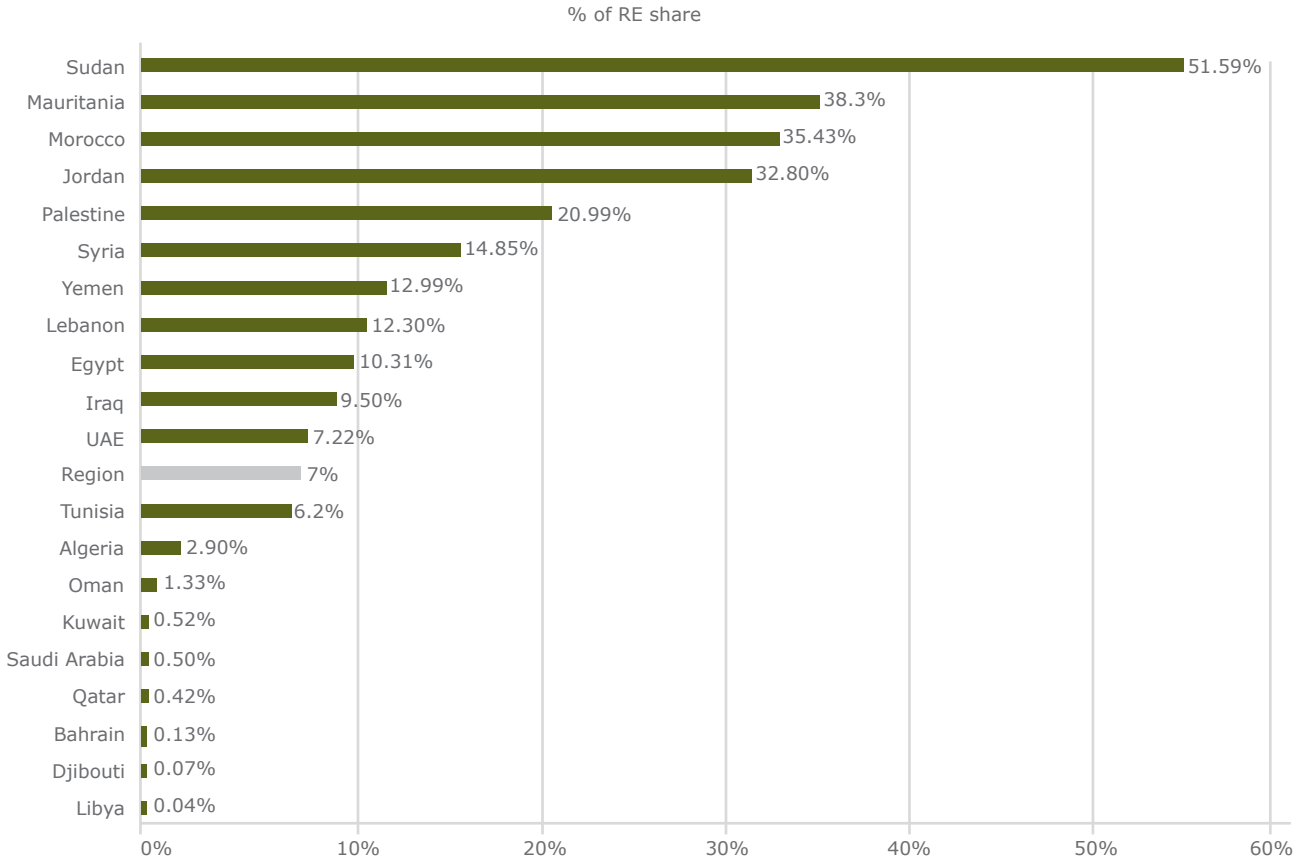


Figure 8: RE share in installed capacity (excluding Hydro power) (MW)

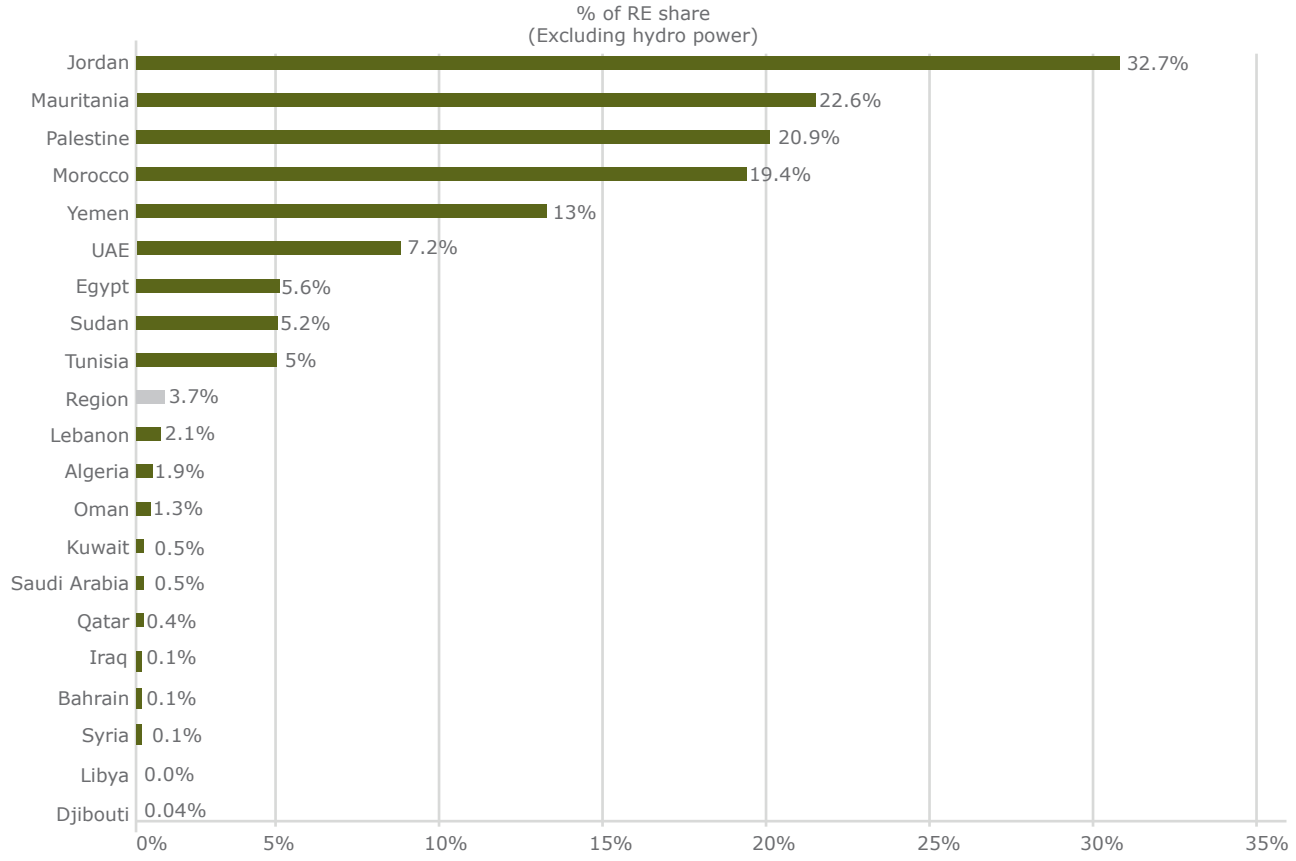


Figure 10: Wind energy installed capacity (MW)

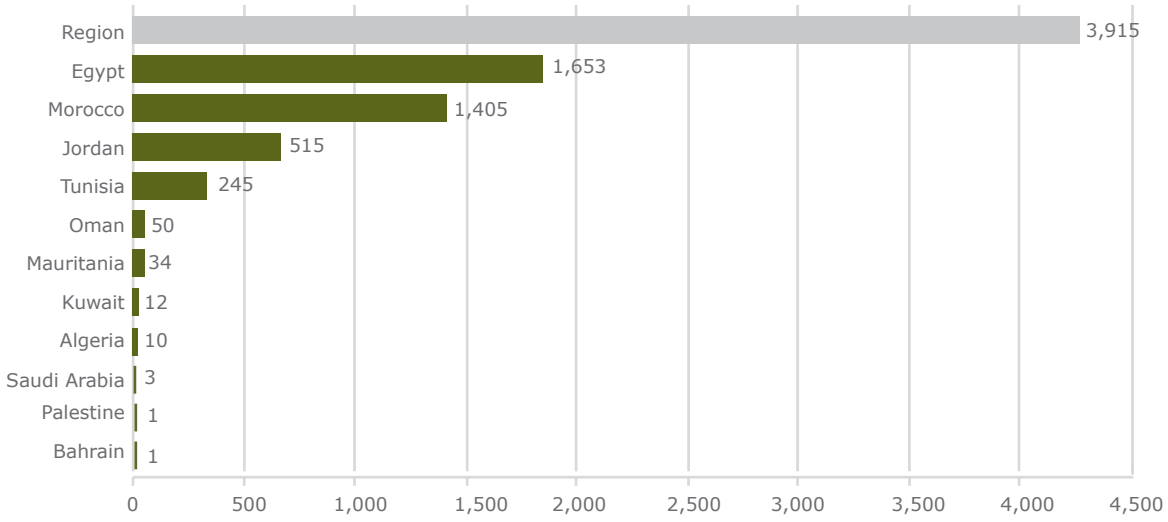


Figure 9: PV Installed Capacity (MW)

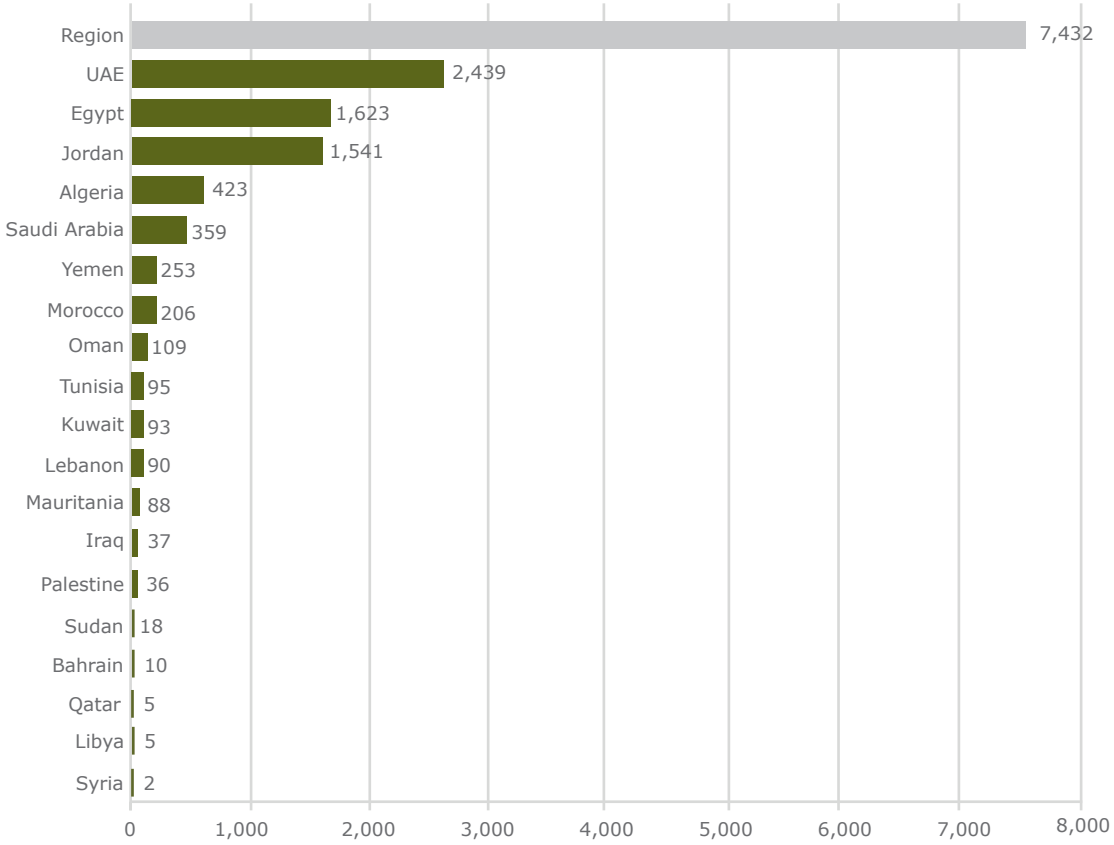
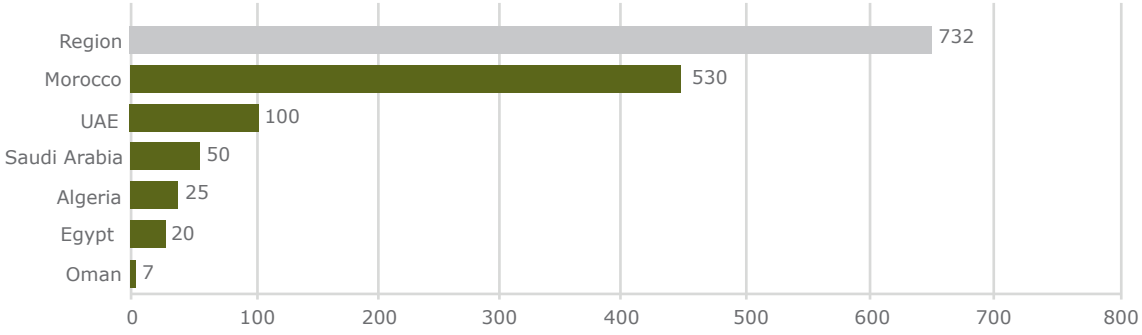


Figure 11: CSP installed capacity (MW)



For wind energy, Egypt and Morocco are the only countries to have installed capacity larger than 1GW. Wind energy represents 49.1% and 65.4% of the RE energy portfolio (without taking hydro power into account) for Egypt and Morocco respectively. They are followed by Jordan that has around 0.5GW, then Tunisia with installed capacity of 245 MW . Figure 9 exhibits the wind energy installed capacity in different Arab countries.

UAE acquired the first place among the Arab countries when it comes to the amount of PV installed capacity constructing 2.4GW. This represents 96% of the RE portfolio in UAE. Egypt holds the second place with installed capacity of 1.623GW representing also 48.7% of the total installed renewable energy. Egypt is followed by Jordan with a 1.54GW accounting for 74.7% of the total installed RE projects. UAE, Egypt, and Jordan are the only countries with PV capacities more than 1GW. Figure 10 shows the installed PV capacities (above 50MW) for Arab countries.

Only six countries have installed CSP technology. The front runner country is Morocco with a total capacity of 530MW representing 72% of the total regional capacity. UAE holds the second place with 100MW. Saudi Arabia has 50MW of CSP technology. The above three countries account for 93% of the regional CSP capacity in the region. Figure 11 exhibits the installed CSP capacity in the region per country.

3.1.3 RE Projects Under Construction

Besides the installed RE capacity indicator,another very important indicator is the number RE projects in the pipeline. A country can have a few RE plants but have several RE projects in the pipeline. This means, in few years, a country can be a frontrunner and lead the region. In addition, a clear overview of the RE projects under construction will strongly provide an important indication about countries performance and commitment towards reaching its RE targets.

The following table shows examples of the RE projects under construction, in the late 2020 in the Arab countries. Currently there are more than 13GW under construction.

A massive amount of ongoing deployment of RE capacities shows the commitment of the Arab region towards the transition to cleaner energy production.

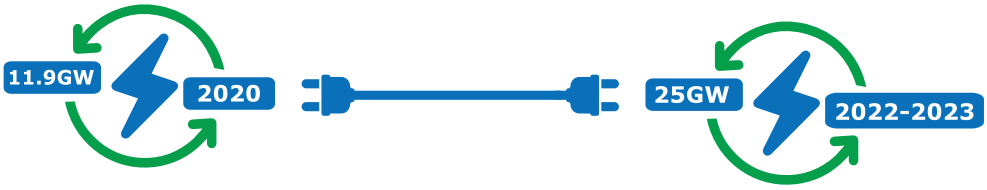
PV technology is dominating the RE projects under construction, accounting for approximately 80% of the projects. Wind projects come second with approximately 13%. Saudi Arabia has the largest RE projects under construction with 3.7GW of solar energy and 400MW wind energy. UAE has the second place with 2GW solar project which aims to be the largest in the world. In the third place is Egypt with more balanced RE combination of 1 GW solar and 750MW wind energy.

It can be observed that several countries with low installed RE capacities are developing large scale projects. For example, Qatar, that has around 50MW of renewable power is developing 800MW solar projects. It is the same case for Iraq (has more than 2GW of RE projects under development), Oman, and Saudi Arabia. The implementation of these large-scale projects will help to fulfill the ambitious targets of RE in the energy mix.

Table 9: RE projects under construction, end 2020 (non-exhaustive list)

Country	RE Technology	MW	Project
Algeria	PV	50	Biskra region
Bahrain	PV	25-100	Different systems at different locations
Djibouti	Wind	60	Ghoubet
	PV	50	Grand Bara Phase I
	CSP	50	Asal –Fiale Project
Egypt	PV	750	At different locations
	Wind	250MW is under construction + 2800 MW in different development phases	Mainly at Gulf of Suze
Iraq	PV	500	Dhi Qar Governorate
Jordan	Wind	203.5	Tafileh
	Wind	134.1	Fujeij/Shobak
	PV	50	Husaineyyah/Ma'an
	PV	200	Baynona PV project, Mawaqar/Amman
Kuwait	PV	1500	Proposals received, Dabdaba, Shagaya RE Complex
Lebanon	Wind	226	Licensed and signed
	PV	2.95 180	Projects in cooperation with the United Nations development program First round of solar PV farms – Final stages of price negotiations for PPA
Libya	PV	100	Kufra in south-eastern Libya
Mauritania	Wind	100	Wind project that will be located in Boulenouar, a town in western Mauritania.
Morocco	PV & CSP	800	Noor Midelt Phase 1
	PV	200	Noor Atlas
Oman	PV	500	Ibri II PV project
Palestine	PV	20	Projects through direct proposal submission
	PV	0.87	Solar projects for schools and the Precedential Building
	others	0.34	Electricity Generation Project from biogas in Hebron
Qatar	PV	800	Al Kharsaah Solar Photovoltaic IPP
Saudi Arabia	Wind	400	Dumat Al Jandal
	PV	3700	seven solar power plants with a combined capacity of almost 3.7 GW including 1.5GW Sudair photovoltaic plant
Sudan	PV	10	Niala (5 MW) and Al-Deain (5 MW)
Tunisia	Wind	30	Sidi Mansour Project
	PV	100	Distributed projects in different sites
UAE	PV	2000	Al Dhafra Solar Photovoltaic

Figure 12: Expected RE installed capacity in 2023- 2023



3.2 Supporting Policies

The current trends in renewable energy policies witness a shift from feed in tariff (FiT) that was applied in several Arab countries such as Egypt and Jordan towards auctions and tender mechanisms which are under competitive bidding policies. FiT is becoming less popular because it puts a burden on the country's financial budget. On the other side, auctions and tender mechanisms are becoming more popular because of their effectiveness to result in low bid prices. Currently, Saudi Arabia announced a record solar pricing of $cents1.04/kWh that was awarded for the 600MW Fasiliyah PV independent power producer (IPP) project, the largest project under the second round of the kingdom's National Renewable Energy Program (NREP). Competitive auction schemes exists in nearly all Arab countries.

3.2.1 Direct Proposal Submission

Jordan, Egypt, Palestine, and Djibouti are the only countries in the Arab region that apply direct proposal submission scheme. Under the direct proposal scheme, developers are responsible for acquiring the development assets by themselves and are guaranteed a tariff for the power they produce usually after a call from the government to have a RE project. The criteria for direct proposal include development plan including financing, preliminary design, the contribution of local inputs to the facility, supplies, operation, and construction. The electricity tariff presented by the developer must be within a pre-determined range (equal or lower than previous project of the same technology) according to government's reference price list. If the direct proposal submission and subsequent negotiations for a project agreement are successful, the project developer signs a PPA with the off-taker.

3.2.2 Competitive bidding

This scheme is currently the most popular and dominating one. Thanks to auctions, several countries in the Arab region are among the global leaders in renewable energy development. The recent auctions resulted in driving the world record price for solar energy lower and lower. To examine how auctions helped Arab countries to achieve several world record solar tariffs, a brief review of some of the latest solar auctions in the gulf region will be discussed below.

In early 2020, Kahramaa (Qatar General Electricity and Water Company) announced the results of the 800 MW solar tender at Al Kharsaah solar photovoltaic IPP project. The winning consortium was formed by French oil giant Total and Japanese conglomerate Marubeni Corp. The consortium offered a world record price at that time of $cents1.567/kWh. This price beats the previous world record of $cents1.6 submitted by French developer Akuo Energy in Portugal's first PV auction.

Moving forward few months, financial closing for 2 GW solar park in Abu Dhabi has been announced. The project will be built approximately 35 kilometers from Abu Dhabi. France's EDF and China's Jinko Power Technology will sell electricity to Emirates Water and Electricity Co. at a price of $cents1.35/kWh under a 30-year power purchase agreement. This price level was the world's lowest bid at that time. It will also be the first plant of this scale to feature bifacial PV modules.

In 2021, two new world records have been announced in Saudi Arabia. The second lowest is of $cents1.239/kWh for the 1.5GW Sudair PV IPP – a project that had been directly negotiated with the developer through Saudi Arabia's sovereign wealth fund Public Investment Fund (PIF). This project will be by far the largest PV solar project awarded in Saudi Arabia to date, and also among the largest single-site PV projects in the world. The current world record for lowest PV tariff is $cents1.04kWh was achieved for the 600MW Fasiliyah PV IPP project.

Building on the results of the recent auctions in the region, it is expected that competitive bidding will continue its dominance over the other renewable energy policy schemes. Table 10 summarizes the current RE policies in Arab countries.

Table 10: RE policies in Arab countries

Country	Direct proposal Submission	Competitive Bidding	FiTs
Algeria		✓	
Bahrain		✓	
Djibouti	✓		
Egypt	✓	✓	✓
Iraq		✓	
Jordan	✓	✓	
Kuwait		✓	
Lebanon		✓	
Libya		✓	
Mauritania			
Morocco		✓	
Oman		✓	
Palestine	✓	✓	✓
Qatar		✓	
Saudi Arabia		✓	
Sudan		✓	FiT study for Dongola wind energy project-2019
Syria			✓
Tunisia		✓	
UAE		✓	
Yemen		✓	

3.3 Policy Framework Final Scores and Ranking

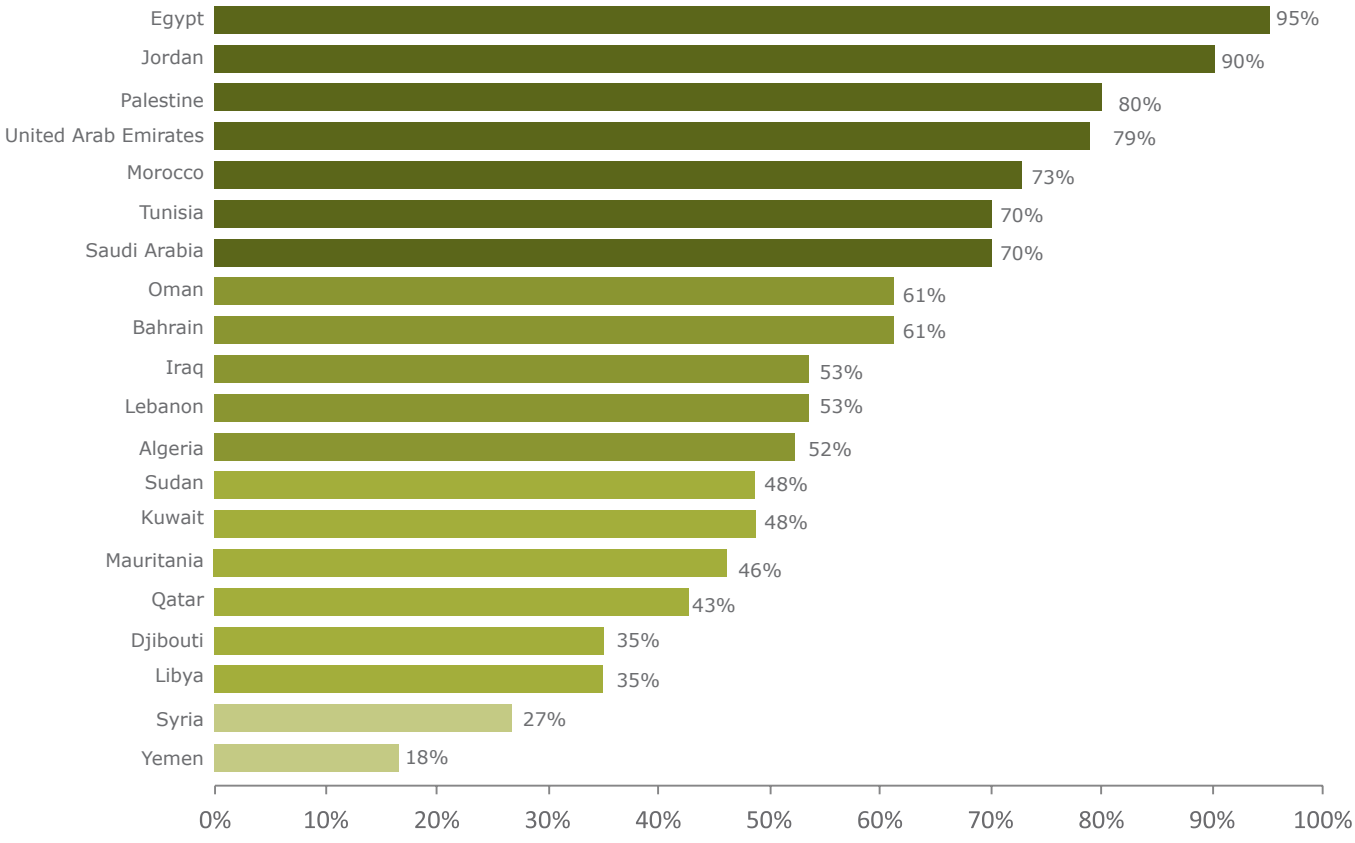


Figure 13: Countries ranking in policy framework dimension

4 Institutional Capacity

The Institutional Capacity category assesses each state's ability to design RE policies and to institutionally support the deployment of RE projects. Indeed, a strong institutional capacity is critical to ensure RE targets are met. The institutional capacity category investigates the following two segments: (1) RE institutions; (2) project support. Table 11 exhibits the two factors along with their four associated indicators.

Table 11: Institutional capacity factors and indicators

Category	Factors	Indicator	Score/Measuring Unit
Institutional Capacity	RE Institutions	Independent Regulator	Established by law; under establishment; nonexistent
		RE Agency	Established by law; under establishment; nonexistent
	Project Support	Resource Quality Assessment	Detailed wind atlas published and available to public; detailed solar atlas published and available to public
		Land Access	Land allocated for private development of large-scale wind projects; land allocated for private development of large-scale solar projects

4.1 RE institutions

4.1.1 Independent regulator

Electricity regulator has three main tasks: setting maximum and minimum electricity tariffs, establishing minimum quality-of-service standards, and specifying entry and exit conditions through licenses, permits, and concessions. For maximum efficiency, the electricity regulator should be independent to allow for setting transparent and cohesive regulatory frameworks for the power sector that is necessary to ensure a functioning, open and trustworthy power market for investors. In addition, the regulatory agency should ensure fair competition in the market and ensure consumers protection. Only eight Arab countries do not have an independent regulator. In countries where there is no independent regulator, national utility operators or transmission systems operators usually perform associated functions. It is worth noting that many regulators are subjected to political interference and to have their regulatory decisions relatively influenced by the government as they somehow act as advisory bodies to the government. Table 12 exhibits the existence of the independent regulator.

Table 12: Regulatory agencies in Arab countries

Country	Electricity Regulatory Agency
Algeria	Commission de Régulation de l'Electricité et du Gaz (CREG)
Bahrain	Nonexistent
Djibouti	Service des Réglementations de la Direction de l'Energie
Egypt	Egyptian Electric Utility and Consumer Protection Regulatory Agency (EgyptERA)
Iraq	Nonexistent
Jordan	Energy and Minerals Regulatory Commission (EMRC)
Kuwait	Nonexistent
Lebanon	Nonexistent
Libya	Department in the renewable Energy Authority of Libya (REAOL)
Mauritania	Autorité de Régulation Multisectorielle
Morocco	National Electricity Regulatory Authority (ANRE)
Oman	Authority for Electricity Regulation
Palestine	Palestinian Electricity Regulatory Council (PERC)
Qatar	Nonexistent
Saudi Arabia	The Electricity and Co-Generation Regulatory Authority (ECRA)
Sudan	Electricity Regulatory Authority (ERA)
Syria	Nonexistent
Tunisia	Nonexistent
UAE	Abu Dhabi Regulation and Supervision Bureau (RSB)
Yemen	Nonexistent

4.1.2 RE Agency

Typically, dedicated renewable energy agency is responsible for introducing and developing renewable energy technologies on a commercial scale. In addition, it will act as a central point for all activities that are concerned with RE development such as RE resource assessment, R&D, building demonstration projects, testing and evaluation of the different RE technologies. Moreover, it will be the technical arm for other agencies, such as electricity regulator, regarding all technical details like standards and codes for RE technologies. Lastly, RE agencies work towards training the skilled and qualified personnel for sustainable RE market. RE agencies can also act as counterparts in negotiating and coordinating donor agreements in countries receiving donor support for RE development. Table 13 summarizes the RE agencies in the Arab region.

Table 13: RE agencies in the Arab region

Country	RE Policy Maker (Dedicated RE Department or Dedicated Agency)	Other Key RE Institutional Stakeholders
Algeria	Ministère de l'Energie et des Mines (MEM) Ministère de l'Environnement et des Energies Renouvelables (MEER) Commissariat aux Energies Renouvelables et à l'Efficacité Energétique (CEREFE)	SharikatKahrabaTakateMoutajadida «SKTM», filiale du Groupe Sonelgaz Centre de Développement des Energies Renouvelables (CDER) Centre de Recherche en Technologies des Semi-conducteurs pour l'Energétique (CRTSE) Centre de Recherche et Développement de l'Electricité et du Gaz (CREDEG), Algerian Renewable Energy Company, (SHAMS)
Bahrain	Sustainable Energy Authority (SEA);	Electricity and Water Authority (EWA)
Djibouti	Direction of Energy at the Ministry of Energy in charge of Natural Resources	Agence Djiboutienne de Maîtrise de l'Energie (ADME)
Egypt	New and Renewable Energy Authority (NREA)	Egyptian Electricity Transmission Company (EETC)
Iraq	Green Tourism Unit within the Ministry of Tourism	Research Center for Energy and Environment under Ministry of Science and Technology Research Center under Ministry of Higher Education and Scientific Research (universities and institutes) Energy and Environment Research Center under Ministry of Industry
Jordan	Renewable Energy Department at the Ministry of Energy and Mineral Resources	- National Energy Research Center (NERC) - Energy and Minerals Regulatory Commission (EMRC) - Jordan Standards and Metrology Organization (JSMO)
Kuwait	No dedicated RE department or agency in place yet	Kuwait Institute for Scientific Research (KISR)
Lebanon	Lebanese Center for Energy Conservation (LCEC)	UNDP – Country Entrepreneurship for Distributed Renewables Opportunities CEDRO) and UNIDO – Decentralized Renewable Energy Power Generation (DREG) Projects; The Lebanese Solar Energy Society (LSES) Industrial Research Institute (IRI) National Council for Scientific Research (CNRS)
Libya	Renewable Energy Authority of Libya (REAOL)	General electricity company of Libya(GECOL) under the Ministry of Electricity and Renewable Energy Center for Solar Energy Research and Studies (CSERS)
Mauritania	Department of Electricity and Energy Management (DEME) at the Ministry of Petroleum, Energy and Mines (MPEM)	Agency for the Development of Rural Electrification (ADER) Multisectoral regulation Authority (ARM)
Morocco	Direction of Electricity and Renewable Energies at the Ministry of Energy, Mines, Water and Environment; Moroccan Agency for Solar Energy (MASEN); Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE)	Société d'Investissements Energetiques (SIE) Institut de Recherche en Energie Solaire et Energies Nouvelles (IRESEN) Centre National pour la Recherche Scientifique et Technique (CNRST)
Palestine	Palestinian Energy Authority (PEA) Palestinian Energy and Environment Research Centre (PEC)	Energy Research Centre (ERC) at An-Najah National University
Qatar	Qatar General Water and Electricity Corporation "KAHRAMAA"	Qatar Science and Technology Park (QSTP) Energy and Environment Research Institute (QEERI) Qatar Solar Technologies (QST)
Saudi Arabia	The Renewable Energy Project Development Office (REPDO) within the Ministry of Energy	King Abdallah City for Atomic and Renewable Energy (KACARE) Saudi Electricity Company (SEC) Saudi Aramco
Sudan	Renewable Energy General Directorate under Sudan Electricity Holding Company within Ministry of Energy and Oil	National Center for Energy Research (NCR)

Country	RE Policy Maker (Dedicated RE Department or Dedicated Agency)	Other Key RE Institutional Stakeholders
Syria	National Energy Research Center (NERC)	Scientific Studies and Research Center Higher Institute for Applied Sciences and Technology Research Centers in universities; mainly Damascus University Industrial Research and Testing Center
Tunisia	Agence Nationale pour la Maîtrise de l'Energie (ANME)	Centre de Recherche et des Technologies de l'Energie (CRTEN)
UAE	Ministry of Climate Change and Environment	MASDAR
Yemen	Renewable Energy Department within the Ministry of Electricity and Energy	Renewable Energy and electronic design Centre, University of Science and Technology Technical Centre for Training and registration – Dhahban, Public Electricity Corporation (PEC)

4.2 Project Support

4.2.1 Detailed Resource Mapping

Wind and solar atlases are tools that quantify the country's wind and solar resources and its geographical distribution as a first step towards accelerating the use of more wind and solar energy across the country. Both types aim to support the development of progressive national policies for promoting renewable energy. In addition, solar and wind atlases are of vital importance for establishing a sound business case to identify and assess the technically feasible, commercialized and economically competitive electricity generation potential of renewable resources.

Investors are always seeking to reduce risks associated with renewable energy projects. Accurate and reliable data on wind speed and solar irradiation are crucial in the early project phases to estimate the anticipated energy production and the return on investment. Moreover, resource mapping and zoning exercises help to identify priority areas for different technology options and represent the first step towards projects site selection, technology preference and design optimization.

Table 14 exhibits the published wind and solar atlases in the Arab region. Most of the documents are easily accessible. However, results are not always available in electronic format for easier processing by developers to produce reliable energy yield predictions.

Table 14: Detailed resource mapping for Arab countries

Country	Wind Atlas Published	Solar Atlas Published
Algeria	Yes	Yes
Bahrain	Yes	Yes
Egypt	Yes	Yes
Iraq	Ministry of Science and Technology installed 9 towers to measure the wind potential	Yes
Jordan	Yes	Yes
Kuwait	Yes	Yes
Lebanon	Yes	Yes
Libya	Yes	Yes
Mauritania	No	Yes
Morocco	Yes	Yes
Oman	Yes	Yes
Palestine	Yes	Yes
Qatar	Mapping of resources is ongoing	Yes
Saudi Arabia	Yes	Yes
Sudan	Yes	Yes
Syria	Yes	Yes
Tunisia	Yes	Yes
UAE	Yes	Yes
Yemen	Yes	Yes

4.2.2 Land Access

Based on the suitability maps and solar and wind atlases, countries should set priorities for lands available for renewable energy development in different regions within the country. Access to land with high quality resources is among the most appealing elements that attracts investments in RE. Land access should be facilitated without entailing excessive administrative burdens for developers. Transparent regulations and standard templates for land allocation agreements have proved to be successful to in shortening the time needed and securing a smooth land allocation process. In all cases, developers must start very early the process of land acquisition from either private or state-owned entities.

Several Arab countries have allocated specific areas for projects under different policy schemes. In Egypt, the New and Renewable Energy Authority (NREA) is responsible for the allocation of government-owned plots of land to developers wishing to establish solar or wind projects. Nearly 7,650 square kilometer have been assigned for NREA to establish renewable energy projects by itself or by availing the land to investors. Wind projects can make use of the land for 20 years, and solar projects for 25 years. In both cases, land is leased to developers on a usufruct basis established at 2% of the energy sold.

In Oman, an area of 150 square kilometer is already allocated for the renewable energy projects. The lands are located along the windy and sunny Omani coast and Arabian Sea. It is planned that the lands will accommodate both onshore wind and solar PV farms with a combined capacity of 1.3 GW.

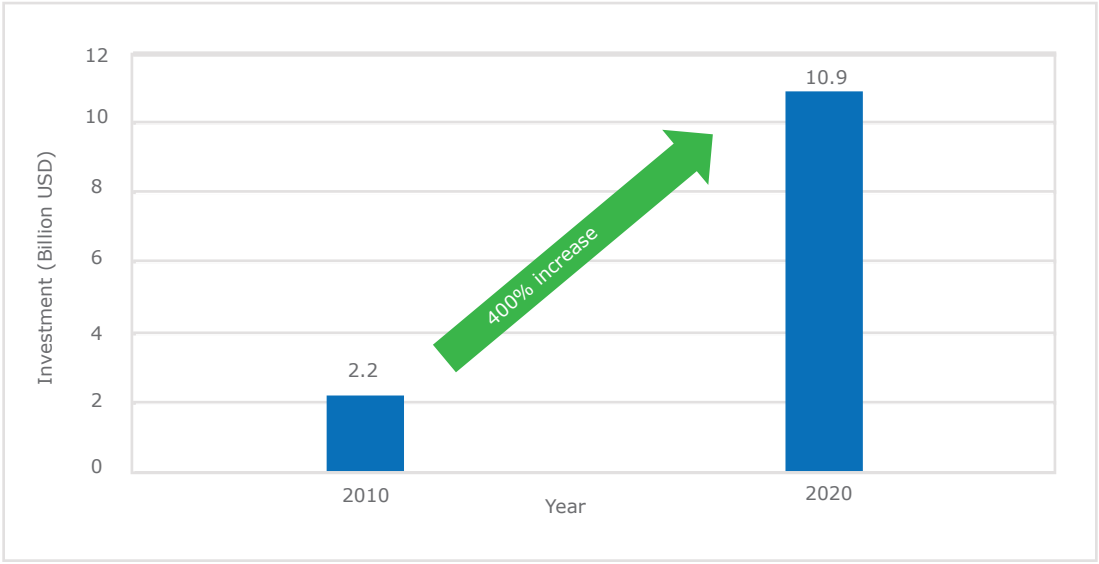
In 2021, Saudi Arabia has announced the allocation of two plots with a total area of 12 million square meters for the development of two renewable energy plants. A project to build a plant with a capacity of 600 megawatt has been revealed.

5 Finance and Investment

Renewable energy investment showed an incremental increase in the last decade. The annual investment leapt form 2.2 billion United States Dollar (USD) in 2010 to 10.9 billion USD in 2020[16] , representing nearly 400% increase, and from 4 countries in 2010 that had a renewable capacity above 50MW, to nearly all Arab countries in 2020. These investment figures are for utility-scale renewable and small-scale solar projects and exclude any investments in large hydropower projects. The falling cost of renewable energy, different supporting schemes, and excellent renewable energy potential that Arab countries have, facilitated this significant boost.

With the ambitious renewable energy targets, the collected experience from implementing several utility scales projects, and the commercial viability of renewable energy projects, the investments in power sector in the Arab region are expected to keep growing steadily.

Figure 14: Increase in RE investment 2010-2020



The Finance and Investment category assessed by one major factor that has two indicators: the level of financial support provided by the state to RE projects. Factor and indicators are summarized in Table 15.

Table 15: Finance and investment evaluation factors and indicators

Finance and Investment		
Factors	Indicator	Score/Measuring Unit
Financial Support	Fiscal and financial Incentives	Number of fiscal and financial incentives for RE projects
	Mechanism to cover incremental costs of RE	Mechanism established by law; sources of financing are clear; disbursement procedure is clear; Fund is operational

[16] Source Renewables Global Status Report 2021, REN21

5.1 Financial Support

5.1.1 Fiscal and Financial Incentives

Fiscal incentives can have many forms. Starting from accelerated depreciation and tax credits to tax exemptions. Attractive fiscal -tax- incentives can influence to great extent the decision made by the investors. Policy makers consider fiscal incentives as complementary tools to support a larger renewable energy policy and financing portfolio. Table 16 shows an overview of various tax rates throughout the region.[17]

Table 16: Tax rates in the Arab region

Country	Corporate Tax Rate (%)	Withholding Tax on Interest (%)	Withholding Tax on Dividends (%)
Algeria	23[18]	10	15
Bahrain	No corporate tax for most companies in Bahrain[19]	0	0
Egypt	22.5[20]	20[21]	5-10
Iraq	15[22]	15	0
Jordan	20[23]	5-10	0
Kuwait	15	0	0-15
Lebanon	17	10	10
Libya	20[24]	5	0
Morocco	10-31	10	15
Oman	12[25]	0	0
Palestine	15-20	10	10
Qatar	10[26]	5	0
Saudi Arabia	20[27]	5	5
Sudan	10-35	-	-
Syria	28[28]	7.5	0
Tunisia	25[29]	0-20	0-10
UAE	0[30]	0	0
Yemen	20[31]	10	10

[17] Source: Corporate tax rates from KMPG website, WHT on interest and dividends from PWC website.

[18] Rate of construction activities. Special tax rules for hydrocarbon sector.

[19] 46% for oil companies.

[20] 40.55% oil and gas companies.

[21] For non-resident.

[22] 35% for hydrocarbon sector.

[23] 24% for electricity generation.

[24] In addition to 20%, Jihad tax is levied (4% of profits).

[25] 55% sale of petroleum.

[26] Applicable only to entities with foreign investors and to the extent of their profit sharing ratio, 35% oil and gas operations.

[27] Payable by non-Saudi/non-Gulf Cooperation Council (GCC) shareholders50-85% hydrocarbon, 20% for natural gas.

[28] top corporate tax rate, a temporary reconstruction fee of 5% applies to all direct and indirect taxes except payroll tax.

[29] A favorable 13.5% rate applies for some selected sectors.

[30] 55% oil and gas companies, 20% foreign banks.

[31] Oil, cigarettes and international call services companies is 35%, for mobile companies is 50%.

Another type of tax that could greatly influence the cost of renewable energy projects is the Value Added Taxes (VAT). Recently, many gulf countries introduced or raised the rate of VAT. Bahrain, Saudi Arabia, UAE are the first gulf countries to implement VAT. Oman introduced 5% VAT in 2021 and it is expected from Kuwait and Qatar to follow the other gulf countries. VAT and customs duties have a significant impact on the initial investment and construction stages.

Arab countries apply exemptions from customs duties for renewable energy equipment on a wide scale. For example, it can be found in Egypt, Jordan, Libya, Palestine, Sudan, Tunisia, Mauritania, and Morocco. Countries have different regulations to apply customs duty exemption. In Egypt, to get the exemption, the importer must obtain a certificate from NREA verifying that imported equipment is to be used for RE projects to reduce the custom duties to 2% and reducing the VAT to 5%. In Palestine, investors need prior authorization from the Israeli authorities, something that has shown to be complicated to obtain. Tunisia has allowed duty exemptions for renewable energy components that do not have locally manufactured substitutes. In Morocco, large-scale investment projects over Moroccan Dirham (MAD) 200 million (approximately 21.3 million USD) can enjoy duty exemptions, and value-added tax exemption on all imported equipment, materials, and tools.

5.1.2 RE Funds

To facilitate renewable energy projects financing at favorable conditions, Several Arab countries have established renewable energy funds. The main target for these funds is to promote renewable energy and energy efficiency technologies through financing different programs. Typically, these funds leverage financial resources from various national and international sources. At least nine out of 20 countries have established RE funds. An example of a successful fund is JREEEF in Jordan

Table 17: Examples of RE & EE energy funds in the Arab region

Algeria	Fond National pour la Maitrise de l'Energie et pour les Energies Renouvelables et de la Cogénération (FNMEERC)
Egypt	Several green banking facilities supported by international finance institutions (IFIs) and the Central Bank of Egypt, such as the Green Environment Financing Facility (GEFF) with a €140 million investment Issuing Green Bond with a US$ 750 million issued by the Ministry of Finance.
Jordan	Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF) Sources of financing: - Annual budget allocations - Foreign donations
Lebanon	National Energy Efficiency and Renewable Energy Action (NEEREA) established by Central Bank of Lebanon in 2010 Sources of financing: - EUR 12 million from EU grant for RE projects - Central Bank of Lebanon (low interest soft loans)
Mauritania	Universal access to services fund. Sources of financing: - Taxes on Telecommunications companies
Morocco	Energy Development Fund (EDF) with a total capital of USD 1 billion Sources of financing: - USD 200 million from Hassan II fund - USD 300 million from UAE - USD 500 million from Saudi Arabia
	Renewable energy fund (FER) established by SEI Sources of financing: - SIE contribution as equity investments in new and established companies focusing on wind projects
Palestine	Revolving Fund Source of finance: - Start-up capital from donor institutions
Syria	Fund for residential solar water heaters Source of finance: - Fund provided by the Ministry of Electricity
Tunisia	Fund for Energy Transition (FTE). Sources of financing: - Revenues from taxes on the first registration of cars and import or manufacturing of air conditioners according to the Law No 2005-2234 (2005) - Financial savings achieved as a result of EE activities - Donations
UAE	Abu Dhabi Fund for Development also sets aside USD 350 million in soft loans for RE projects in developing countrie
	Dubai Green Fund with AED 100 billion Source of financing: - Founding investors from Dubai, with additional investment from the private sector, international banks and large investment companies

6 Carbon Emission Targets

Currently, the world is facing the threat of climate change. Most Arab countries pledged to reduce their carbon emissions. These pledges were made through the submission of NDC or INDC. This chapter assesses the steps that have been taken to reduce carbon emissions from energy sectors. In addition, the chapter presents data about the emissions released from power generation activities.

This section is newly introduced to the AFEX and aims to draw attention to the emissions produced by the energy sector in the Arab region and to assess these emissions. The carbon emissions and actions category is assessed by one major factor that has three indicators: The grid emission factor, existence of NDC, and target for carbon reduction. Factor and indicators are summarized in Table 18.

Table 18: Carbon emission and monitoring factors and indicators

Carbon Emission and Monitoring		
Factors	Indicator	Score/Measuring Unit
Carbon Emission and Monitoring	Grid Emission Factor	The value of Grid emission Factor
	NDC, INDC	The existence of NDC or INDC submitted to UNFCC
	Carbon Reduction Targets	Target to reduce carbon emissions in the Power sector

6.1 Grid Emission Factor

Grid emission factor is a value that expresses the amount of carbon produced when electricity is consumed. The unit can be tCO2/ Megawatt hour (MWh) or gCO2/kWh. There are several ways to calculate grid emission factor. However, since 2012, many international financial institutions (IFIs)—including multilateral development banks have been working together through the "Technical Working Group of the International Financial Institutions (IFI TWG)" to harmonize project-level greenhouse gas emissions accounting. In 2015 at COP21, the IFI TWG released harmonized GHG accounting methodologies for different applications such as renewable energy, energy efficiency, and transport sector projects. The combined margin grid emission factor (gCO2/kWh) was selected to assess the Arab countries. Table 19 presents the grid emission factors for the Arab countries[32].

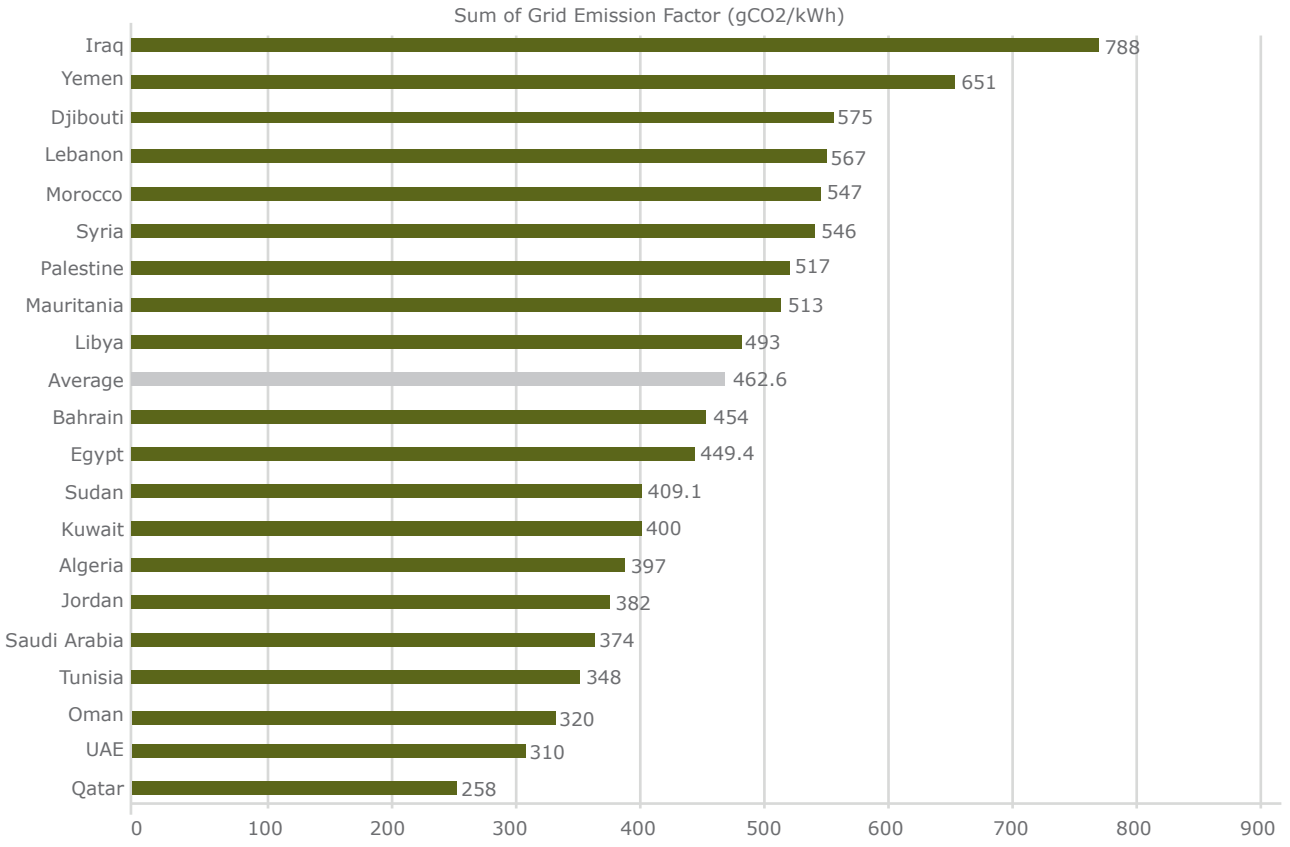
The highest country in this indicator is Iraq which depends on diesel fuel and has high distribution and energy losses. Followed by Djibouti, Syria and Yemen as they have similar situation of high transmission and distribution losses. The lowest country is Qatar, followed by Sudan that has high shares of hydropower in the energy mix, then UAE. The average emission factor for the region is 501 gCO2/kWh. This is considered high, especially if compared to the average value of EU that is well below 300 gCO2/kWh[33].

[32] Source: IFI TWG - List of methodologies | UNFCCC
[33] https://www.eea.europa.eu/ims/greenhouse-gas-emission-intensity-of-1

Table 19: Grid emission factor for Arab countries

Country	Grid Emission Factor (gCO_2/kwh)
Algeria	397
Bahrain	454
Djibouti	575
Egypt	449.9
Iraq	788
Jordan	382
Kuwait	400
Lebanon	567
Libya	493
Mauritania	513
Morocco	547
Oman	320
Palestine	517
Qatar	258
Saudi Arabia	374
Sudan	409.1
Syria	546
Tunisia	348
UAE	310
Yemen	615
Average	462.6
EU average	230.7

Figure 15: Grid emission factor for Arab countries



6.2 NDCs and Carbon Emission Targets

After Paris agreement, each country was requested to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve. NDCs represent the efforts that each country will commit to execute to reduce national emissions and adapt to the impacts of climate change. NDCs are submitted every five years to the UNFCCC secretariat.

Arab countries are prone to threats that climate change impose such as desertification and increasing temperature. Responding to these threats, most of Arab countries submitted their NDCs to explain their intended measures to reduce carbon emissions. Table 20 summarizes the Arab countries that submitted NDCs and the carbon reduction targets if existsing [34].

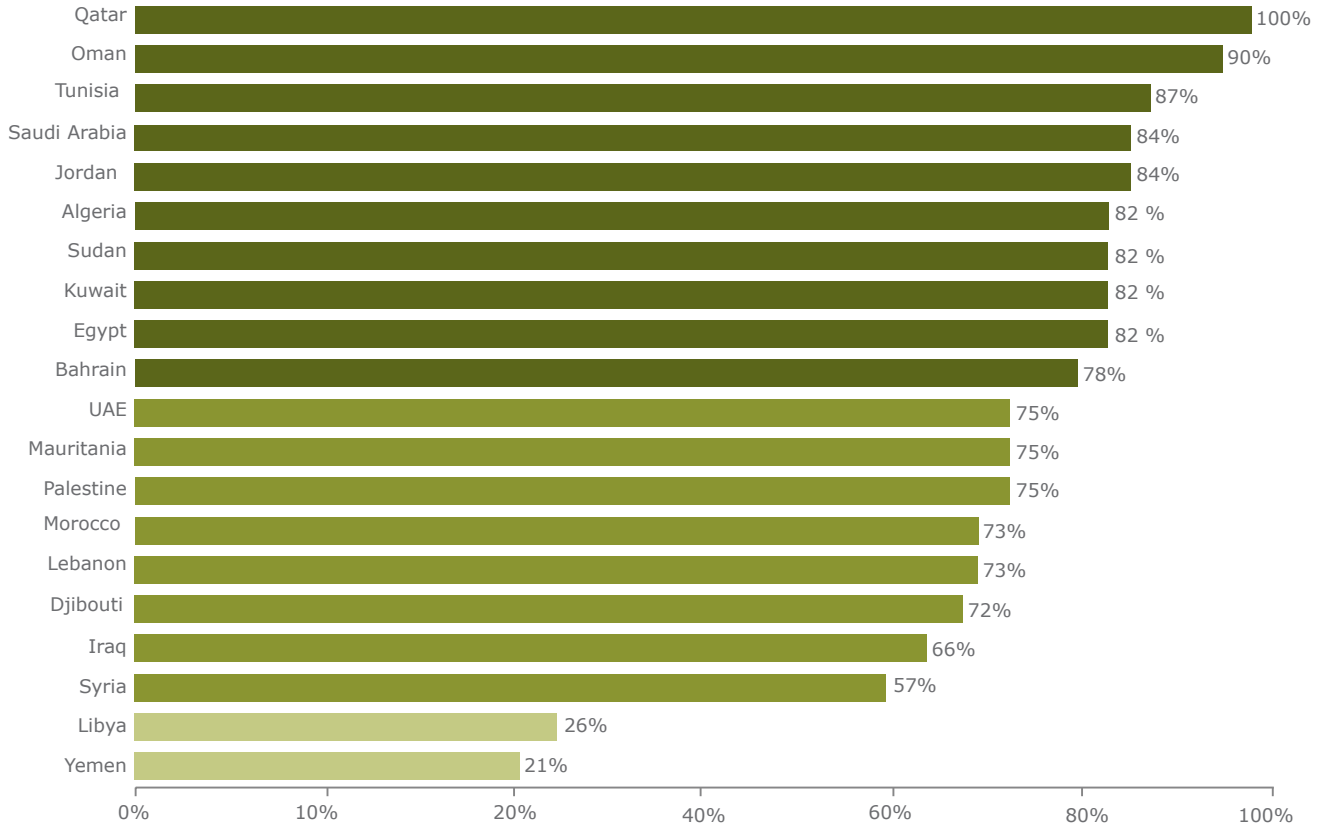
Table 20: Arab countries NDC carbon reduction targets

Country	NDC	Carbon reduction target
Algeria	Submitted in 2015	Reduction of greenhouse gases emissions by 7% to 22% (if international support is provided), by 2030, compared to a business as usual -BAU- scenario, reducing the global consumption of energy by 9% by 2030
Bahrain	Submitted and updated in 2021	No carbon reduction target, Reduction of final energy consumption by 6% by 2025
Djibouti	Submitted in 2015	Reduction of GHG emissions by 40% by the year 2030, representing close to 2 Mt of CO2e, compared to projections for that year according to the business-as-usual scenario.
Egypt	Submitted in 2017	NA
Iraq	Submitted in 2021	The expected carbon reduction is between 1-2% and 15% is international support is provided
Jordan	Submitted and updated in 2021	Reduction of GHG emission by 31% (was 14% in the first NDC) by 2030
Kuwait	Submitted and updated in 2021	Avoidance of emitting 7.4% of its total GHG emissions in 2035
Lebanon	Submitted and updated in 2020	Lebanon commits to unconditionally increase its greenhouse gas emission reduction target relative to the Business-as-Usual (BAU) Lebanon commits to unconditionally increase its greenhouse gas emission reduction target relative to the Business-as-Usual (BAU) scenario from 15% (first draft) to 20%, and conditionally increasing its GHG emission reduction target relative to the BAU scenario from 30% to 31%
Mauritania	Submitted and updated in 2021	NDC forecasts a net reduction in GHG emissions of 11% in 2030 compared BAU scenario. With more substantial support, Mauritania could ensure its carbon neutrality, going up to a conditional 92% reduction compared to the BAU.
Morocco	Submitted and updated in 2021	Emissions reduction for the year 2030 by 26,119.2 Gg Eq CO2, or 18.3% from the base line emissions. A conditional target of 45.5% is presented in the updated NDC.
Oman	Submitted and updated in 2021	Reduction of GHG emissions by 7% in 2030, compared to the Business-As-Usual (BAU) scenario, which is predicted at about 125.254 MTCO2e. 4% of the GHG reduction commitment will be based on national efforts, and the remaining 3% would necessitate international support
Palestine	Submitted and updated in 2021	17.5% emissions reduction by 2040 relative to the BAU levels under a scenario where the Israeli occupation continues (Status-quo Scenario) and 26.6% emissions reduction by 2040 under a scenario where the Israeli occupation ends (Independence Scenario)
Qatar	Submitted and updated in 2021	Reduction of GHG by 25% by 2030 compared to the BAU scenario
Saudi Arabia	Submitted and updated in 2021	The updated NDC aims at reducing, avoiding, and removing GHG emissions by 278 million tons of CO2eq annually by 2030, with the year 2019 designated as the base year.
Sudan	Submitted and updated in 2021	Avoiding GHG emissions by 6 million tons of CO2eq annually by 2030 from the energy sector
Syria	Submitted in 2018	NA
Tunisia	Submitted and updated in 2021	Mitigate greenhouse gas emissions by 45% by 2030, compared to its 2010 level.
UAE	Submitted in 2015	NA

[34] Source: all NDC can be found at interim NDC registry Home (unfccc.int)

6.3 Carbon Emission and Monitoring Final Scores and Ranking

Figure 16: Countries ranking in Carbon emission and monitoring dimension



Arab Future Energy Index

AFEX 2023

Energy Efficiency

Executive Summary

AFEX EE 2021 exhibits the efforts and progress achieved by Arab countries to develop and implement their energy efficiency strategies and action plans (e.g., NEAPP). In addition, it also assesses the current status quo for energy consumption and energy and electricity subsides.

Arab countries managed to reduce the money spent on subsidies except for Iraq. However, Arab countries are still spendings considerable number of financial resources. For example,75 billion USD were spent from only nine Arab countries in 2020. For electricity subsides, Bahrain, Libya, Qatar, Saudi Arabia, and UAE reduced the electricity subsides dramatically from 2010 to 2020. Algeria is the only country that has increased of the amount of electricity subsidies.

Arab countries electricity prices vary greatly. In residential sector (considering monthly consumption of 500kWh), the electricity prices fluctuate from 0.2 ¢$/kWh in Syria to 30.95 ¢$/kWh in Djibouti which is nearly 20 folds more. The average price in the region is 7.11 ¢$/kWh. For industrial sector (considering 30,000 kWh monthly consumption), the electricity prices stretch from 0.33 ¢$/kWh in Sudan to 25.32 ¢$/kWh in Djibouti. The average price for industrial sector is 9.26 ¢$/kWh which is higher than the residential sector.

Thirteen Arab countries have national energy strategies. Most of the strategies foresee the national energy system until 2030. Only Oman set the plan for 2040. Several national strategies in Algeria, Bahrain and Egypt focus on energy efficiency in buildings, appliances, and lighting. Jordan focuses on utilizing the local resources and increase generation efficiency.

Eleven Arab countries have ongoing adopted NEEAP while Lebanon has its new NEEAP under development. NEEAP usually has a shorter timeline than national energy strategy, however Algeria, Morocco, and Dubai have long term NEEAP that is ongoing until 2030.

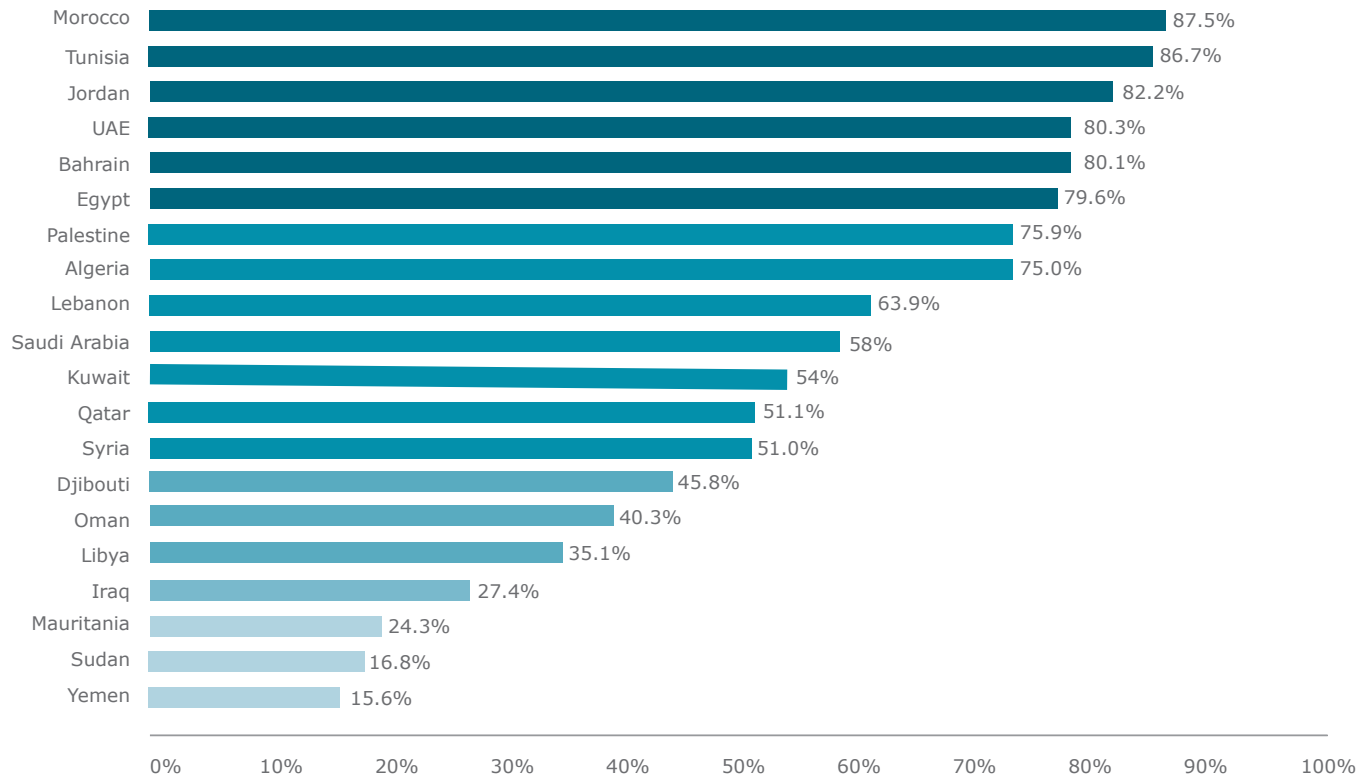
Thirteen Arab countries have mandatory minimum energy performance standards (MEPS), and two countries have a voluntary MEPS policies. Air conditioning has the largest share of MEPS policy across Arab countries, due to the hot weather that requires turning air conditioning units on for long periods of time. For Energy efficiency standards and labels, twelve countries have mandatory energy labels policy while one country has a voluntary scheme. As in MEPS, air conditioning has the largest share of energy label policy across Arab countries.

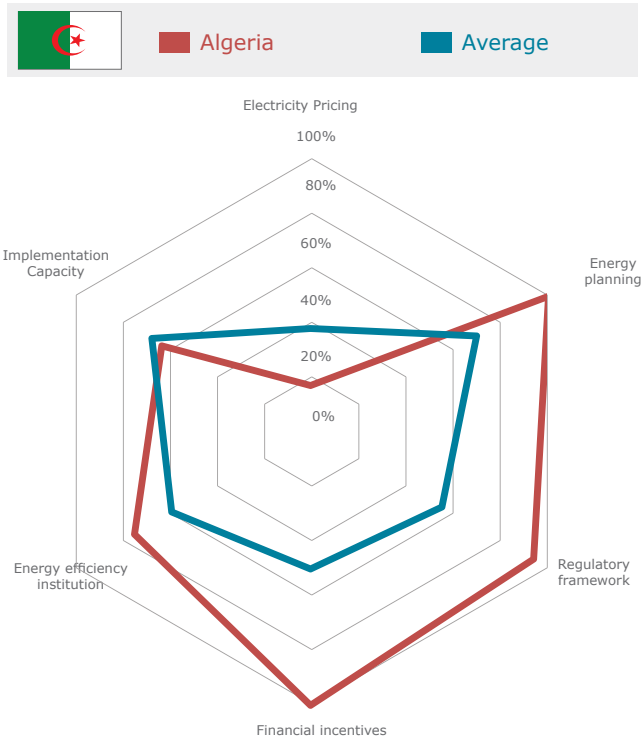
According to International Energy Agency (IEA), industrial sector is the most energy consuming sector in the Arab region with share of 29% in the total final consumption (TFC). Unfortunately, the majority of Arab countries still do not have comprehensive industrial EE policies. Only six countries have energy efficiency policies for industrial sector.

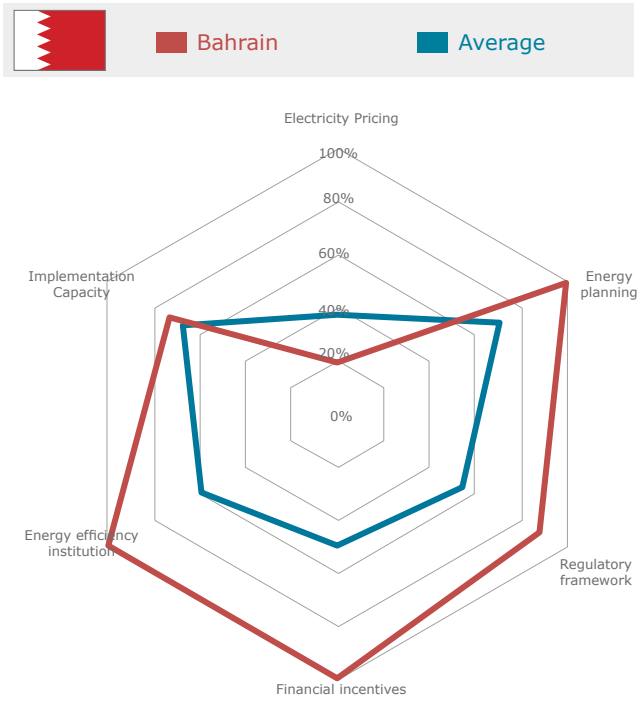
Although Arab countries are adding considerable amounts of renewable energy capacities each year, natural gas and oil are still the largest sources for total energy supply (TES) in the Arab regions. In 2019 and according to IEA, natural gas and oil have 59% and 40% share in total energy supply, respectively. For electricity generation, natural gas was the largest fuel used with a share of 72% followed by oil with a share of 25%. Conventional power generation technologies release a huge amount of carbon emissions. Electricity and heat generation were responsible for 39% of the total carbon emission in the Arab region. The majority of Arab countries have set targets to increase renewable energy shares, increase generation efficiency, reduce transmission and distribution losses, and consequently decrease carbon emission from the electricity sector.

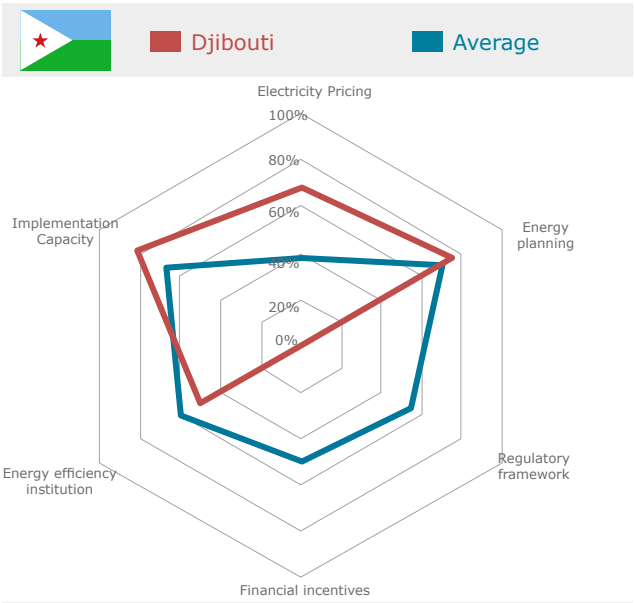
Ten Arab countries have established financing mechanisms to secure sustainable and effective implementation of energy efficiency programs. Such established funds are intended to shift fuel subsidies into EE incentives and to decrease carbon emissions and to reduce reliance on fossil fuels. While many countries across the world have adopted fiscal incentives for EE investments, few countries in the Arab region offer tax incentives for such investments.

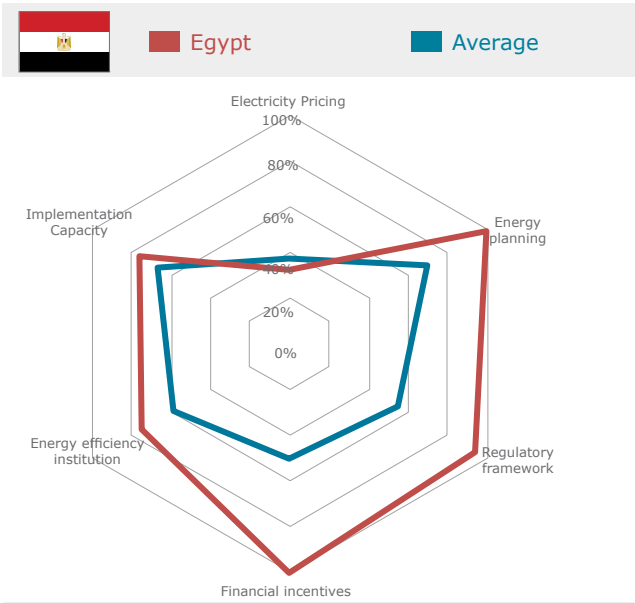
Figure 17: AFEX EE final ranking

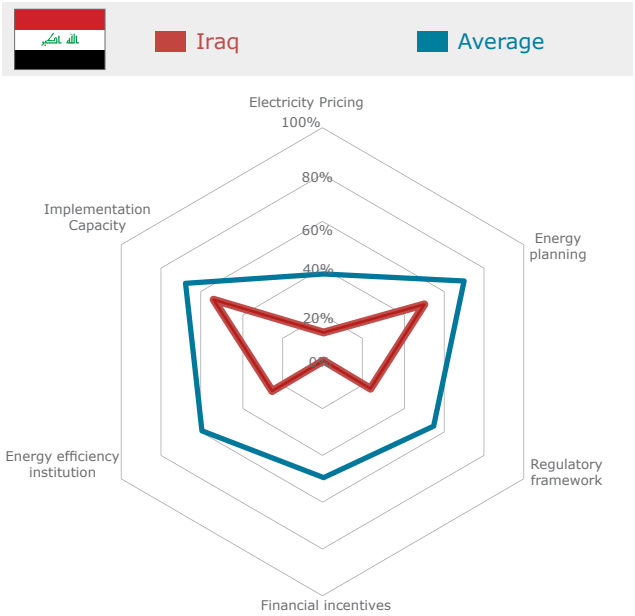


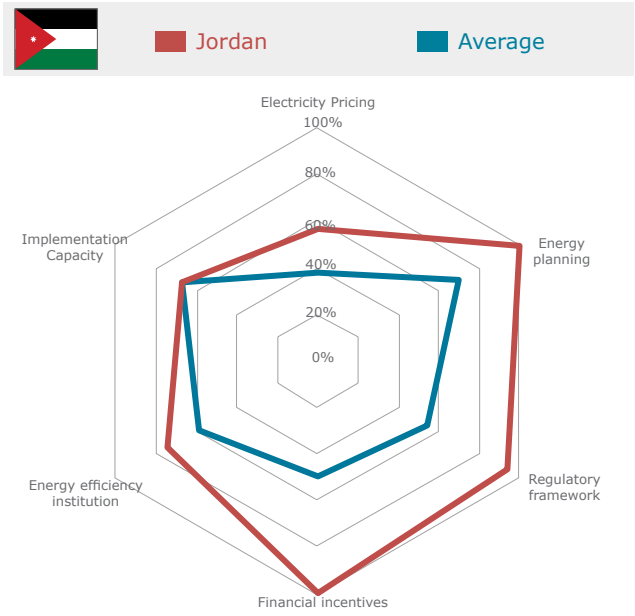


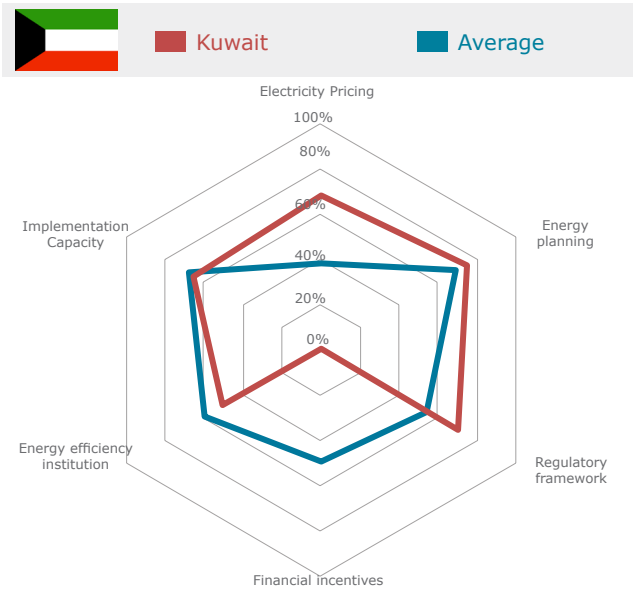


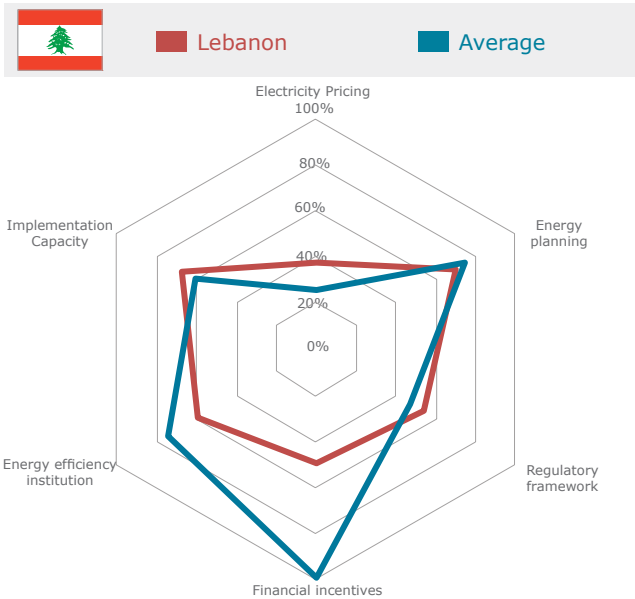

Djibouti
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

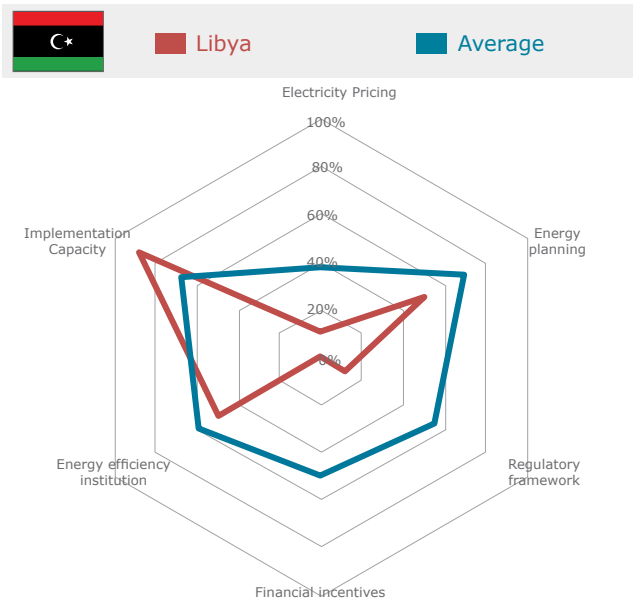

Egypt
Average
Electricity Pricing
100%
80%
60%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

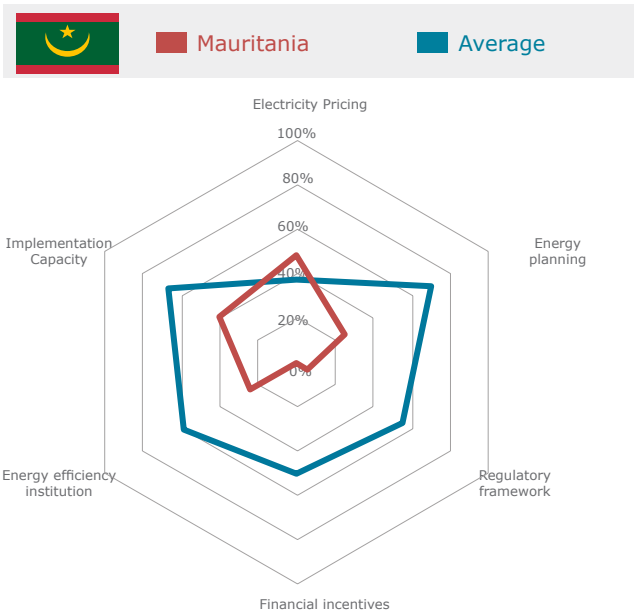

Iraq
Average
Electricity Pricing
100%
80%
60%
40%
20%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

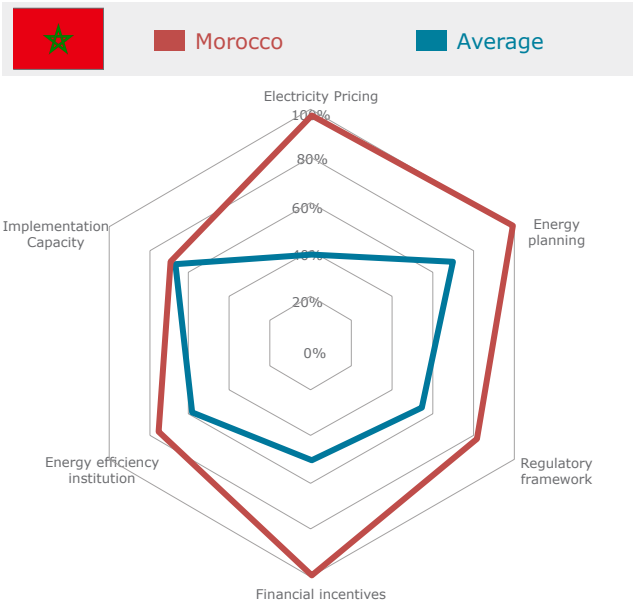

Jordan
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

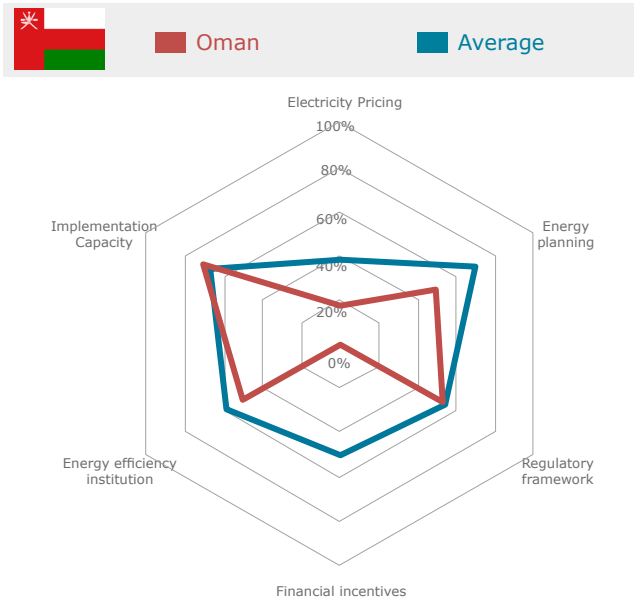

Kuwait
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

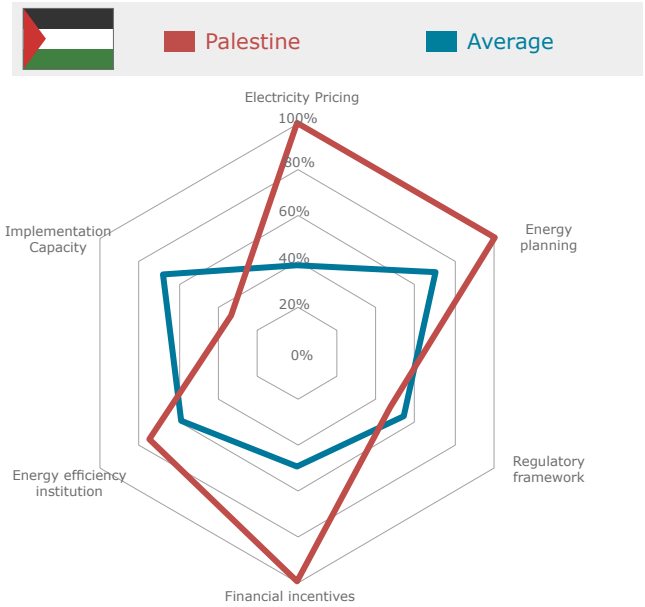

Lebanon
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

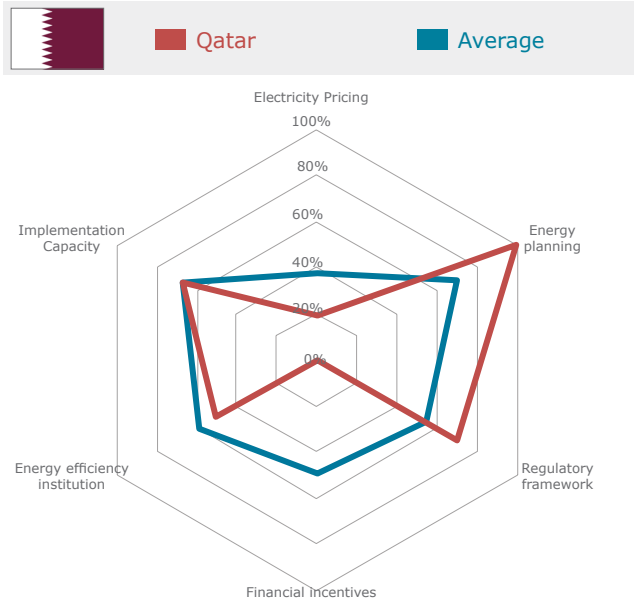

Libya
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

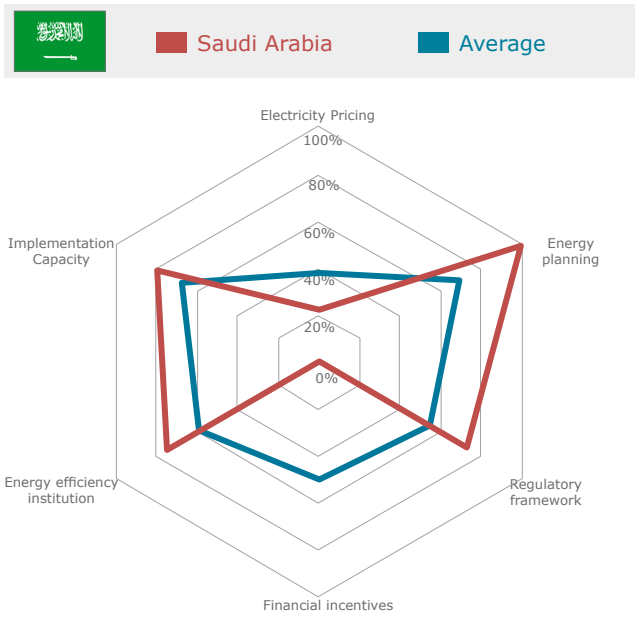

Mauritania
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

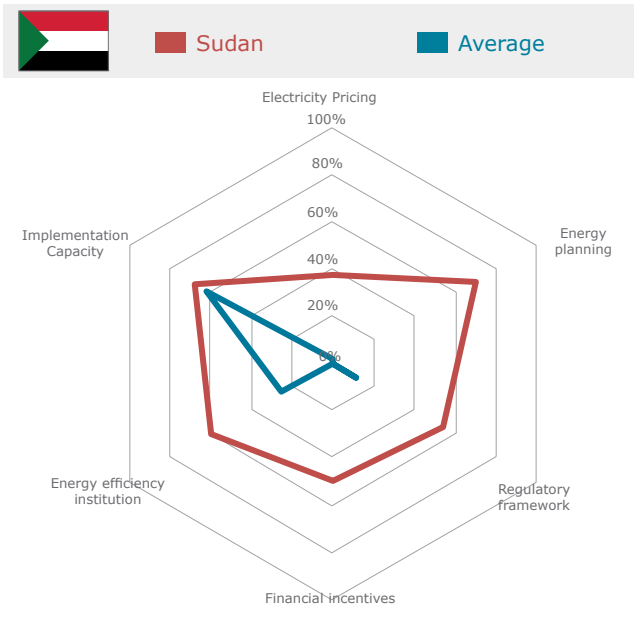

Morocco
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

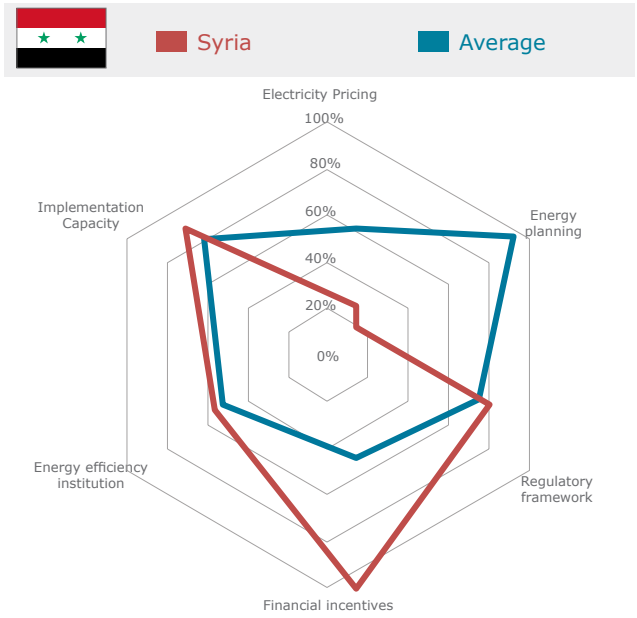

Oman
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

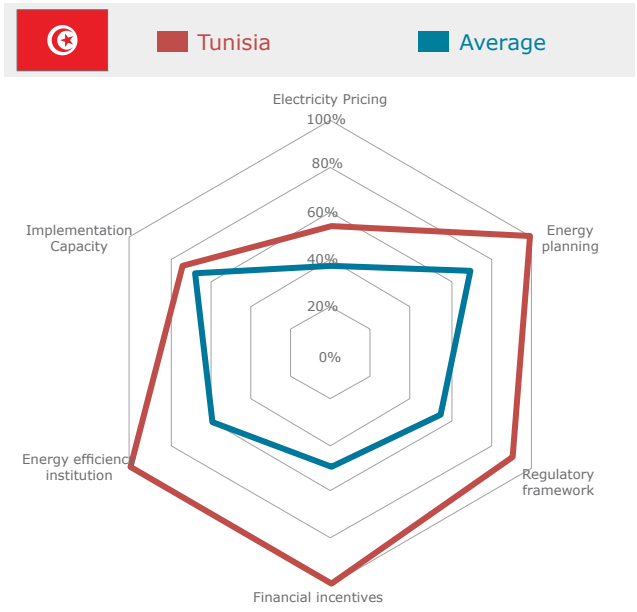

Palestine
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

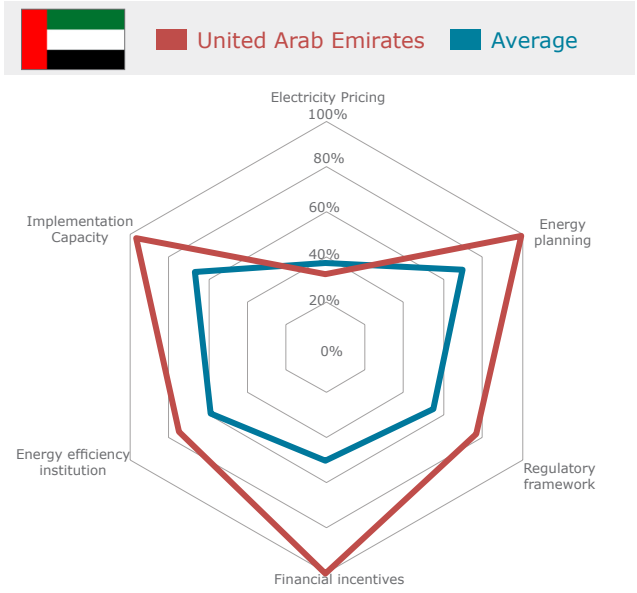

Qatar
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

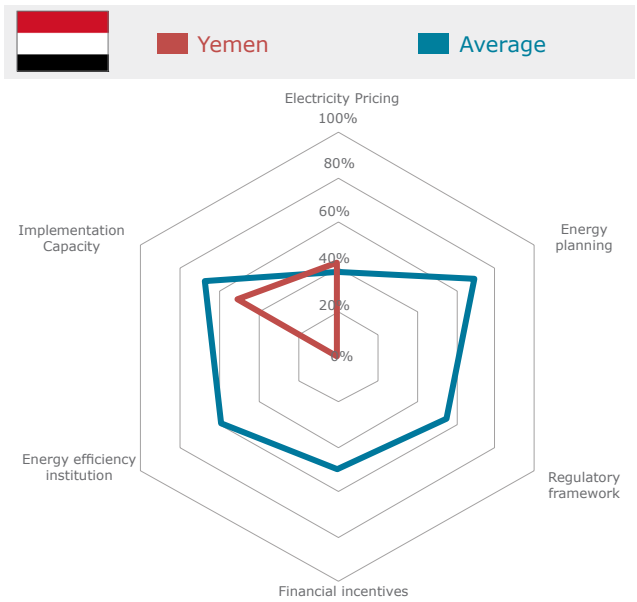

Saudi Arabia
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity


Sudan
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity


Syria
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity


Tunisia
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity


United Arab Emirates
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity


Yemen
Average
Electricity Pricing
100%
80%
60%
40%
20%
0%
Energy planning
Regulatory framework
Financial incentives
Energy efficiency institution
Implementation Capacity

1 Introduction

The Arab Future Energy Index – Energy Efficiency (AFEX-EE) is the first Arab index dedicated to monitoring and analyzing the energy efficiency competitiveness in the Arab region and offers both quantitative and qualitative analysis of the energy efficiency markets in 20 Arab countries. The various energy efficiency indicators utilized in the AFEX aim to support Arab countries in developing and implementing more effective energy efficiency policies and strategies as well as to evaluate existing energy efficiency institutions, policies, trends and infrastructure in the Arab region in order to encourage continuous improvement in the energy efficiency markets. Furthermore, the AFEX monitors the progress of Arab countries toward meeting both their short-term and long-term EE objectives and targets.

1.1 Objectives

AFEX Energy Efficiency is a policy assessment and benchmarking tool that aims to provide a comprehensive assessment of the current state of energy efficiency (EE) markets and quality of EE governance in the Arab region. The assessment is based on compilation and analysis of detailed country-specific data, according to the set of predefined indicators listed in Table 21. AFEX Energy Efficiency covers major sectors of the economy: residential, industrial, tertiary, transport, and utility. AFEX Energy Efficiency aims to:

- Provide a comparative overview and comprehensive assessment of the current state of EE markets in the Arab region
- Benchmark each country's performance in EE
- Provide in-depth analysis of the quality of EE governance in the region
- Highlight developments and progress made by each country towards EE
- Identify areas for possible intervention at the regional level to support EE efforts

1.2 Scope of Assessment

The conceptual framework of AFEX Energy Efficiency is presented in Table 21. It consists of three evaluation categories relating to the index's objectives and scope of assessment:

1. Energy Pricing: assesses the current energy and electricity subsidies and electricity pricing for residential and industrial sectors.

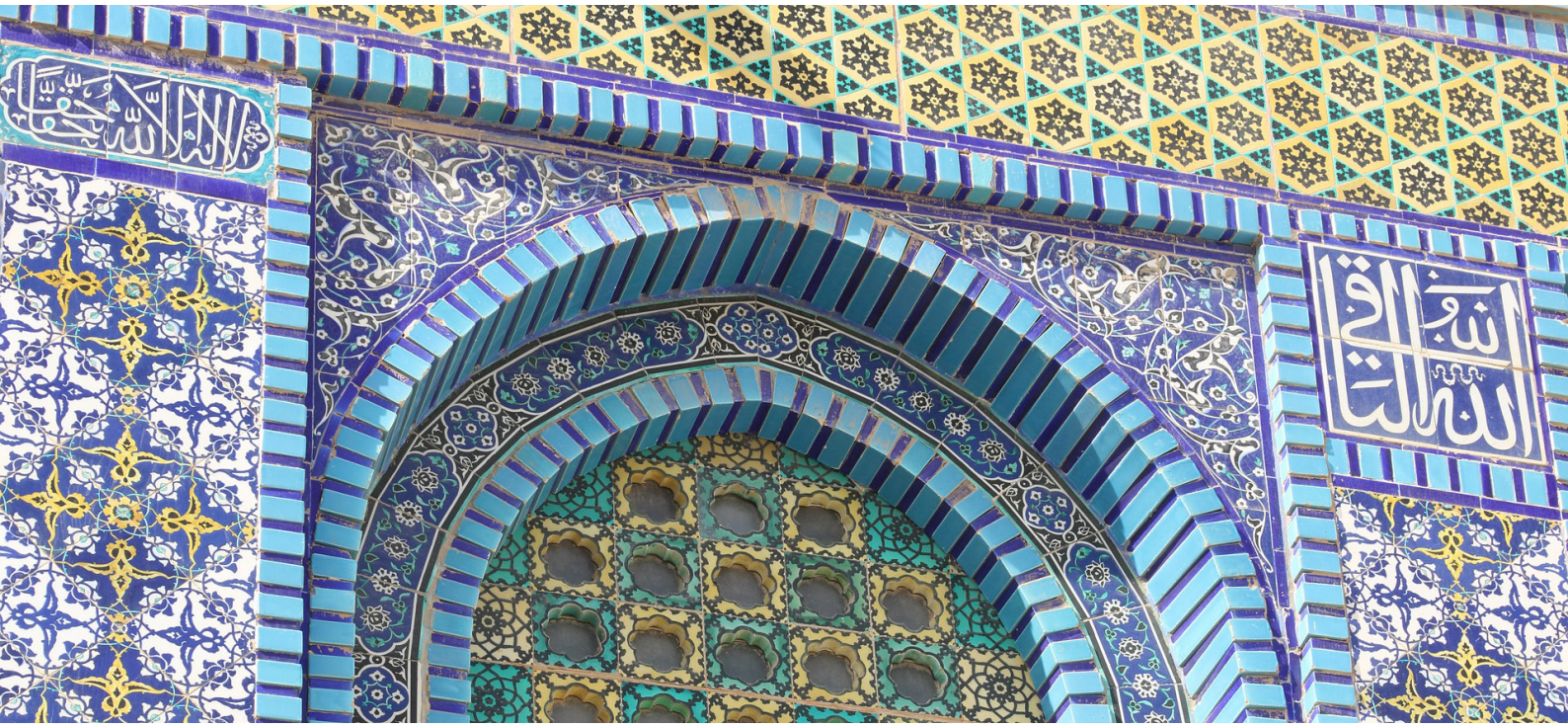
2. Policy Framework: assesses states' use of policy frameworks and level of commitment to overcome market, social, and political barriers to EE by formulating and adopting strategies, policies, and target-based action plans.

3. Institutional Capacity: assesses the institutional capacity to design, implement, and evaluate EE policies.

Three evaluation categories are broken into six factors, which are further divided into seventeen quantitative and qualitative indicators. Table 21 shows the selected factors and indicators.

Table 21: AFEX EE factors and indicators

Category	Factors	Indicator	Score Measuring unit
Electricity pricing and subsidy	Electricity pricing and subsidy	Amount of subsidy in 2020	Subsidy % of Gross Domestic Product (GDP)
		Electricity prices for residential and industrial sectors	Electricity prices in USD/kWh
Policy Framework	Energy Planning	Energy strategy with long-term EE objectives	Officially adopted; nonexistent
		National Energy Efficiency Action Plan	Adopted; not adopted; under development
	Regulatory Framework	Framework legislation for EE measures	Adopted; draft prepared; nonexistent
		EE regulations for buildings	Mandatory; voluntary or under preparation; non-existent
		Minimum energy performance standards	Mandatory, voluntary, nonexistent
		labeling schemes for household appliances	Mandatory, voluntary, nonexistent
		EE regulations for industries	Officially adopted; nonexistent
		Policies and regulation for transport	Officially adopted; nonexistent
		EE measures in utilities	Officially adopted; nonexistent
	Financial Incentives	EE Fund	Established by law; sources of financing are clear; disbursement procedure is clear; fund is operational
		Customs duty, internal tax benefits	Officially adopted; nonexistent
Institutional Capacity	EE Institutions	Dedicated EE units within ministries	Presence of designated EE unit; adequacy of technical and human resources; capacity to formulate and monitor EE policies
		Dedicated EE agency	Presence of designated EE agency; adequacy of technical and human resources; capacity to implement EE policies
	Implementation Capacity	Total final consumption (TFC)	Percent of TFC change compared to GDP change for the same period
		Total energy supply (TES)	Percent of TES change compared to GDP change for the same period



2 Electricity Pricing and Energy Subsidies

Electricity pricing and subsidies are crucial factors when it comes to promoting energy efficiency best practices. Low Electricity prices that are not cost reflective will lead to tremendous amount of financial expenditures, and cause a burden on fiscal budget. This section presents the current electricity subsidies amount and its evolution in Arab countries. In addition, electricity prices in residential and industrial sectors are demonstrated. Table 22 represents the two indicators that are used to assess the electricity pricing and subsidy factor.

Table 22: Electricity pricing and subsidy indicators

Category	Factors	Score/Measuring Unit
Electricity pricing and subsid	Amount of subsidy in 2020	Subsidy % of GDP
	Electricity prices for residential and industrial sectors	Electricity prices in USD/kWh

2.1 Subsidies Values

Electricity subsidies can be defined as any income or price support and/or any financial contribution by a government or any public body within its territory. Governments implement subsidies mainly for social reasons. Arab countries implement Electricity subsidies to help the lower income citizens. However, high income group benefits more than lower income group because they have better access to services and goods. Electricity subsidies burden the fiscal budget and cause fiscal deficit. Table 23 below shows the total Electricity subsidy as a share of GDP for selected countries in the Arab Region.

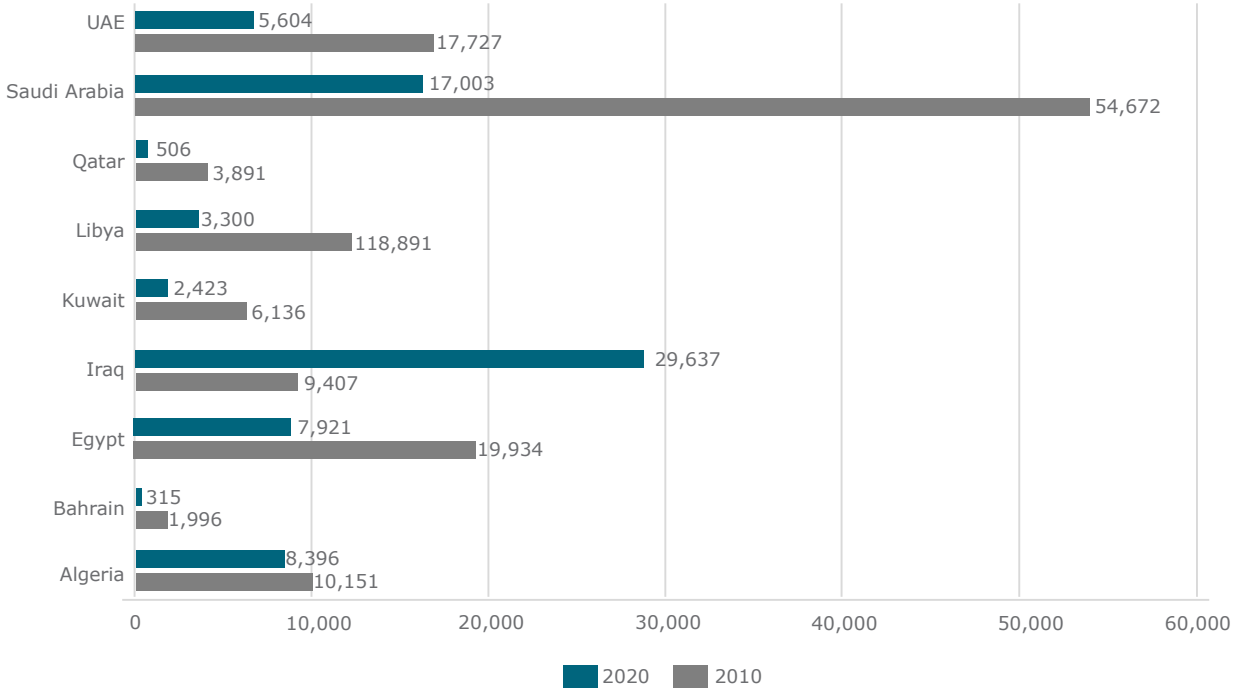
Table 23: Subsidies statistics for selected Arab countries

Country	Total subsidy as share of GDP (%)
Algeria	1.6%
Bahrain	3.2%
Egypt	2.0%
Iraq	1.9%
Kuwait	2.2%
Libya	4.9%
Qatar	0.6%
Saudi Arabia	1.3%
UAE	1.1%

Source: IMF, 2022

As seen from the Table 23 above, electricity subsidies cost Libya 4.9% of its GDP and for Bahrain 3.2% of GDP. Figure 18 shows the difference in total subsidies amount in real USD from 2010 and 2020. Arab countries managed to reduce the money spent on subsidies except for Iraq. However, Arab countries are still spendings considerable number of financial resources. 75 billion USD were spent from only nine Arab countries represented in the below graph in 2020.

Figure 18: Total energy subsides value in some of Arab countries (Real 2020 million USD)



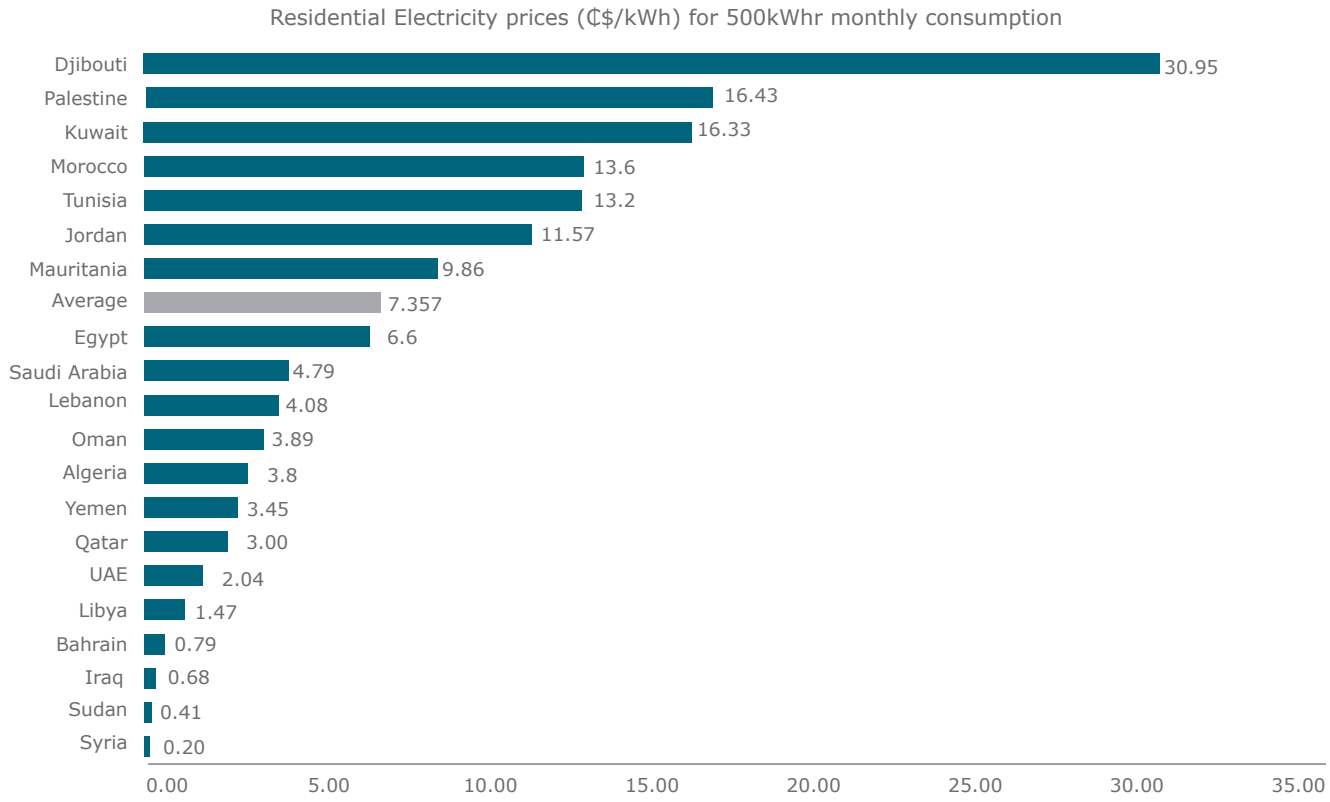
2.2 Electricity Prices for Residential and Industrial Sectors

Subsidizing electricity means that the electricity prices paid by the customers do not reflect the real cost of electricity production. The difference between the real cost of electricity generation and the price paid by the consumer must be covered by someone, for example, the fiscal budget of the country. There are several effects of subsidizing electricity prices. To name a few, it incurs losses to electricity suppliers, and constrains the ability to invest in new electricity capacity and improve service quality. Even countries with high energy subsidies maintain the current assets which leads to deterioration in the electricity plants and grid conditions. Subsidized electricity prices encourage inappropriate practices related to excessive electricity consumption and diminish the efforts of energy efficiency initiatives and programs.

Eliminating electricity subsidies would generate substantial financial, environmental, and health benefits. It would release considerable amount of funds to be spent on other sectors such as education and health. In addition, consumers would rationalize their consumption and release less GHG emissions into the atmosphere.

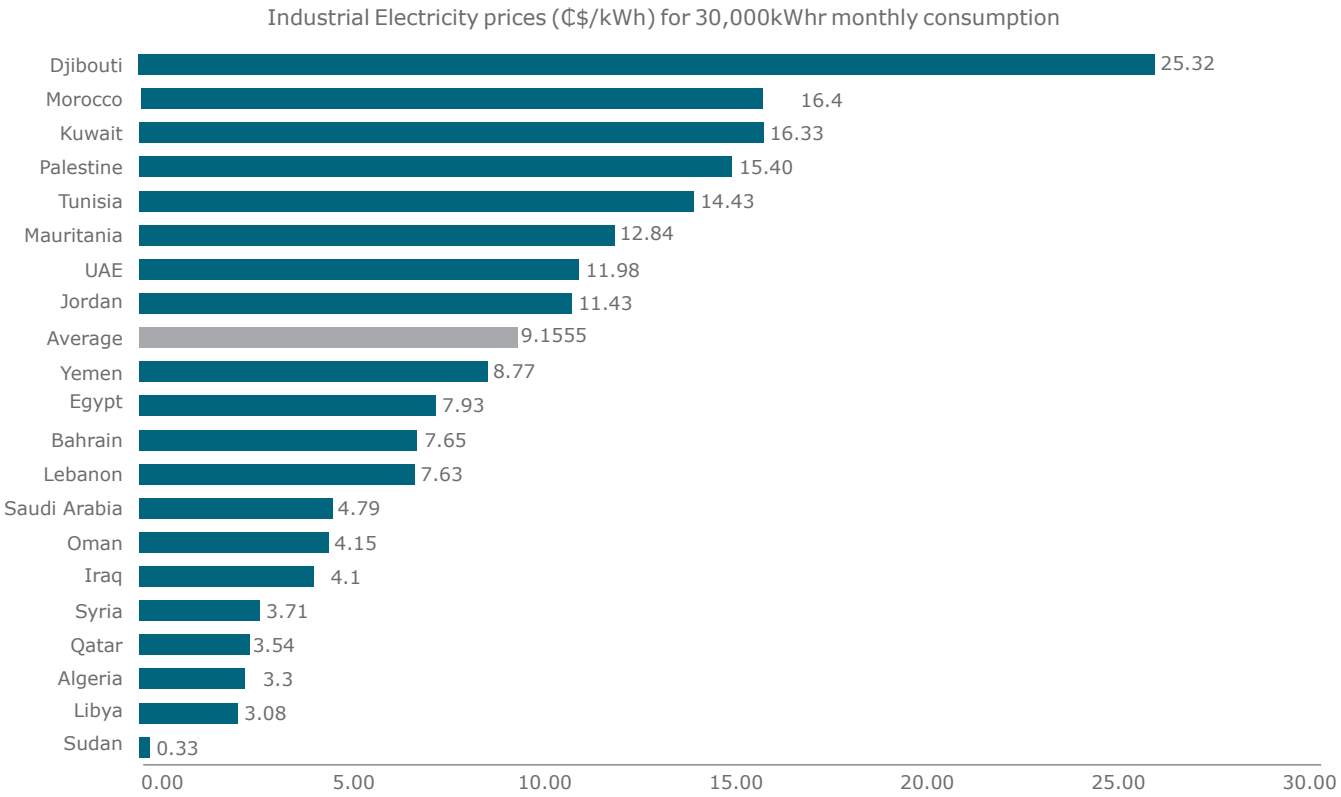
Arab countries electricity prices vary greatly. In residential sector (considering monthly consumption of 500kWh) the electricity prices fluctuate from 0.2 ¢$/kWh in Syria to 30.95 ¢$/kWh in Djibouti which is nearly 20 folds more. The average price in the region is 7.36 ¢$/kWh. Prices do not include any taxes or levies. The chart below exhibits the electricity price in Arab region using exchange rates of 31 December 2020.

Figure 19: Residential Electricity prices (₵$/kWh) for 500kWhr monthly consumption



For industrial sector (considering 30,000 kWh monthly consumption) the electricity prices range from 0.33 ₵$/kWh in Sudan to 25.32 ₵$/kWh in Djibouti. The average price for industrial sector is 9.16 ₵$/kWh which is higher than the residential sector. Prices in industrial sectors should be low, to stimulate the economy and decrease production costs. In several Arab countries, electricity prices in industrial sector are higher than in residential sectors. Figure 20 shows the electricity prices for industrial sector.

Figure 20: Industrial Electricity prices (¢$/kWh) for 500kWhr monthly consumption

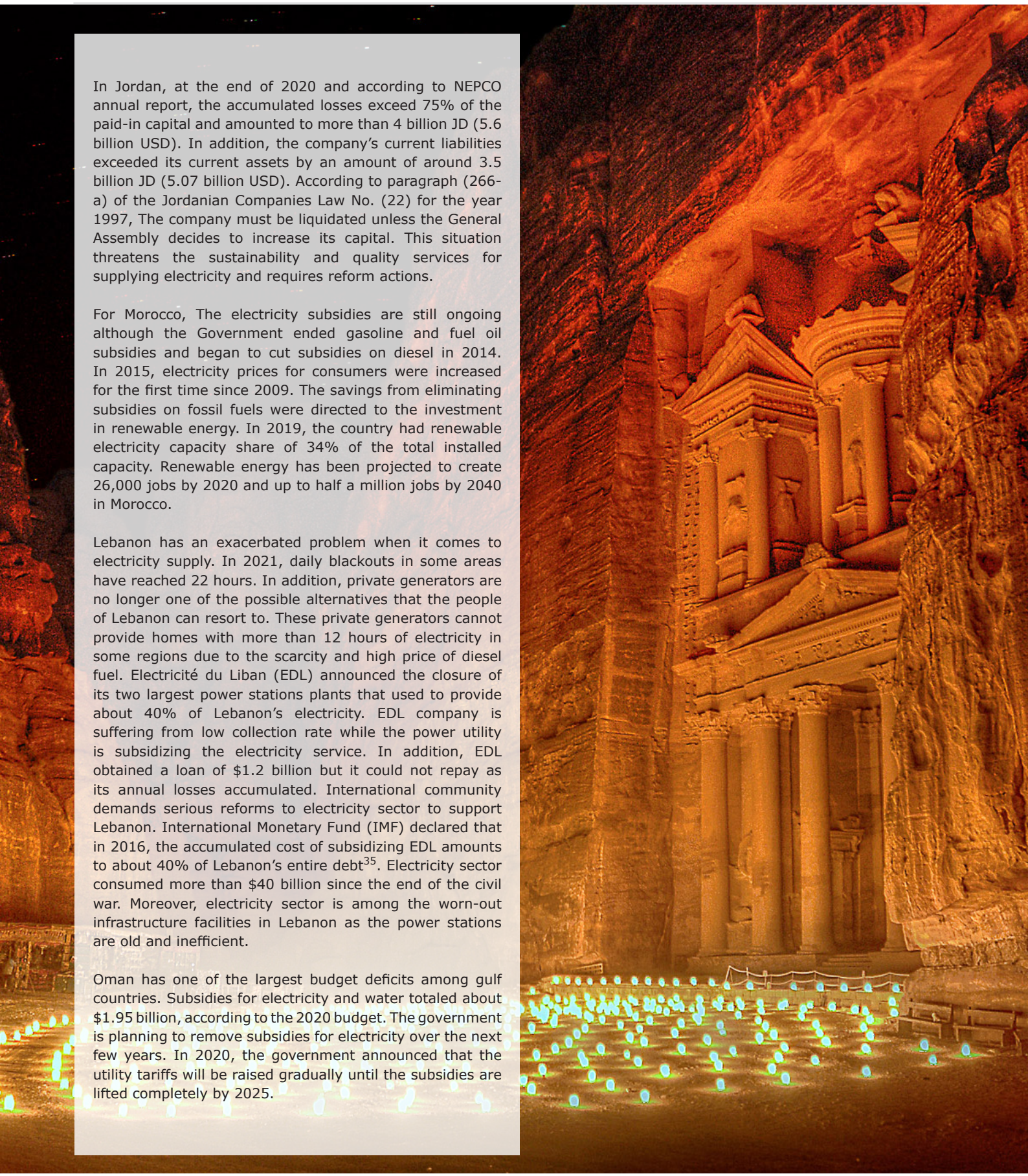


Bahrain, Libya, Qatar, Saudi Arabia, and UAE reduced the electricity subsides dramatically from 2010 to 2020. Algeria is the only country in the table that has increase the amount of electricity subsidies.

Table 24: Electricity subsidies values in Arab countries

Country	Subsidy in 2010 (Million USD)	Subsidy in 2020 (Million USD)
Algeria	1,322.9	1,963.1
Bahrain	1,372.9	274.6
Egypt	3,553.9	2,613.5
Iraq	2,056.3	1,358.7
Kuwait	2,550.6	1902.2
Libya	1,512.3	632.7
Qatar	1,522.8	360.6
Saudi Arabia	14,142.6	4,586.7
UAE	5,430.2	48.0

Source: IEA



In Jordan, at the end of 2020 and according to NEPCO annual report, the accumulated losses exceed 75% of the paid-in capital and amounted to more than 4 billion JD (5.6 billion USD). In addition, the company's current liabilities exceeded its current assets by an amount of around 3.5 billion JD (5.07 billion USD). According to paragraph (266-a) of the Jordanian Companies Law No. (22) for the year 1997, The company must be liquidated unless the General Assembly decides to increase its capital. This situation threatens the sustainability and quality services for supplying electricity and requires reform actions.

For Morocco, The electricity subsidies are still ongoing although the Government ended gasoline and fuel oil subsidies and began to cut subsidies on diesel in 2014. In 2015, electricity prices for consumers were increased for the first time since 2009. The savings from eliminating subsidies on fossil fuels were directed to the investment in renewable energy. In 2019, the country had renewable electricity capacity share of 34% of the total installed capacity. Renewable energy has been projected to create 26,000 jobs by 2020 and up to half a million jobs by 2040 in Morocco.

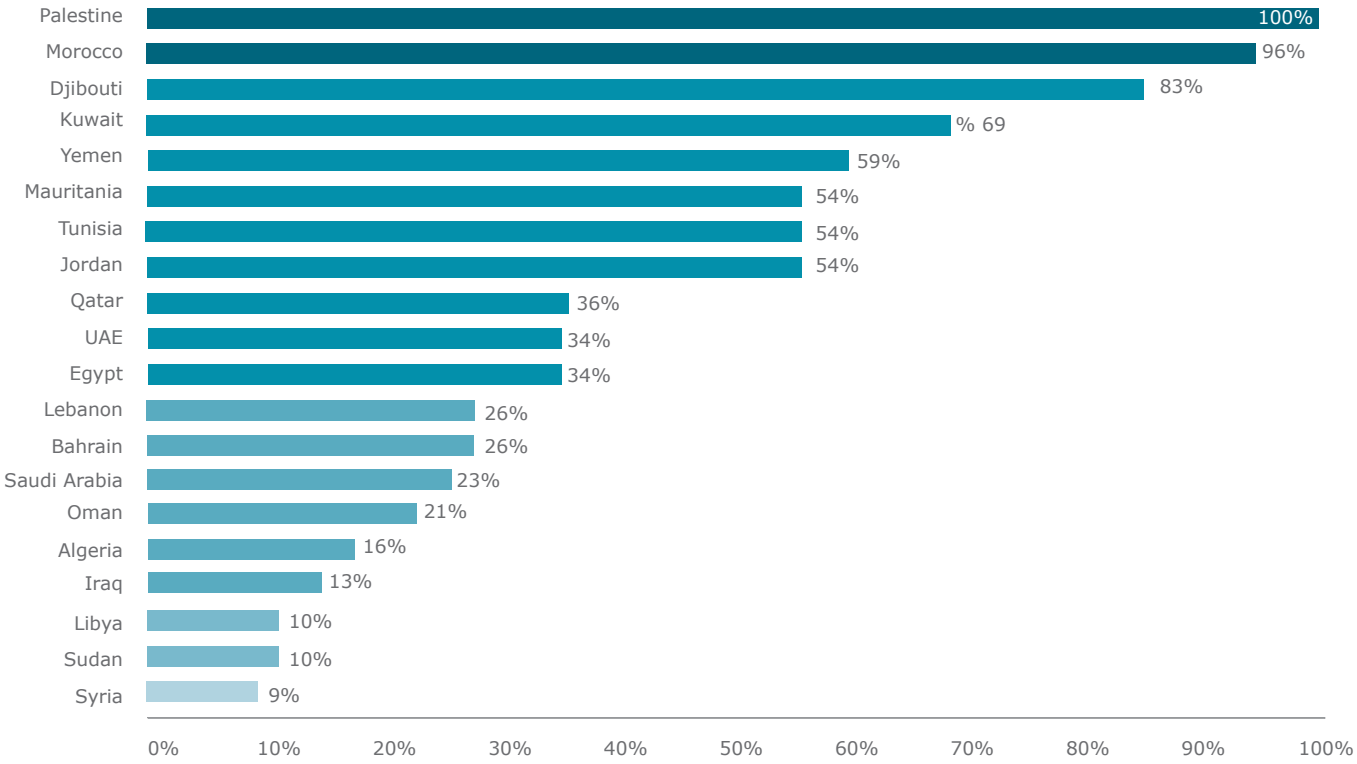
Lebanon has an exacerbated problem when it comes to electricity supply. In 2021, daily blackouts in some areas have reached 22 hours. In addition, private generators are no longer one of the possible alternatives that the people of Lebanon can resort to. These private generators cannot provide homes with more than 12 hours of electricity in some regions due to the scarcity and high price of diesel fuel. Electricité du Liban (EDL) announced the closure of its two largest power stations plants that used to provide about 40% of Lebanon's electricity. EDL company is suffering from low collection rate while the power utility is subsidizing the electricity service. In addition, EDL obtained a loan of $1.2 billion but it could not repay as its annual losses accumulated. International community demands serious reforms to electricity sector to support Lebanon. International Monetary Fund (IMF) declared that in 2016, the accumulated cost of subsidizing EDL amounts to about 40% of Lebanon's entire debt[35]. Electricity sector consumed more than $40 billion since the end of the civil war. Moreover, electricity sector is among the worn-out infrastructure facilities in Lebanon as the power stations are old and inefficient.

Oman has one of the largest budget deficits among gulf countries. Subsidies for electricity and water totaled about $1.95 billion, according to the 2020 budget. The government is planning to remove subsidies for electricity over the next few years. In 2020, the government announced that the utility tariffs will be raised gradually until the subsidies are lifted completely by 2025.

[35] www.reuters.com/article/us-lebanon-economy-electricity-idUSKCN1RA24Z

2.3 Final Score and Ranking for Electricity Pricing and Energy Subsidies

Figure 21: Ranking for electricity pricing and energy subsidies dimension



3 Policy Framework

Arab countries are among the countries that are most vulnerable to climate change. Increased average temperatures and heat waves, less precipitation, raising sea level, to name a few. Adding to that, the region is already suffering from aridity, recurrent droughts and water scarcity.

Energy activities is among the largest GHG emission producers. Setting up effective policies to reduce energy consumption will help to achieve the target of 1.5 degree rise. This section examines the energy efficiency policies in the Arab region and its applications. Table 25 exhibits the factors and indicators that will be used to assess policy framework in the region. There are three factors and 12 indicators. Each indicator has been associated with a measuring unit as depicted in the below table.

Table 25: Policy framework factors

Category	Factors	Indicator	Score/Measuring Unit
Policy Framework	Energy planning	Energy strategy with long-term EE objectives	Officially adopted; nonexistent
		National Energy Efficiency Action Plan	Adopted; not adopted; under development
	Regulatory framework	Framework legislation for EE measures	Adopted; draft prepared; non-existent
		EE regulations for buildings	Mandatory; voluntary or under preparation; non-existent
		Minimum energy performance standards	Mandatory, voluntary, non-existent
		labeling schemes for household appliances	Mandatory, voluntary, non-existent
		EE regulations for industries	Officially adopted; nonexistent
		Policies and regulation for transport	Officially adopted; nonexistent
		EE measures in Utilities	Officially adopted; nonexistent
	Financial incentives	EE fund	Established by law; sources of financing are clear; disbursement procedure is clear; fund is operational
		Customs duty, Internal tax benefits	Officially adopted; nonexistent

3.1 Energy Planning

Energy planning is a process where the country decides how it will meet its future demand, increase energy security, achieve its energy targets, and also includes many other elements. Energy planning is a cornerstone element of energy policy-making processes and guiding decisions on when, where, and how to invest in the energy sector. The first factor of energy planning has two indicators, energy strategy and national energy efficiency action plan (NEEAP).

3.1.1 National Energy Strategy

National energy strategy is a long-term plan that could span over 10 years or more to enhance the energy supply system of a country. For example, national energy strategy can help to ensure the security of supply, manage, and predict the changes in the national energy systems, reduce dependence on oil imports or local oil consumption, foster a continuous growth of energy supply, and increase energy efficiency. National EE strategies vary in their degree of comprehensiveness and ambition to reduce energy intensity.

Thirteen Arab countries have national energy strategies. Most of the strategies foresee the national energy system until 2030. Only Oman set the plan until 2040. Several national strategies in Algeria, Bahrain and Egypt focus on energy efficiency in buildings, appliances, and lighting. Jordan focuses on utilizing the local resources and increase generation efficiency.

Table 26: National energy strategy in Arab countries

Country	National Energy Strategy
Algeria	Government Action Plan
	Key provisions related to EE: - The development of technical clauses relating to regulatory and technical measures for the energy performance of buildings. - Progressive transformation of traditional domestic lighting by high-performance lighting (LED type) for an electrical energy saving of approximately 5,600 Gigawatt hour (GWh). - Promoting of the local LED lamp manufacturing industry. - Ban of conventional incandescent lamps from 2023 - Gradual replacement of public lighting lamps with LED-type lighting. - Implementation of a photovoltaic lighting plan on the motorway East-West and on other highways. - Introducing energy performance in street lighting
Bahrain	The Economic Vision 2030 for Bahrain
	Key provisions related to EE include implementing energy-efficiency regulations (e.g., for buildings and electrical appliances)" (Section 3.5)
Egypt	Integrated Suitable Energy Strategy 2035 (ISES 2035)
	• Institutional development of the energy efficiency industry • Developing EEIPs for intensive-energy-use industries. • Developing system and technologies program fit for application over different industries. • Development of the market of energy services serving the industry • Replacement of electrical appliances with energy efficient ones • Application of the energy efficiency building code over new buildings Renovation of old buildings to achieve energy efficiency • Shift to green tourism. • Use of high energy efficient lighting systems. • Energy efficient vehicles • Use of energy efficient means of transportation in shipping goods
Iraq	Integrated National Energy Strategy (INES)
	• The only fossil fuel capacity to be added will be Combined Cycle Gas Turbines (CCGT's), which are the most fuel efficient and least environmentally damaging of fossil fuel technologies. • In parallel Iraq will expand, strengthen, and de-bottleneck the T&D network. Technical losses will be reduced to acceptable levels and a smart grid program will be initiated to monitor grid performance.
Jordan	The updated Energy Strategy for the Energy Sector 2020-2030
	The updated Energy Strategy has five main objectives: 1. Diversify energy resources 2. Increase the share of local resources in the energy mix. 3. Increase the energy efficiency use in all sectors. 4. Reduce the cost of energy on the national economy 5. Develop the energy sector system in Jordan to make it a regional center for energy exchange by all energy forms.
Kuwait	Kuwait Energy Outlook 2019
	• Enforce and update building regulations and codes to reduce energy demand for air-conditioning. • Enhance the arrangement of windows in buildings to increase efficiency and install photovoltaic building integrated systems. • Invest in building retrofits. • Invest in district cooling. • Implement a standardized labeling program for appliances and equipment. • Promote energy service companies to market energy efficiency programs to consumers and support consumers in estimating energy savings.
Morocco	National Energy Strategy Horizon 2030
	Key provisions related to EE:

Country	National Energy Strategy
Morocco	"Implementation of measures to halt consumption during peak hours and during high load periods agreed upon between the government and ONEE Signing of contract program between government and ONEE to set a clear and quantified objectives for the reduction of electricity consumption by 2012" (Ch. I-6, p. 50)
Palestine	The Palestinian 2017-2023 • Promote efficient energy policies • Convert lighting to more efficient systems by using led for domestic and industrial • Energy audit for industrial & commercial • Revolving fund for energy efficiency projects • Reduce technical and non-technical losses • Reduce the total energy consumption of 5% (384 GWh) within 2020
Qatar	Qatar Second National Development Strategy 2018-2023 Improve and implement energy efficiency by 10% and utilize existing Gulf connectivity network infrastructure by 2023
Saudi Arabia	Integrated energy strategy (Under Preparation)
Sudan	Sudan National Energy Strategy 2020-2035 • Meeting the total demand for electrical energy by 100% at the lowest cost. • Increasing the percentage of customers and Electrification Rate from 37% to 100% (85% in National Grid and 15% Off-Grid through isolated networks and Home Solar Systems). • Increase the installed capacity in the National Grid to more than (15,000) MW by 2035 to meet the expected demand. • Achieving a generation reserve within the National Grid of not less than 10% and not exceeding 35% of the total installed capacity. • Coverage of the whole country by extending the voltage levels of 110, 220 and 500 kV to connect the Eastern, Western, Southern, and Northern areas of the country with the National Grid by 100%. • Add (4050) MW of renewable energy (Wind - Solar) and 1280 MW of Nuclear energy by the end of planning period. • Implement energy efficiency program to improve the consumption rate and reducing the technical losses in the transmission network to 3% and in the distribution Grid to 11% by the end of the plan period.
Tunisia	National Energy Management Strategy The specific actions concern the energy efficiency program targeting the industrial sector, transport, and buildings. Audits and Contracts Programs: Mobilization of the potential for energy savings in the three sectors concerned (industry, transport, and tertiary).
UAE	Abu Dhabi Economic Vision 2030 Dubai Integrated Energy Strategy 2030 Key provisions related to EE: **Abu-Dhabi** • To ensure new development respects scaled to the natural environment. • To create plans that respond to the desert climate, respecting water assets and making use of sustainable energy and waste techniques and technologies where appropriate." (p. 72) "Abu Dhabi's future lies in the ability to prudently use its existing wealth to actively explore renewable energy production, reduce the consumption of non-renewable resources and educate future generations. Resource efficiency is vital, and the implementation of Estidama will support Abu Dhabi's move to become a truly sustainable Emirate." (p. 80) **Dubai** Dubai Integrated Energy Strategy 2030 includes eight demand side management programs in three areas: power, water, and transportation fuel. These programs include: updating green building regulations, building retrofits, district cooling for new developments and retrofits, standards and labels for appliances and equipment, efficient street lighting, change of tariff rates, and implementing demand response programs.

3.1.2 National Energy Efficiency Action Plan

The National Energy Efficiency Action Plan (NEEAP) is a strategic national plan framework that helps Arab countries to Implement energy efficiency goals. The aim of NEEAP is to act as a guideline to foster and improve energy efficiency and consumption rationalization at different levels such as generation, transmission, distribution, and consumption.
11 Arab countries have ongoing adopted NEEAP while Lebanon has its new NEEAP under development. NEEAP usually has a shorter timeline than national energy strategy, however Algeria, Morocco, and Dubai have long term NEEAP that is ongoing until 2030.

Table 27: NEEAP in Arab countries

Country	NEEAP	Adaption
Algeria	Government Action Plan	Adopted in September 2021
Bahrain	NEEAP 2017-2025	Adopted in 2017
Egypt	NEEAP 2017-2025	Adopted in 2016
Jordan	National Energy Efficiency Action Plan (2018-2020)	Adopted in 2017
Kuwait	Kuwait Institute for Scientific Research (KISR) Energy Efficiency Technology Program	Adopted
Lebanon	NEEAP 2021-2025	Under Development
Morocco	NATIONAL STRATEGY ENERGY EFFICIENCY 2030	Adopted in 2020
Palestine	Energy Efficiency Action Plan for 2020-2030	
Qatar	National Program for Conservation and Energy Efficiency (Tarsheed)	Adopted in 2013, ongoing
Saudi Arabia	National Energy Efficiency Program	Adopted in 2012, ongoing
Sudan	The National Electrical Energy Efficiency Action Plan (NEEAP), 2021 – 2024 - 2028	
Tunisia	New Energy Program 2013-2020	Adopted in 2014, on going
UAE	Abu Dhabi Comprehensive Cooling Plan Dubai Integrated Energy Strategy 2030	Adopted Adopted

3.2 Regulatory Framework

3.2.1 Framework legislation for EE measures

Regulatory frameworks are very important for any successful energy efficiency plans or actions. It can be considered as the strong pillars that plans can build on them. In other words, they set the foundation to implement effective EE measures and actions. Regulatory frameworks exhibit a strong sign to show the political commitment to EE. Regulatory frameworks typically involve different levels of legislation, bringing together the participation of a wide network of stakeholders.

Regulatory frameworks in Arab countries vary from binding law, bylaw, ministerial resolution, or decree. Ten Arab countries have a law related to energy efficiency, four countries have bylaws or ministerial decision, and one country has a law under preparation.

Table 28: Laws related to EE in Arab countries

Country	Framework Law for EE Measures	Implementing Bylaws
Algeria	Law No 1999-09 (1999) on energy conservation	• Decree No. 2000-90 (2000) on energy isolation of new buildings • Decree No. 04-149 (2004) on fixing the implementation process of the law No 1999-09 • Decree No. 05-16 (2005) on specific energy efficiency rules for appliances running on electricity, gas, and petroleum products • Decree No. 05-495 (2005) on energy audits for large energy consumers • Bylaw: 21/2/2009 on labels and standards for domestic lamps, refrigerators, and AC • Bylaw: 29/11/2008 on general provisions related to the organizational arrangements and the energy efficiency control of electric domestic appliances and subject to specific rules on energy efficiency • Bylaw: 22/12/2016 on identifying income and expenditure list in account number 131-302 • title "national fund for energy control and renewable and combined"
Bahrain	Law No 13 -1977 on Organizing buildings	• Bylaw No (2) – 1998 amendment of executive regulation for the law No 13 -1977 • Decree No 8 /1999 on installation of thermal insulation in buildings for both the commercial and government sectors • Decree No 63/ 2012 on installation of thermal insulation in Residential sector • Cabinet Order. No. 6-14/2013 was enacted and implemented in 2014 on the minimum efficiency of household lamps • Ministerial Order No. 3/2015) to facilitate the phase out of incandescent amps.
Djibouti	None	None
Egypt	Electricity law No. 87/2015. Articles (45,46,47,48,49,50 and 51)	• Decision No 230/2016 executive regulations of electricity law 87/2015
Jordan	Law No. 13 (2012) on renewable energy and energy efficiency Law No. 33 (2014) on amendment of Law No. 13 (2012)	• Bylaw No 73 (2012) on regulating procedures and means of conserving energy and improving • its efficiency, issued by virtue of Article (18) of the Renewable Energy and Energy Efficiency • Law No 13 (2012) • Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) By-Law 49 of 2015 • RE/EE Tax Exception By-Law 50 of 2018
Kuwait	NA	• Energy Conservation Program, Code of Practice, MEW/R-6/2014 • Ministerial Resolution no. 15/2018 in Kuwait, Enforcement of Energy Efficiency Regulation for Direct Expansion Air Conditioners in Kuwait
Lebanon	Draft version of the Energy Conservation law is under review by the concerned public bodies	NA
Libya	NA	NA
Mauritania	NA	NA
Morocco	Law No. 47-09 (2009) on energy efficiency Law No. 16-09 (2009) on extending the authorities of the National agency for RE to include EE	• Approving the decree No. 2-13-874 (2014) on EE building codes • Decree No. 17-10-1 (2010) on approving the extension of the national agency for RE to include EE
Oman	NA	• Ministerial Decree 107/2018, Energy efficiency label for air conditioners in accordance with EE standards for air conditions
Palestine	The Renewable Energy and Energy Efficiency Law in Palestine regulates the mechanism for investment in renewable energy and energy efficiency	
Qatar	Law No. 26 (2008) on energy efficiency in electricity and water consumption	• Ministerial decision No. 42 (2011) on establishing a unit for energy efficiency (Article 4)
Saudi Arabia	NA	• Decree No. 6927 (2014) on the installation of thermal insulation on all new residential, commercial, or other buildings • Ministerial Decree 363 on establishing energy efficiency center
Sudan	NA	NA
Syria	Law No. 3 (2009) on energy Conservation Law No. 17/2013 on Establishment of the Domestic Solar Heating Fund at the Ministry of Electricity	NA

Country	Framework Law for EE Measures	Implementing Bylaws
Tunisia	Law No. 2004-72 (2004) on energy efficiency further amended by Law No. 7 (2009) Law No. 82/2005 on power control Law No. 106/2005 on establishment of the National Fund for Energy Control	• Order No. 148 / 2000 dated 24/1/2000 relating to the regularization of the technical inspection of vehicles and procedures • Order No. 1497 of 2005 dated 11/5/2005 concerning the regularization of the technical inspection of vehicles and the amendment to Order No. 148 of 2000 • Decree No 2004-2144 (2004) establishing obligations of conducting mandatory periodic energy audits • Order No. 2269 / 2009 dated 31/7/2009 concerning the revision of Order No. 2144 - 2004 concerning the establishing obligations of conducting mandatory periodic energy audits • Decree No 2004-2145 (2004) on EE labels and standards for appliances and equipment • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 24/10/2005 concerning the minimum energy efficiency for refrigerators, freezers and dual machines • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and Minister of Transport dated 10/8/2007 relating to the approval of the booklet of conditions relating to the regulation of the practice of diagnosing motor vehicles whose total authorized weight does not exceed 3500 kg and does not exceed the more than nine seats (including the driver's seat) in the private sector • Order No. 4193 /2007 dated 27/12/2007 related to the control of the percentage of fees on lamps • Order No. 3210/2008 dated 6/10/2008 regarding the control of the percentage of fees on lamps and the amendment to order number 4193 for the year 2007 • Mandatory Decree of 23 July 2008 dealing with minimum technical specifications for energy saving in building projects or refurbishment of existing administrative buildings • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 27/10/2008 in respect of the minimum efficiency in energy consumption for refrigerators, freezers, double machinery. • The joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 21/4/2009 in respect to labels for individual air conditioners with cooling capacity of less than 12 kW. • The joint decision of the Minister of Equipment, Housing and Urban Planning and the Minister of Industry, Energy and Small and Medium Enterprises on 1/6/2009 concerning the adjustment with minimum technical specifications aimed at the energy efficiency of construction projects and expansion of buildings intended for housing • A joint decision of the Minister of Industry, Energy and Small and Medium Enterprises and the Minister of Commerce and Handicrafts dated 30/6/2009 concerning the minimum energy efficiency of individual air conditioners with cooling capacity below 12 kW Decision dated 09/02/2006 on technical characteristics of the energy economy at the stage of installation of public lighting networks. • Order No. 3377 / 2009 dated 2/11/2009 on the combined generation and modified order 3232 for the year 2002 • The decision of the Minister of Industry, Energy and Small and Medium Enterprises, dated 11/6/2007 approving the booklet of special specifications in the energy audit on • The plan in the residential and services sectors. • Joint decision of the Minister of Industry and Technology and the Minister of Commerce dated 12/08/2011 in respect to the minimum efficiency in energy consumption for individual air-conditioners with cooling capacity of less than 12 kW. • Order number 2234/2005 fixing the rates and amounts of grants for operations related with energy conservation, conditions, and disbursement procedures, as revised by Decree No 362 (2009). • Order No. 1521/2010, amendment of Decree No. 744 of 1995, concerning the development of a list of raw materials and semi-finished materials used in renewable energy and energy efficiency • Joint order of Ministry of Industry and Technology and the Ministry of Commerce and Handicraft of 18 August 2010 prohibits the sale of incandescent light bulbs with power superior or equal to 100 watt and voltage superior or equal to 100 volt is banned effective from 1 January 2011
UAE	Law No. 11 of 2018 concerning the establishment of the Department of Energy in Abu Dhabi	In 2010, the UAE Cabinet approved the Green Building and Sustainable Building standards to be applied across the country.
Yemen	NA	Law No. 11 of 2018 concerning the establishment of the Department of Energy

3.2.2 EE Regulations for Buildings

Building sector in the Arab region is among the most energy consuming sectors. According to IEA, residential sector consumed 17% of the total final consumption in the middle east region in 2019. With a rising population in the region, a projected 24 million new housing units will be built by 2030 (Visser and Yeretzian, 2013). The residential sector uses energy in numerous applications such as cooling and heating, hot water, cooking, cleaning, washing, drying, lighting, and entertainment.

The building sector can contribute effectively to reducing energy consumption in the MENA region. This can be done through the application of thorough energy efficiency measures, regulations, and building codes. 14 countries have a building code or energy efficiency specification for buildings. The most common form of building regulation in the region is thermal insulation requirements for new constructions.

Table 29: Building codes and regulations in Arab countries

Country	Buildings EE regulations	Implementation
Algeria	Document Technique Réglementaire (DTR)	Voluntary
	Thermal regulations for new buildings (2005)	mandatory
	Act 99-09 dated 28 July 1997is concerned with energy control in buildings and energy efficiency of new buildings	Voluntary
Bahrain	Thermal insulation regulation for all buildings (2013)	mandatory
	Code of practice for thermal insulation in buildings issued by Ministry of Electricity & Water (2002)	mandatory
	Thermal insulation for commercial buildings (1999)	mandatory
Egypt	Building Energy Efficiency Codes (BEECs) were introduced in Egypt between 2005 and 2009. They impose mandatory energy performance requirements for residential, commercial, and public buildings in three different code documents. However, these codes are not enforced.	mandatory
	Energy efficiency code for governmental buildings (2011)	mandatory
	EE code for commercial buildings (2006)	mandatory
	EE code for residential buildings (2003)	mandatory
Iraq	EE specifications for buildings (2012) In 1987 the Iraqi building code was suggested to be used optionally for two years. The government did not adopt the code legally. For that reason, Iraqi designers and engineers did not use the code, and depended on ACI and British codes in their works for the last forty years. In 2013, the Ministry of Construction and Housing adopted the Arabic codes. These codes are issued by the Council of Arab Ministers of Housing; during this year (2014), the Iraqi ministries started to adopt these codes in their buildings works.	Voluntary
Jordan	Green building manual (2015)	mandatory
	Solar energy code (2012)	mandatory
	Energy efficiency buildings code (2008)	mandatory
	Thermal insulation code (1998)	mandatory
Kuwait	Mandatory Energy Conservation Code for Practice for Buildings No R-6, (2014)	mandatory
Lebanon	EE building code	Voluntary
Morocco	Morocco is developing energy efficiency label, "Eco-Binayate". This voluntary scheme is targeting main contractors and developers, with the aim of improving buildings' quality in terms of energy-efficiency and the environment.	Under preparation
	Thermal regulation for construction in Morocco	mandatory
	Act 47-09 concerns energy efficiency in buildings (residential and commercial), transport and industry. It introduces energy performance ratings for buildings, equipment and appliances, compulsory energy audits for facilities exceeding a certain consumption threshold in the industrial and the service sector, prior energy impact assessments for urban development and construction programs when anticipated consumption exceeds a certain threshold, and technical energy efficiency measures.	mandatory

Country	Buildings EE regulations	Implementation
Palestine	Green buildings guidelines (2013)	Voluntary
	EE building code (2004)	Voluntary
Qatar	Global Sustainability Assessment System (GSAS) certification	mandatory
Saudi Arabia	Saudi Energy Efficiency Building Code (2007). The codes were introduced on a voluntary basis in 2009 and became mandatory in 2010. The code covers all of a building's energy systems including: the envelope, mechanical, electrical, lighting, and domestic hot water systems. It has both, prescriptive and performance compliance options.	mandatory
	Since 2014, the Saudi government has required the mandatory installation of thermal insulation in walls and roofs for all new buildings as a condition to obtain a connection to the electricity grid.	mandatory
Syria	Building thermal insulation code (2006), effective since 2009	mandatory
Tunisia	EE specifications for residential buildings (2009)	mandatory
	EE specifications for office buildings (2008) for offices or similar premises that are not occupied at night	mandatory
	and for public and private buildings whose floor area ≥500 m2	mandatory
	Mandatory measures for the thermal performance of new buildings (2004)	Voluntary
UAE	Estidama has a 1 Pearl and 2 Pearls Rating System (PRS) for Buildings (2010). All new development projects in Abu Dhabi must achieve at least the 1 Pearl rating, while government office projects must achieve, at minimum, a 2 Pearl certification.	mandatory
	Regulations on the technical specifications for thermal insulation systems (2003)	mandatory

3.2.3 Minimum Energy Performance Standards

Minimum energy performance standards (MEPS) is a specification that describes the performance requirements for energy using devices. The appliances must have an energy performance baseline that meets or exceeds minimum level of energy performance before they can be offered for sale or used for commercial purposes. Adopting mandatory MEPS for appliances would ensure that only energy efficient equipment can enter the market, thus gradually eliminating the existence of any inefficient appliances.

13 Arab countries have mandatory MEPS, and two countries have a voluntary MEPS policy. Air conditioning has the largest share of MEPS policy across Arab countries, due to the hot weather that requires turning air conditioning units on for long hours.

Table 30: MEPS in Arab countries

Country	Products	Implementation
Algeria	Lighting, refrigerators, freezer, air conditioning	Mandatory for refrigerators
Bahrain	Air conditioning and lighting	Mandatory
Egypt	Air conditioning, lighting, refrigerator/ freezer, washing machines, TV, vacuum cleaners, fans, dish washer, electric heaters, electric ovens, laundry dryer	Mandatory
Jordan	Air conditioning, refrigerators/freezer, lighting, dryer, washing machines, TV, dish washer, fans	Mandatory
Kuwait	Air conditioning	Mandatory
Lebanon	Lighting	Mandatory
Libya	Lighting	NA
Morocco	Air conditioning, refrigerators/freezer, lighting, dryer, washing machines, TV, dish washer, fans, vacuum devices, electric oven, water heaters	Mandatory
Oman	Air conditioning, refrigerators, lighting. A draft for washing machines and water heaters was issued	Mandatory
Palestine	MEPs do not exist as mandatory activity in Palestine	Voluntary
Qatar	Air conditioning, refrigerators, lighting, water heaters	Mandatory for AC and lighting
Saudi Arabia	Air conditioning, refrigerators, lighting	Mandatory for AC and lighting
Sudan	Lighting, refrigerators, air conditioning	Under preparation
Syria	Refrigerators, lighting	Mandatory for Refrigerators
Tunisia	Air conditioning, refrigerators/freezer, lighting	Mandatory
UAE	Air conditioning, refrigerators, lighting	Mandatory

3.2.4 Labeling Schemes for Household Appliances

Energy efficiency standards and labels can be a long-term effective policy that any government can use to reduce energy consumption at the end use. Energy efficiency labels are informative labels that are affixed to manufactured products. They describe a product's energy performance and provide consumers with the required information for making informed purchases. 12 countries have mandatory energy label policy while one country has a voluntary scheme. As in MEPS, air conditioning has the largest share of energy label policies across Arab countries.

Table 31: Energy labels for appliances in Arab countries

Country	Products	Implementation
Algeria	Lighting, refrigerators, freezer, air conditioning	Mandatory
Bahrain	Air conditioning	Mandatory
Egypt	Air conditioning, lighting, refrigerator/ freezer, washing machines, TV, vacuum cleaners, fans, dish washer, electric heaters, electric ovens, laundry dryer	Mandatory
Jordan	machines, TV, vacuum cleaners, fans, dish washer, electric heaters, electric ovens, laundry dryer	Mandatory
Kuwait	Air conditioning, lighting, refrigerator/ freezer, washing	Mandatory
Lebanon	machines, TV, vacuum cleaners, fans, dish washer, electric heaters, electric ovens, laundry dryer	Mandatory
Libya	Air conditioning	Mandatory
Morocco	Air conditioning, refrigerators/freezer, lighting, dryer, washing machines, TV, dish washer, fans, vacuum devices, electric oven, water heaters	Mandatory
Oman	Air conditioning,	Mandatory
Palestine	Labeling in Palestine is voluntary and is attached to the EU label through Israel testing laboratories	Voluntary
Qatar	Air conditioning, refrigerators, water heater	Mandatory for AC
Saudi Arabia	Air conditioning, refrigerators, lighting	Mandatory
Sudan	Lighting, refrigerators, air conditioning	Under preparation
Syria	Refrigerators, lighting	Mandatory for Refrigerators
Tunisia	Air conditioning, refrigerators/freezer, lighting	Mandatory
UAE	Air conditioning, refrigerators, lighting	Mandatory

Source: meetMED project, RISE

3.2.5 EE Regulations for Industries

According to IEA, industrial sector is the most energy consuming sector in the Arab region with share of 29% in the total final consumption (TFC). Unfortunately, the majority of Arab countries still do not have comprehensive industrial EE policies. Only six countries have energy efficiency policies for industrial sector. Petrochemical industry is the largest industry in the Arab region, particularly in the fossil fuel producing countries. At the same time, petrochemical industry emits a considerable GHG emissions that have a crucial role in climate change. Effective and strict energy efficiency policies in industry are required at the current time more than before. Besides reducing the GHG emissions, EE policies will enhance the profitability and competitiveness of the Arab industries.

Table 32: Regulation related to EE in industry

Country	Products
Algeria	Executive Decree No. 05-495 (2005), which was modified and completed by Decree No. 13-424 (2013) For industrial establishments whose total energy consumption exceeds 2,000 Ton of Oil Equivalent (toe).
	Mandatory energy audits every three years
Egypt	According to the new electricity law, industries whose contractual capacity exceeds 500 kW shall hire energy manager to improve the power usage efficiency and keep a power register. In 2020, Egypt update MEPS for motors. The motors with efficiency class of IE3 or higher will be admitted to the country
Jordan	The Bylaw No 73 (2012) on Regulating Procedures and Means of Conserving Energy and Improving its Efficiency issued by virtue of Article (18) of the Renewable Energy and Energy Efficiency Law No 13 (2012)
	Any entity, whose annual energy consumption exceeds 50 toe per year and all public entities regardless of their consumption shall be subject to the mandatory and periodic energy audit carried out by the licensed entities.
Morocco	Law No 47-09 applies to energy intensive industries to: -Requiring companies to declare their installed capacity and energy use, as well as to carry out mandatory energy audits, if the use exceeded 1500 tons of oil equivalent (toe) per year. -Shifting the energy use of Morocco's industrial sector from the super peak tariff in order to benefit from a significantly lower rate in hours of low demand. -Encouragement of the companies to become more energy efficient by setting limits on air pollutant emissions. Further, improvements in energy efficiency, meanwhile, reduce Greenhouse gases emissions.
Saudi Arabia	No current policies however, SEEC has cooperated with a number of government agencies to develop an eco-system in the view of obliging companies operating in the iron, cement or petrochemical industry to comply with energy efficiency standards and requirements established by SEEC. The relevant authorities have been identified and selected, as their bylaws and legislative regulation can be utilized to activate their roles in the binding mechanism of factories through: -Submitting an action plan for each factory explaining how to increase energy consumption. -Providing SEEC with the required energy efficiency information annually.
Tunisia	Decree No 2004-2144 (2004), as amended by decree No 2269-2009 of July 31, 2009: For industrial establishments with annual energy consumption exceeding 800 toe: -Mandatory energy audits -Mandatory dedicated energy manager -Mandatory energy reporting system every year For new industrial projects whose total projected energy consumption exceeds 800 toe -Mandatory prior consultation with ANME: For new construction projects for residential and tertiary sectors whose total projected energy consumption exceeds 200 toe -Mandatory prior consultation with ANME For new industrial projects or expansion of existing industrial facilities whose total projected energy consumption exceeds 7,000 toe -Prior authorization from the ministry in charge of energy

3.2.6 Policies and Regulations for Transport

Transport sector holds the second place in the total final consumption (TFC) after industrial sector. In 2019, the transport sector consumed 28% of the TFC, just one percent lower than industrial sector. With the growing population, the need for transportation will increase releasing more emissions into the atmosphere and consuming more energy. Road traffic casualties, additional stress on fossil fuel extraction and resources depletion are also expected with increasing demand for transportation. All of the above effects are expected to be exacerbated due to Arab countries' lack of adequate public transportation services, poor quality road infrastructure, aging vehicle fleets, as well the lack of appropriate environmental policies and regulations in the transportation sector.

It is mandatory for Arab states to improve energy efficiency in the transport sector. Improving energy efficiency in the second largest consumer of petroleum products and a significant contributor to air pollution in the region will be a great help to achieve the declared target in the Arab countries NDCs. Improvements can be made by developing stricter energy efficiency requirements for transportation vehicles, adopting electric and hybrid vehicle technology, improving the public transportation sector by electrifying public mass transport such as metros and railways, and establishing vehicle emission standards in the region.

Table 33: Transport emissions, energy share, targets in Arab countries

Country	Emissions from transport sectors emissions (Mt CO_2), %	Transport share in energy consumption in TFC	Target
Algeria	40, 24%	29.6%	Energy efficiency program 2011 updated 2016: saving 15 million tons of oil equivalent (Mtoe) of energy consumption by fuel products by 2030. This program targeted 1.3 million vehicles be converted to LPG, the acquisition of 11,000 natural gas buses and the conversion of 11,000 vehicles to natural gas by 2030
Bahrain	3.7, 11.34%	18.3%	NEEAP: Expected savings of 253 GWh by 2025. Two initiatives were launched: Vehicle Efficiency Standards & Labeling and Transport Subsidy Reform
Egypt	54, 23.9%	29.6%	ISES 2035: To save 4.6 million tons of fuel equivalent (18% reduction)
Iraq	34.5, 24.9%	49.7%	NA
Jordan	9.2, 40.3%	47.4%	Updated NDC 2021; The measures that are considered to achieve the NDC target are: -Promoting hybrid and electric cars -Bus Rapid Transit Project (BRT) -Intelligent transport systems (ITS)
Kuwait	16, 17.8%	29.4%	NA
Lebanon	8.4, 32.9%	54.2%	NA
Libya	17, 37%	52.6%	NA
Morocco	19, 28.8%	37.1%	National energy efficiency strategy 2030: 24% reduction of energy consumption equivalent to 2.3 Mtoe by 2030
Oman	12.1,17.5%	17.2%	NA
Qatar	12.2, 14%	19.7%	National Program for Conservation and Energy Efficiency's projects "Green Car Initiative": Ministry of Transport & Communications will guide the concerned authorities to launch electrical cars within its fleets of transport vehicles and buses in order to spread them in local market as a strategic and eco- friendly option to reach the strategic goal represented in raising this type of vehicles to 10% by 2030.
Saudi Arabia	136.4, 27.5%	32.6%	No targets however, the government has introduced several energy efficiency standards to enhance the efficiency of heavy-duty vehicles (HDVs). These include a fuel efficiency improvement program, and a fuel efficiency labeling and tire resistance and grip initiative. An HDV aerodynamic initiative started in 2019 and is scheduled to be implemented in 2021. This initiative is expected to achieve fuel savings of 5%-9%.
Sudan	10.6, 57.3%	27.3%	NA
Syria	5.5, 23.3%	33.4%	NA
Tunisia	7.3, 27.8%	29.6%	National Energy Strategy 2030: 5.7% reduction of energy by 2030, 2.3% reduction in carbon intensity by 2030. 30% of emission reduction by 2030.
UAE	35.8, 20.1%	21.3%	NDC: the Emirate of Abu Dhabi has also set targets to shift 25% of government vehicle fleets to compressed natural gas
Yemen	3.3, 34.3%	45%	NA

Source: IEA, Focal Points

3.2.7 EE Measures in Utilities

Although Arab countries are adding considerable amounts of renewable energy resources each year, natural gas and oil are still the largest sources for total energy supply (TES) in the Arab region. In 2019 and according to IEA, Natural gas and oil have 59% and 40% share in total energy supply respectively. For electricity generation(source IEA), natural gas was the largest fuel used with a share of 72% followed by oil with a share of 25%. Conventional power generation technologies release a huge amount of carbon emissions. Electricity and heat generation were responsible for 39% of the total carbon emission in the Arab region. The majority of Arab countries have set targets to increase renewable energy shares, increase generation efficiency, reduce transmission and distribution losses, and consequently decrease carbon emission from the electricity sector.

Table 34: EE in utilities

Country	Share of electricity output from fossil fuels (year 2000 100=) *	Thermal efficiency of electricity plant (year 100=2000)*	Actions
Algeria	99.2	127	NDC: Increase the share of liquefied petroleum and natural gas in the consumption of fuels between 2021 and 2030.
Bahrain	100	119.2	NEEAP 2017: -The Electricity Production Efficiency initiative aims to deliver a 1% improvement by 2025 in the efficiency by which natural gas is converted into electricity. The target savings is 772 GWh. -The Electricity T&D Efficiency Program initiative aims to improve the efficiency of the system. The target savings is 93 GWh. -The Power Factor Correction Program initiative aims to improve the power factor to be 0.9 or greater. The target savings is 1978 GWh.
Egypt	110.1	75.6	NEEAP 2018-2023: Conversion of gas (simple cycle) turbines established during the urgent plans of 2010/2011 and 2014/2015 to combined cycle power plants, whereby an additional capacity of 1,840 MW can be added, and enhanced efficiency of fuel use can be achieved at an average rate of 50% before 2020. A program to reduce Losses in electricity transmission and distribution Networks
Iraq	100	98.2	Integrated National Energy Strategy: Iraq will expand, strengthen, and de-bottleneck the T&D network. Technical losses will be reduced to acceptable levels and a smart grid program will be initiated to monitor grid performance and enhance peak load management.
Jordan	86	133.5	Strategic plan 2020-2023 (by World Food Program (WFP)): • Project for the transition to smart grid and smart metering • Project EN01 to enhanced demand side management
Kuwait	99.8	115.6	Kuwait Energy outlook 2019: Kuwait will favor the use of natural gas in combined-cycle and steam plants, and the share of oil products in total generation is likely to fall to about a quarter by 2035. Combined-cycle plants make up the lion's share of installed capacity over the projection period, resulting in a more efficient and flexible fleet of power plants.
Lebanon	99.4	99.7	NEEAP 2016-2020: - transforming the Open-Cycle Gas Turbine (OCGT) power plants into Combined-Cycle Gas Turbine (CCGT) power plants in Sour and Baalbeck. - increasing the efficiency of all the transformers owned by EDL. - implementing a power factor correction plan in order to "free" more"sellable" MVA capacity at the EDL power generation stations and to reduce the MVA load on the transmission and distribution grid points
Libya	100	135.8	NA
Mauritania	NA	NA	NA
Morocco	83.7	101.9	NA
Oman	100	191.3	NDC 2021: The National Energy strategy further enhances the gas-fired plant's overall energy efficiency in conjunction with the clean energy plans. The energy efficiency of the gas fired plants' has improved by 13% between 2004 and 2015 (from 26% in 2005 to 39% in 2015). Between 2015 and 2020, the improvement was even more significant at 15.63% (from 39% in 2015 to 55% in 2020). The continuous increase in overall energy efficiency was attributed to the older, less productive plants' shut-down, technical advances in the gas-fired plants, and a switch to combined-cycle plants. The gas-fired plants' efficiency will continue to improve over the next five years (2021-2025) by about 11% (from 55% in 2020 to 63% in 2027)
Qatar	100	161.9	NA

Country	Share of electricity output from fossil fuels (year 2000 100=) *	Thermal efficiency of electricity plant (year 100=2000)*	Actions
Saudi Arabia	99.9	129.1	NA
Sudan	74.7	120.3	NDC 2021: Reduce transmission and distribution losses by 1213 GWh to save 463,582 tCO2 by 2030.
Syria	109.8	91.4	NA
Tunisia	95.8	123.9	NA
UAE	97.3	140.1	NA
Yemen	86.6	113.1	NA

Source IEA

3.3 Financial Incentives

3.3.1 EE Funds

To ensure successful implementation of energy efficiency policies, a functional financing scheme is a crucial part that should be included in the planning. National energy efficiency programs that lack financing or do not plan where the program will be funded will remain a plan without any implementation or real value. The lack of financing remains one of the biggest hurdles in implementing national programs to reduce energy consumption in the Arab region.

Ten Arab countries have established financing mechanisms to secure sustainable and effective implementation of energy efficiency programs. Such established funds are a step forward and in the right direction in shifting fuel subsidies into EE incentives to decrease carbon emissions and reduce reliance on fossil fuels.

Table 35: EE funds in Arab countries

Country	EE Fund	Source of funding	Disbursement Procedures
Algeria	Fond National pour la Maitrise de l'Energie, des Energies Renouvelables et de la Cogénération (OCGT).	For Renewable Energies and Cogénération: • 1% of oil royalties each year Taxes on natural gas (AD 0.0015/ btu) and electricity (AD 0.02/kWh) For Energy Efficiency: • - Government subsidies; - Revenue from the taxe on the national energy consumption; - Revenue from taxes on high energy consuming appliances; - Revenue from the fines provided for under the law relating to energy mastery; -unpaid loan repayment revenues granted within the framework of energy mastery; any other resources or contributions	The inter-ministerial order of September 17, 2000 defines six areas of expenditure, including: • Granting credits for activities selected through competitive proposals • Loans at zero or reduced rates • Guarantees for loans from third parties to facilitate access to credit
Bahrain	Sustainable Energy Finance Initiative	Bahrain Commercial Facilities Company (BCFC)	Financing scheme is based on a lease-to-own system, which means consumers can benefit from solar power systems installed on their premises in return for a monthly rent, which is determined by the size of electricity generated and available space in each building that allows the installation of solar panels onit."

Country	EE Fund	Source of funding	Disbursement Procedures
Egypt	Green Environment Financing Facility (GEFF) with a €140 million investment	• European Bank for Reconstruction and Development (EBRD) • Agence Française de Développement (AFD) • European Investment Bank (EIB).	The fund includes: • Grants loans of up to $5 million to private entrepreneurs and enterprises. • Low-interest loans with five-year flexible payment plans. • Investment incentive grants of 10%-15% of the value of the loan.
	Industrial Energy Efficiency Fund (IEEF)		
Jordan	Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF) established by Law on Renewable Energy and Energy Efficiency (2012)	• Annual budget allocations • Return on investment from the Fund's own investment	Different programs using different funds and delivery mechanisms targeting Solar Water Heater (SWH), LEDs, PV roofs….
Lebanon	National Energy Efficiency and Renewable Energy Action (NEEREA)	Central Bank of Lebanon (BDL)	Low-interest loans (between 0 - 1%) for RE and EE projects with a repayment period of 14 years with a grace period of 2 years for new projects and a repayment period of 10 years with a 2 year grace period for existing projects. Loans can be as low as US$ 2,000 and as high as US$ 20 million.
Morocco	Sustainable Energy Facility for Africa (Sefa) fund	The African Development Bank (AfDB)	This fund has just allocated 965,000 dollars to the Société Ingénierie énergétique (SIE) of Morocco. The funding is intended to support the public company in its transition to the Energy Services Super Enterprise (ESCO) initiative.
	Energy Development Fund (EDF) with a total capital of one billion $US	• 200 million from Hassan II fund • 300 million from UAE • 500 million from Saudi Arabia	
Palestine	Revolving Fund for EE projects established in 2012	• Start-up capital from donor • Institutions • Funds saved through EE projects	Free energy audits for public institutions/ facilities
Syria	Fund for residential solar water heaters	Fund provided by the Ministry of Electricity	The fund covers 50% of the price with the solar water heater system's price not exceeding Syrian Liras 20,000
Tunisia	National Fund for Energy Management (FNME) established by Law 2005-82 (2005) and Law 2005- 106 (2005)	• Revenues from taxes on the first registration of cars and import or manufacturing of air conditioners, according to the Law No 2005-2234 (2005) • financial savings achieved as a result of EE activities • Private donations	• Financial incentives for EE projects in the industrial sector through "contract program" • 50% of the total investment cost of EE • demonstration projects, with a ceiling of TND 100,000 • Incentives to promote the development of solar • water heaters market
UAE	Dubai Green Fund with $ 650 million	Founding investors from Dubai, with additional investment from the private sector, international banks and large investment companies	

3.3.2 Customs Duty and Taxes for Appliances

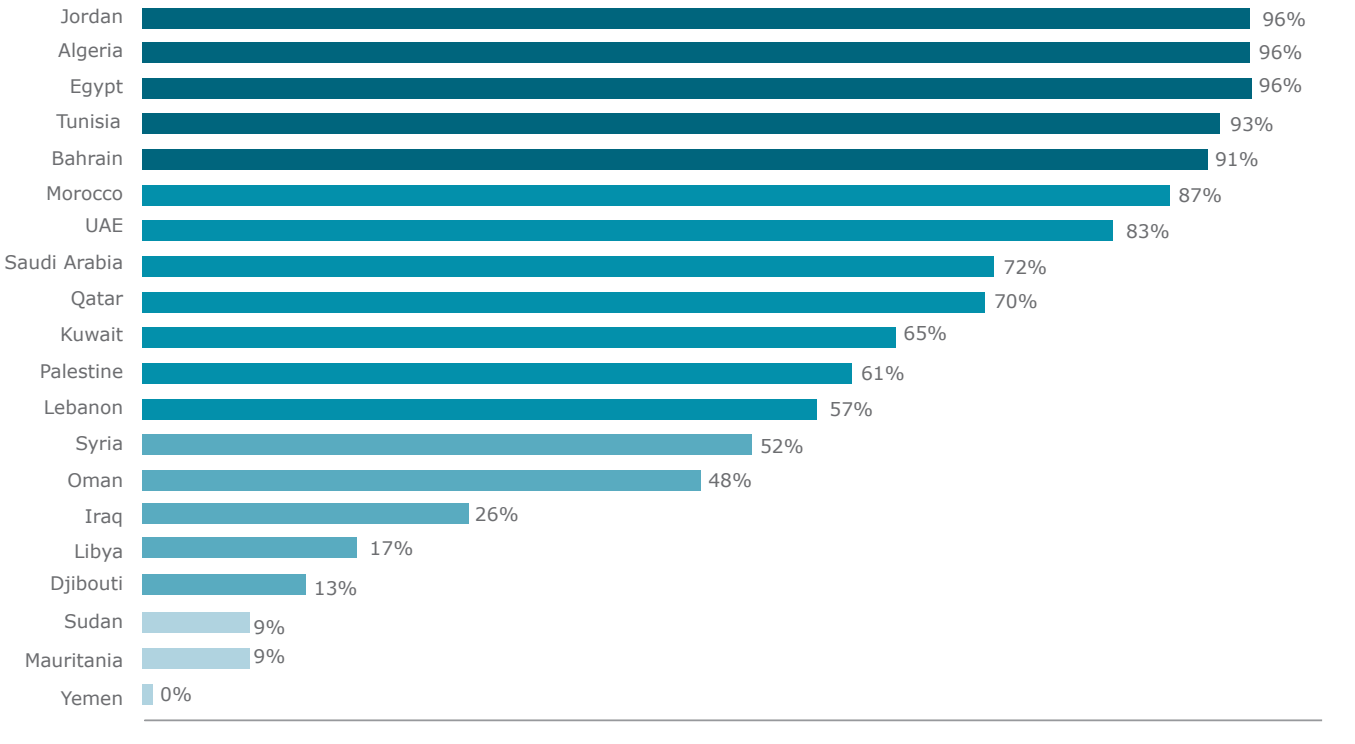
Customs reliefs, reduced tax rates, tax credits, tax reductions, tax exemptions, and other preferential treatment in taxation are considered fiscal incentives that should encourage the implementation of energy efficiency policies by reducing initial and overall costs. This is a fact, especially in countries where taxes and tax collection rates are high. While many countries across the world have adopted fiscal incentives for EE investments, few countries in the MENA region offer tax incentives for such investments.

Table 36: Customs and taxes in Arab countries

Countries	Vat/Sales tax%	Incentives
Algeria	19%	According to Ordinance No. 01-03 of 20-8-2001 (modified and completed by Ordinance No. 06-08 of 15-7-2006) and (additional finance law 2009 to the law of finance2015). The equipment, machinery, materials and services imported, or purchased from the local market, are exempt from customs duties and Value Added Tax (VAT).
Bahrain	5%	None
Djibouti	33%	None
Egypt	14%	Exemption from customs duties for EE equipment
Iraq	None	None
Jordan	16%	Exemption from sales tax and customs duties for EE equipment
Kuwait	None	None
Lebanon	11%	None
Libya	None	None
Mauritania	16%	None
Morocco	20%	- A 20% rebate on any energy bill that conserves 20% of energy when compared with the same month in the previous year - A reduction in import duties for hybrid vehicles
Oman	5%	None
Palestine	16%	Exemption from VAT/sales tax
Qatar	None	None
Saudi Arabia	15%	None
Sudan	17%	None
Tunisia	18%	Exemption from VAT tax and reduction of customs duty to 10% for EE equipment
UAE	5%	None
Yemen	5%	None

3.4 Final Score and Ranking for Policy Framework

Figure 22: Ranking for Policy framework dimension



4 Institutional Capacity

The existence of dedicated institutions promotes action plans design and implementation. The absence of the dedicated institution can be a major obstacle for the government to reach its announced targets and goals. This section is meant to assess the ability of the Arab countries to develop and effectively implement energy efficiency policies.
Two factors were selected to assess the institutional capacity in the region: EE institutions and implementation capacity. Table 3 7 exhibits the two factors and the selected indicators that are associated with each factor.

Table 37: Institutional capacity factors and Indicators

Finance and Investment			
Category	Factors	Indicator	Score/Measuring Unit
Institutional Capacity	EE Institutions	Dedicated EE units within ministries	Presence of designated EE unit; adequacy of technical and human resources; capacity to formulate and monitor EE policies
		Dedicated EE agency	Presence of designated EE agency; adequacy of technical and human resources; capacity to implement EE policies
	Implementation Capacity	Total Final Consumption	Percent of TFC change compared to GDP change for the same period
		Total Energy Supply	Percent of TES change compared to GDP change for the same period

4.1 Energy Efficiency Institutions and Governance

4.1.1 Dedicated EE Entities

For successful implementation of EE strategies and action plans, efficient EE institutions are required as many barriers can hinder EE programs and policies applications. These barriers can include EE initiatives financing, spreading information and promoting consumers and investors awareness of EE benefits, developing and implementing regulations to encourage EE, and the technical capacity to carry out EE initiatives. Dedicated EE institutions can help to overcome those barriers using effective EE governance to develop and implement legislative frameworks, regulations, funding mechanisms, provide institutional oversight, as well as coordinate with the wide array of EE stakeholders to ensure a degree of accountability.

Nearly all Arab countries have energy efficiency entities to promote best practices for using energy. Nine countries have a dedicated EE agency while the rest have EE units within ministries. Only five countries have both dedicated EE agencies and EE units within ministries.

Table 38: EE entities in Arab countries

Country	EE agency within ministry		Dedicated EE Agency	Status
	Ministry/other entities	Unit		
Algeria	Electricity / Oil and Gas	The Department of New and Renewable Energies and Energy Efficiency Directorate within Ministry of Energy and Mines		established
	Energy transition	The sub-directorate for energy management in the economic sectors Directorate within Ministry of Energy Transition and Renewable Energy	National Agency for the Promotion and Rationalization of Use of Energy (APRUE)	
Bahrain	Electricity	Electricity and Water Conservation Directorate at the ,Electricity and Water Authority Sustainable Energy Authority at the Ministry of Electricity	-	established
	Oil and Gas	National Oil and Gas Authority (NOGA)		
	Other entities	The High Energy Committee in charge of formulating energy policy		
Djibouti	Energy	-	Djiboutian Agency for energy conservation (ADME)	established

Country	EE agency within ministry		Dedicated EE Agency	Status
	Ministry/other entities	Unit		
Egypt	Electricity	Energy Efficiency and climate change unit at Ministry of Electricity and Renewable Energy	-	established
	Other entities	EE Unit at the Council of Ministers Secretariat, EE Unit within the Ministry of Industry, and Green Tourism Unit within the Ministry of Tourism		
Iraq	-	-	-	-
Jordan	Electricity	EE Department at the Ministry of Energy and Mineral Resources		
	Oil & Gas			
	Other entities	National Energy Research Center (NERC) Energy and Minerals Regulatory Commission (EMRC) Jordan Standards and Metrology Organization (JSMO)	-	established
Kuwait	Electricity	National Energy Research Center (NERC) Energy and Minerals Regulatory Commission (EMRC)	-	established
	Other entities	Kuwait Institute for Scientific Research (KISR)		
Lebanon	Other entities	- Lebanese Center for Energy Conservation (LCEC) - Lebanese Association for Energy Saving and for Environment (ALMEE)	-	established
Libya	-	-	Renewable Energy Authority of Libya (REAOL)	established
Mauritania	The Ministry of Petroleum, Energy and Mines	La Direction de l'Electricité et de la Maitrise de l'Energiecontribue (The Department of Electricity and Energy Management)	-	-
Morocco	Electricity	Renewable Energy and Energy Efficiency Department at the Ministry of Energy, Mines, Water and Environment	Moroccan Agency for Energy Efficiency (AMEE)	established
Oman	Other entities	Oman Energy Efficiency Center	-	under establishment
Palestine	-	-	Moroccan Agency for Energy Efficiency (AMEE)	established
Qatar	Electricity	Conservation and Energy Efficiency Department at the Qatar General Electricity and Water Corporation, KAHRAMAA	-	established
	Other entities	Qatar Environment and Energy Research Institute, National Program for Conservation and Energy "Efficiency "Tarsheed		
Saudi Arabia	Electricity	Energy Conservation and Awareness Department under the Ministry of Water and Electricity	Saudi Energy Efficiency Center (SEEC)	established
Sudan	Electricity	Electricity Regulatory Authority within the Ministry of Energy and Oil	-	established
Syria	-	-	Saudi Energy Efficiency Center (SEEC)	established
Tunisia	Electricity/ Oil & Gas	General Directorate of Energy at the Ministry for Industry, Energy, and Mines	National Agency for Energy Conservation (ANME)	established
UAE	Electricity/ Oil & Gas	Rationalization and Energy Usage Efficiency Department under Ministry of Energy	Abu Dhabi Cooling Taskforce; Dubai Supreme Council of Energy	established
	Other entities	Masdar Institute of Science and Technology		

4.2. IMPLEMENTING CAPACITY

4.2.1 Total Final Consumption

Total Final Consumption (TFC) is the summation of all energy used by end users such as industry and residential sectors. However, it excludes the energy used by energy sector itself such as transmission and fuel transformation. TFC is influenced by the energy efficiency by the end users and the energy supply chain. Table 39 below exhibits the TFC for Arab countries in years 2015 and 2019. The later year was selected instead of 2020 to avoid the Covid-19 effects on the economy and consequently energy consumption. To conclude if there is any improvement in TFC, GDP must be considered also as shown in Table 39 below.

The optimal case is to increase GDP and decrease TFC as in the case of Saudi Arabia where the TFC is decreased by 8.6% and GDP is increased by 3.7%. The second-best case is that GDP will increase more than the increase in TFC as in the case of Egypt where the GDP is raised by 20.8% and TFC is raised by 9.4% only.

Table 39: TFC and GDP for Arab countries 2015-2019 for Arab countries

Country	TFC 2015 (TJ)[1]	GDP 2015 (Constant 2015 million USD)[2]	TFC 2019 (TJ)	GDP 2019 (Constant 2015 million USD)	TFC%	GDP%
Algeria	1,568,932	165,979	1,829,201	177,767	16.6%	3.5%
Bahrain	258,214	31,051	290,067	34,985	12.3%	12.7%
Djibouti	-	2,430	-	3,192	-	31.4%
Egypt	2,328,192	329,367	2,546,392	398,037	9.4%	20.8%
Iraq	711,858	166,774	973,267	202,614	36.7%	21.5%
Jordan	232,188	38,587	270,839	41,756	16.6%	8.2%
Kuwait	723,265	114,567	770,329	114,249	6.5%	-0.3%
Lebanon	216,266	50,066	220,711	46,777	2.1%	-6.6%
Libya	381,763	27,842	458,064	40,474	20.0%	45.4%
Mauritania	-	6,167	-	7,336	-	19.0%
Morocco	630,045	101,180	701,565	112,827	11.4%	11.5%
Oman	851,546	68,420	997,738	72,202	17.2%	5.5%
Palestine	-	13,972	-	15,829	-	13.3%
Qatar	820,555	161,740	858,038	167,371	4.6%	3.5%
Saudi Arabia	6,403,658	654,270	5,851,823	678,581	-8.6%	3.7%
Sudan	489,060	51,727	533,751	51,312	9.1%	-0.8%
Syria	242,009	16,492	231,015	16,266	-4.5%	-1.4%
Tunisia	329,482	45,780	345,583	49,199	4.9%	7.5%
UAE	2,449,995	358,135	2,380,744	395,104	-2.8%	10.3%
Yemen	109,827	42,445	105,679	36,790	-3.8%	-13.3%

1 Source: IEA, 2 Source: World Bank

4.2.2 Total Energy Supply by GDP

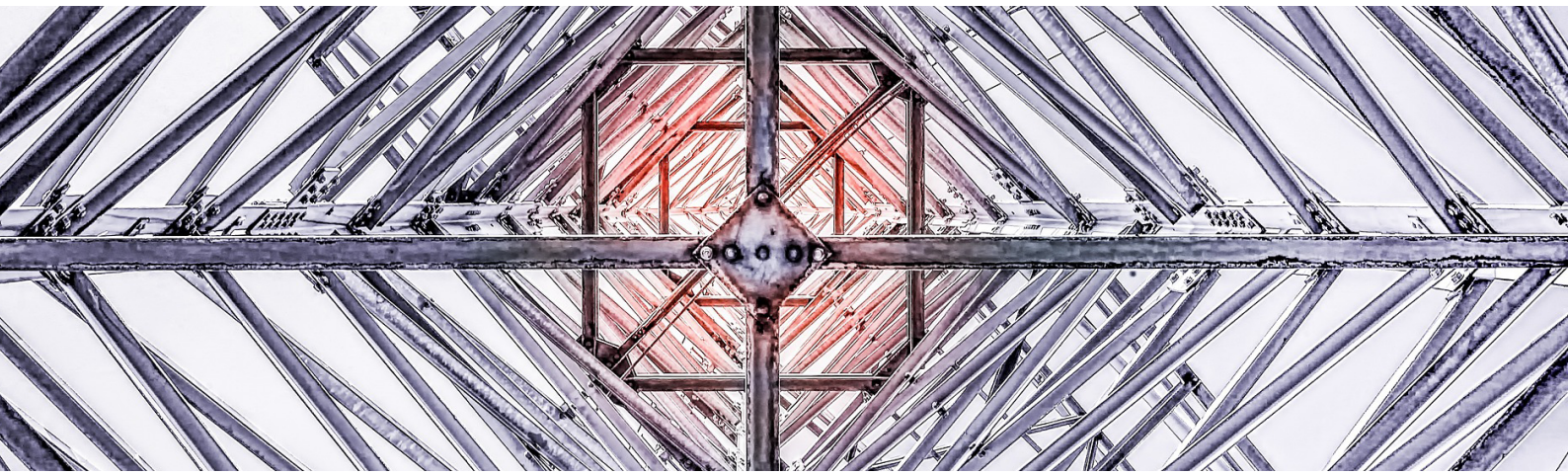
The other side of the coin for total final consumption (TFC) is the total energy supply (TES). TES can be defined as the sum of all primary energy sources. This can include energy extracted from natural resources, imported primary energy resources (diesel, gasoline) – if there is any exported energy, it will be subtracted off -, and the net result from electricity trading. If the country used less TES for the same GDP, it means that the energy conversion and the energy transmission are more efficient.

Table 40 shows the TES for years 2015 and 2019 (the latter was selected to avoid the impact of Covid-19) and the percent change of GDP for the same years. United Arab Emirates decreased the TES by 34% while increased GDP by 10%. Saudi Arabia is following by reducing TES by nearly 1% and increasing GDP by 3.7%.

Table 40: TES and GDP change 2015-2019

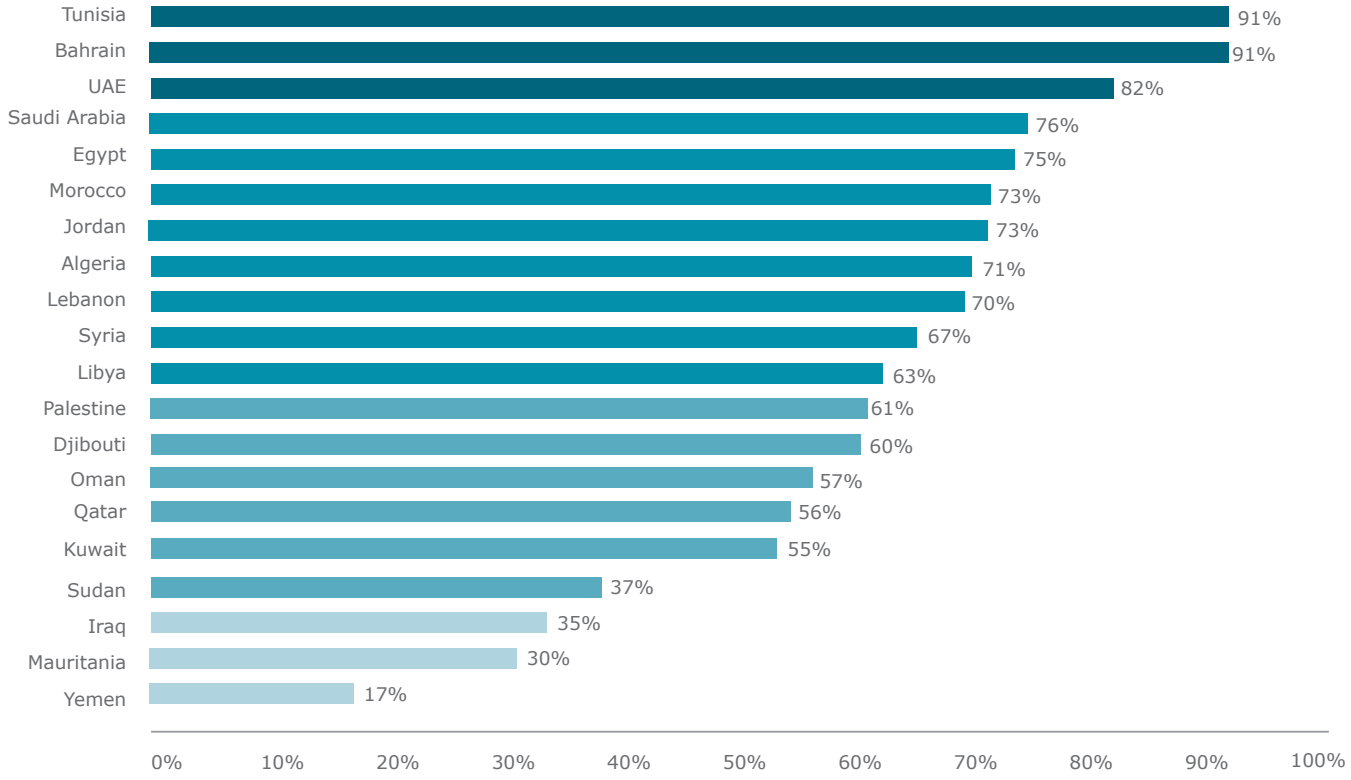
Country	TES 2015 (TJ)	TES 2019 (TJ)	TES% Change	GDP% Change
Algeria	14.1 (TES/GDP GJ/1000$ (2015))	14.9(TES/GDP GJ/1000$ (2015))	5.7 %	3.5 %
Bahrain	597,000	645,737	8.2%	12.7%
Djibouti	-	-	-	31.4%
Egypt	3,379,452	4,027,340	19.2%	20.8%
Iraq	1,569,990	2,312,876	47.3%	21.5%
Jordan	361,030	386,424	7.0%	8.2%
Kuwait	1,488,643	1,553,012	4.3%	-0.3%
Lebanon	347,992	361,508	3.9%	-6.6%
Libya	767,067	915,735	19.4%	45.4%
Mauritania	-	-	-	19.0%
Morocco	816,021	931,713	14.2%	11.5%
Oman	1,055,933	981,511	-7.0%	5.5%
Palestine	-	-	-	13.3%
Qatar	1,554,930	1,731,163	11.3%	3.5%
Saudi Arabia	9,060,023	8,983,957	-0.8%	3.7%
Sudan	768,022	827,624	7.8%	-0.8%
Syria	421,738	388,094	-8.0%	-1.4%
Tunisia	455,050	471,647	3.6%	7.5%
UAE	3,361,837	2,203,603	-34.5%	10.3%
Yemen	156,516	174,224	11.3%	-13.3%

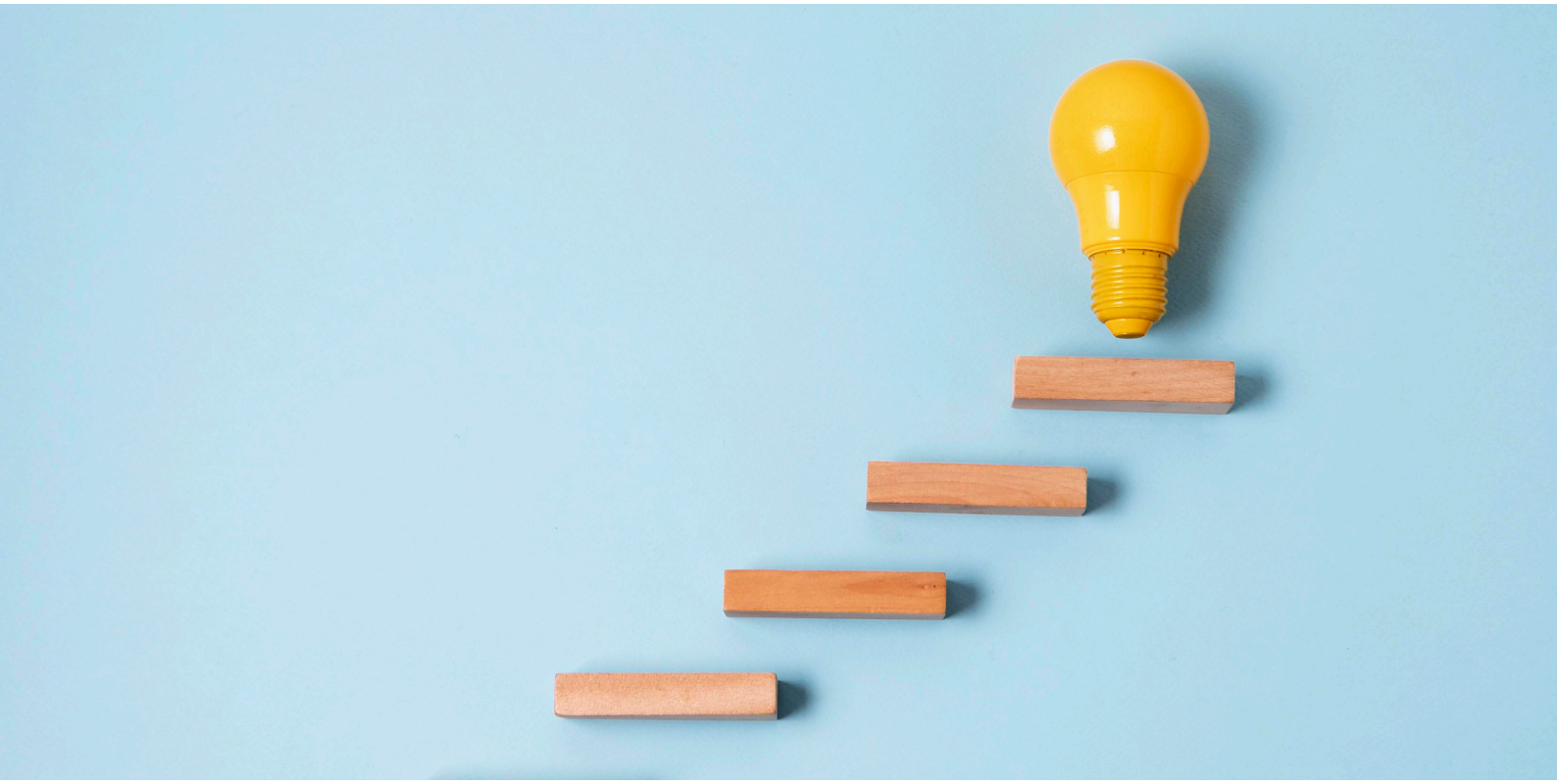
Source: IEA



4.3 Final Score and Ranking for Institutional Capacity

Figure 23: Ranking for institutional capacity dimension





Arab Future Energy Index

AFEX 2023

Energy Access

Executive Summary

Energy is pivotal for a country's economic development and its citizens wellbeing. Energy access is necessary for the provision of industrial activity, lighting, heating, cooking, transport, and telecommunications services. In addition, clean water, sanitation, and healthcare need energy to be provided. AFEX EA is the newly added section to assess energy access and energy security in the Arab countries.

Only six Arab countries have low electricity access: Djibouti, Libya, Mauritania, Sudan, Syria, and Yemen. The rest have almost 100% access to electricity, although 100% access rate does not mean that the electricity service is available 24/7 as several countries suffer from frequent power outages. High rates of electricity access will ease the transformation to full electrification as explained in the associated chapter. For clean cooking, Fortunately, most of the Arab countries have high access to clean cooking. Only four Arab countries have low rates of clean cooking access.

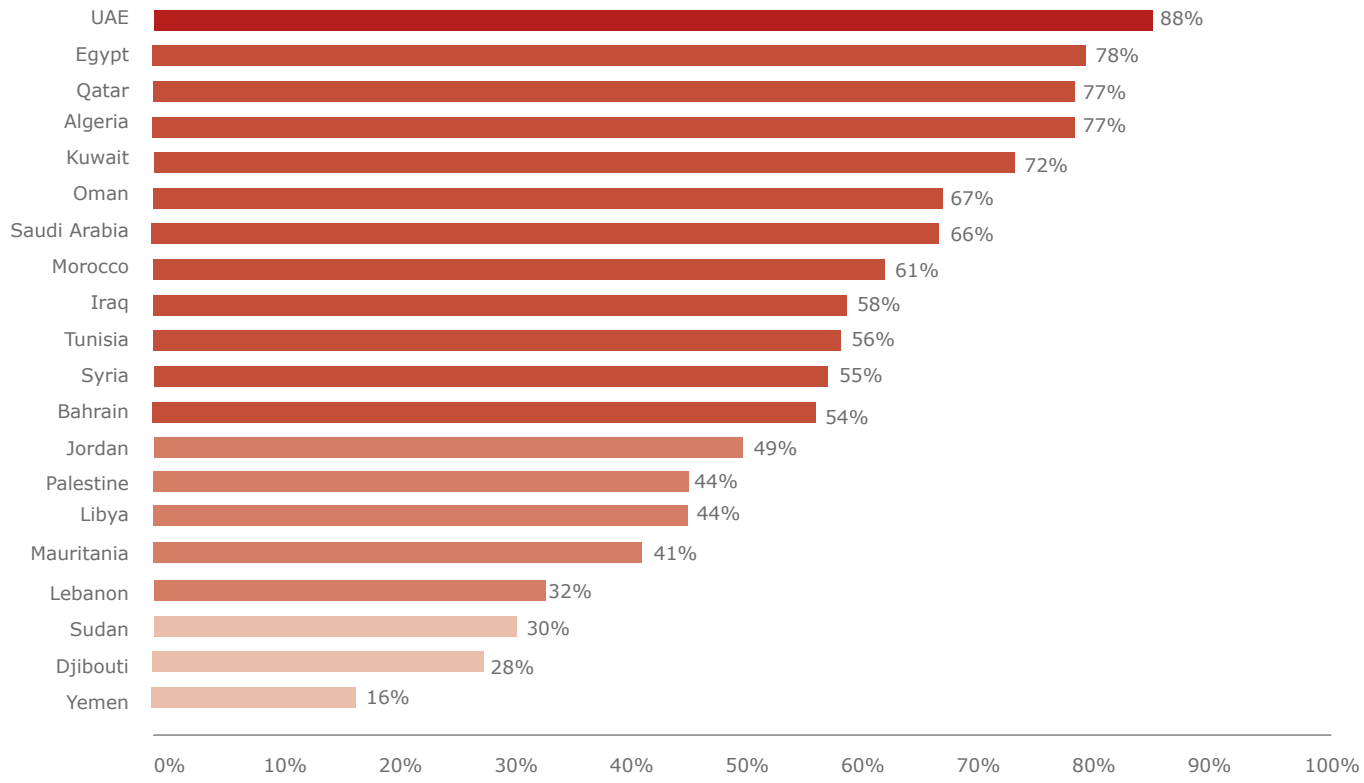
Self-sufficiency is indicated if the country is a net importer or exporter of energy. A percentage above 100% indicates that the country is net exporter, and a percentage lower than 100% indicates that the country is net importer. Arab countries vary greatly, 9 countries (oil rich countries) are net exporters: Algeria, Bahrain, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, and UAE. Egypt and Sudan are near 100% ratio, which means they nearly energy self-sufficient. Jordan, Lebanon, and Palestine have a self-sufficient ratio below 10% which means they import most of their energy needs.
The indicator electrification rate measures the percentage of electricity consumption of the total final consumption. The higher the percentage, the more the country approaches total electrification. Bahrain has the highest percentage with 42% followed by Lebanon with 32%. Four countries have a percentage between 20% and 30%.

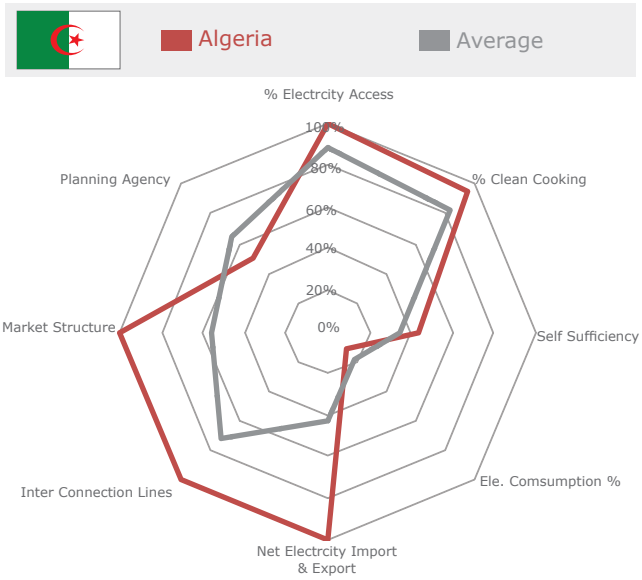
Countries that have a net positive balance between electricity exports and imports have more potential to reach high electrification rate since they have the required resources. While the countries that imports large amounts of electricity will find hardship in reaching full electrification. There is a special case which is Syria that has less than 100% electricity access, however it exports electricity to Iraq and Lebanon.

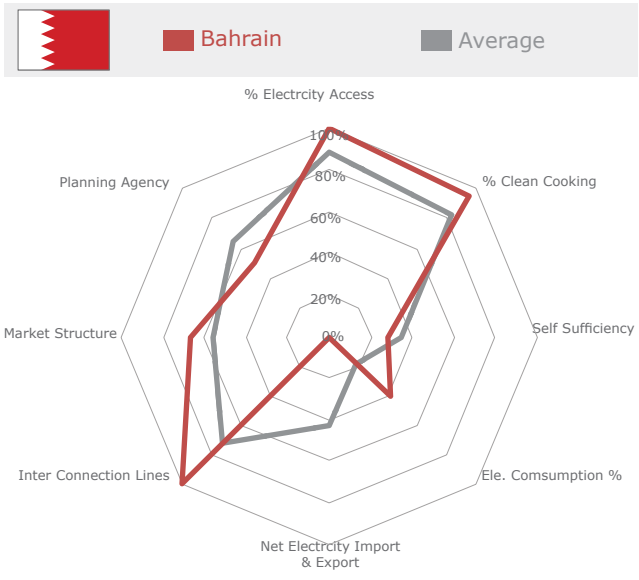
Arab countries have three power pools for electricity trading. The Maghreb pool which includes Algeria, Libya, Morocco, and Tunisia. The EIJLPST pool which includes Egypt, Iraq, Jordan, Libya, Lebanon, Palestine, Syria, and Turkey. And finally, the Gulf power pool that includes Bahrain, Kuwait, Qatar, and Saudi Arabia.

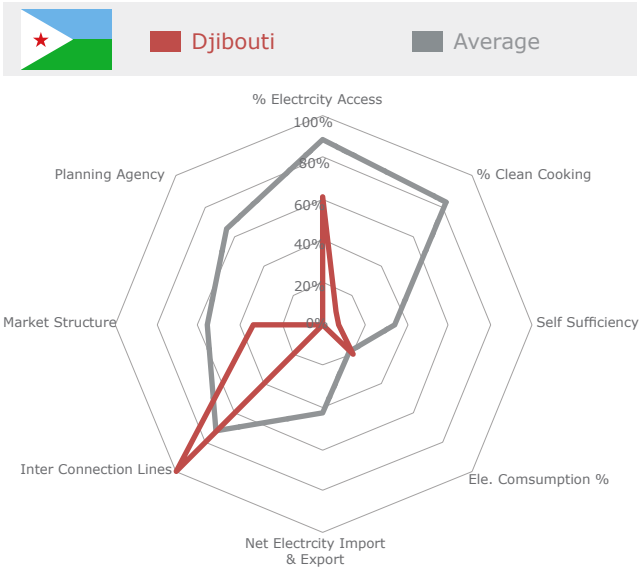
Approximately half of Arab countries have a vertically integrated electricity market. Which means the government is accountable for providing electricity or delivering energy to its citizen. This will require financial resources that will burden fiscal budget and may delay the process if there are no sufficient funds. The other half is single buyer market (sometimes with unbundled transmission, and sometimes with bundled transmission and distribution). In this type of market, private sector finances part of delivering energy to customers by installing power generation plants and selling electricity to the government.
The final ranking of the countries can be seen in the next figure 26. For individual results, the spider web figures shoes the

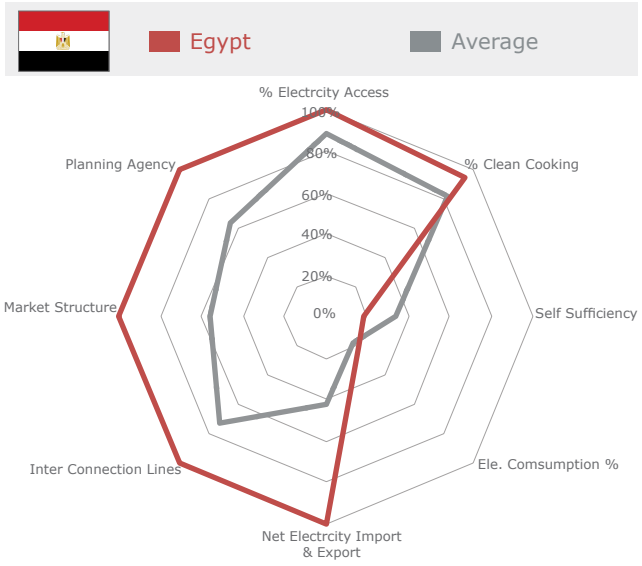
Figure 24: Countries Final ranking for AFEX EA

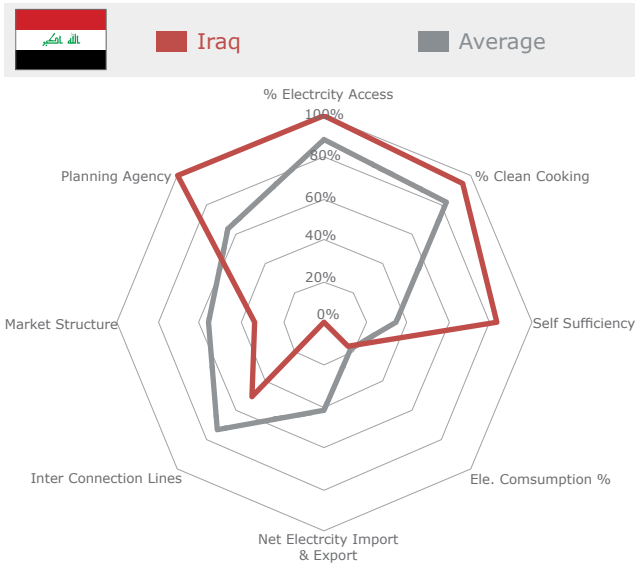


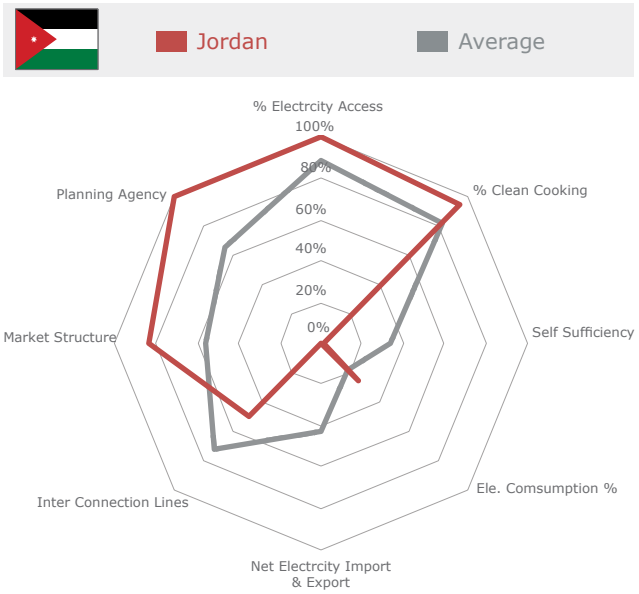


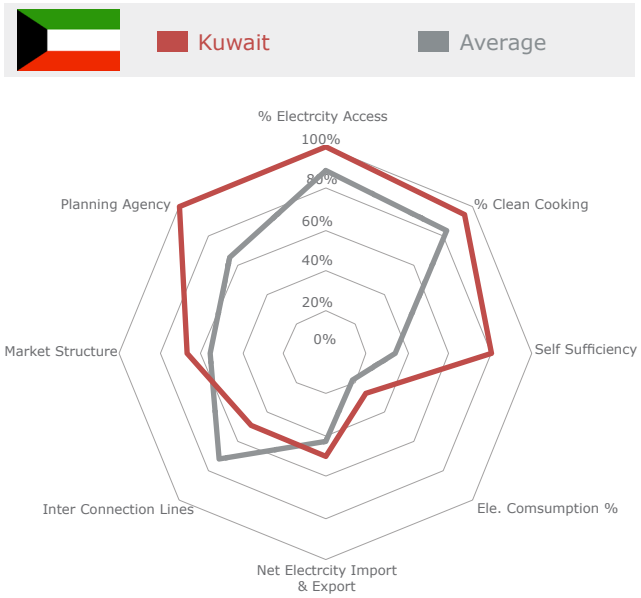


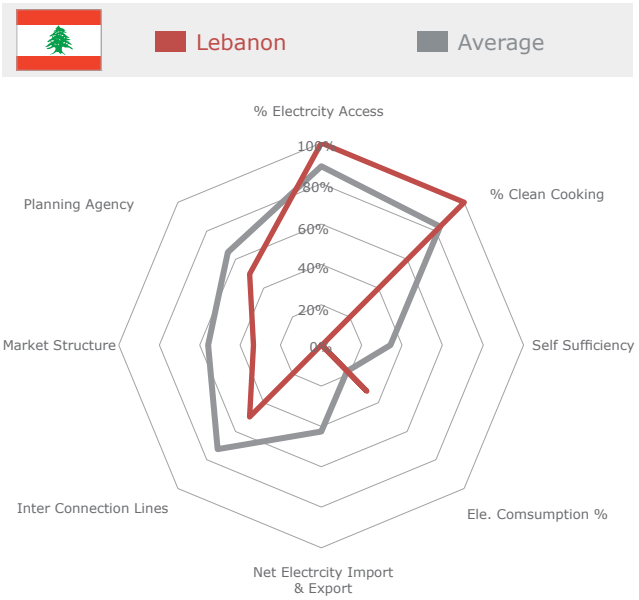

Djibouti
Average
% Electrcity Access
100%
80%
60%
40%
20%
0%
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency

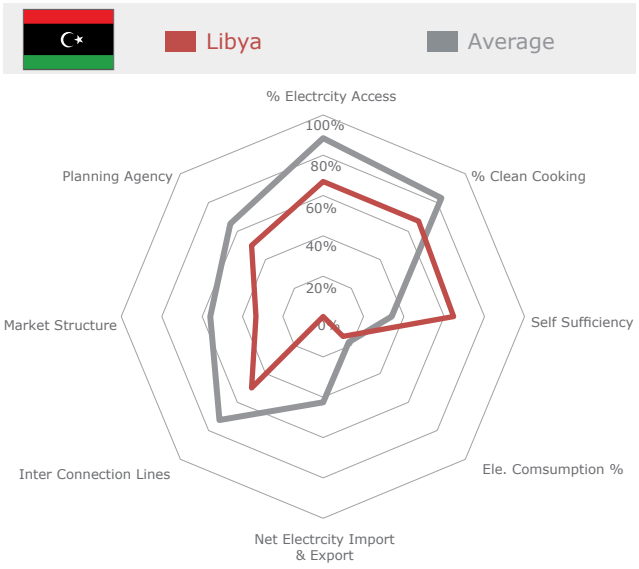

Egypt
Average
% Electrcity Access
100%
80%
60%
40%
20%
0%
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency

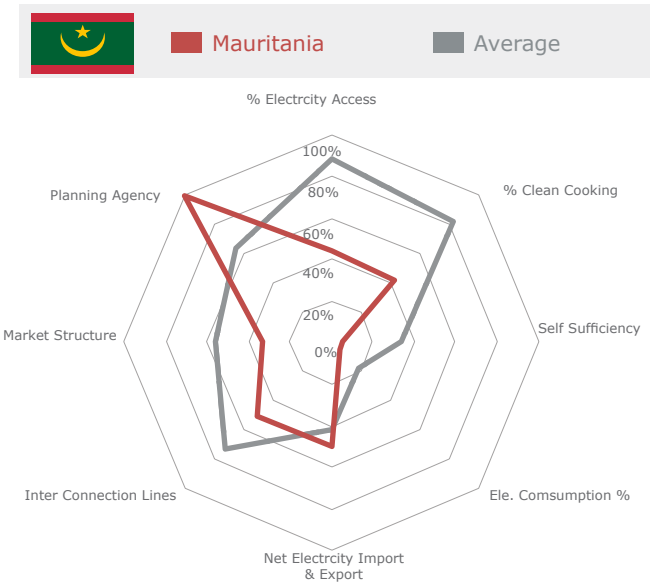

Iraq
Average
% Electrcity Access
100%
80%
60%
40%
20%
0%
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency

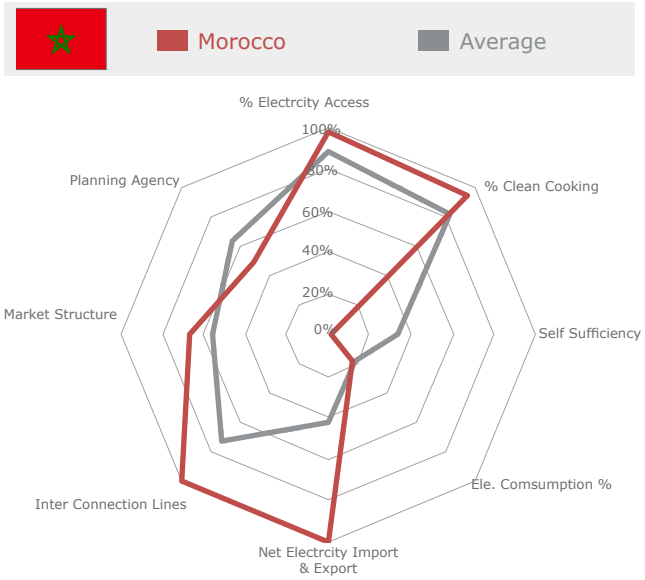

Jordan
Average
% Electrcity Access
100%
80%
60%
40%
20%
0%
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency

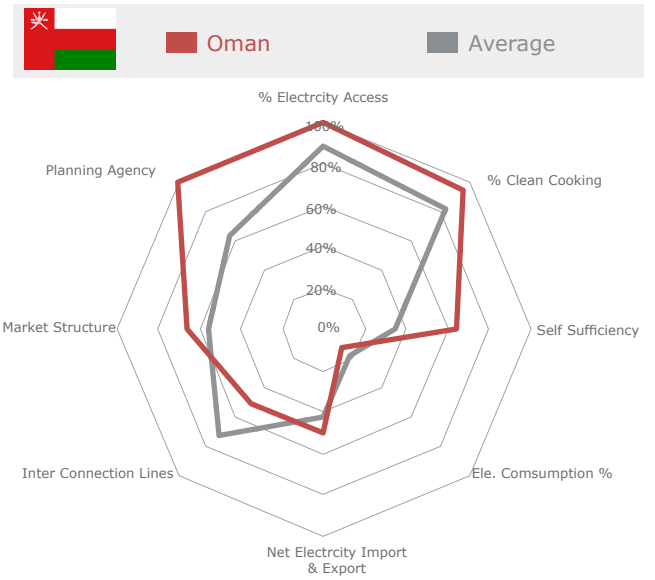

Kuwait
Average
% Electrcity Access
100%
80%
60%
40%
20%
0%
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency

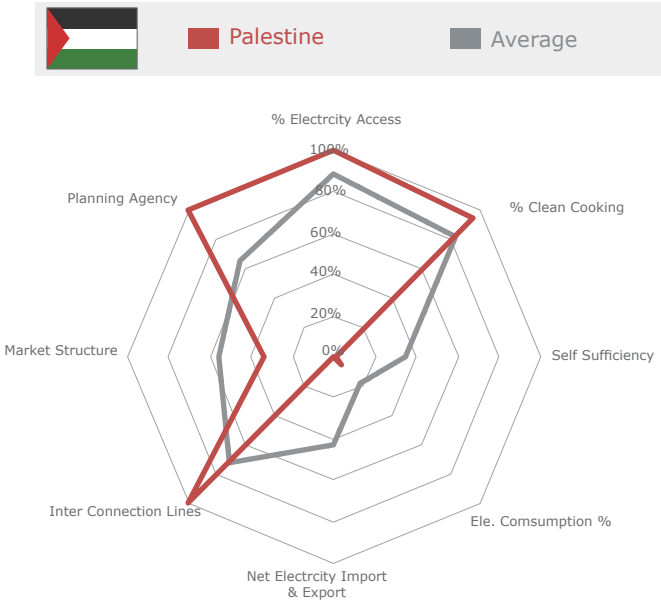

Lebanon
Average
% Electrcity Access
100%
80%
60%
40%
20%
0%
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency

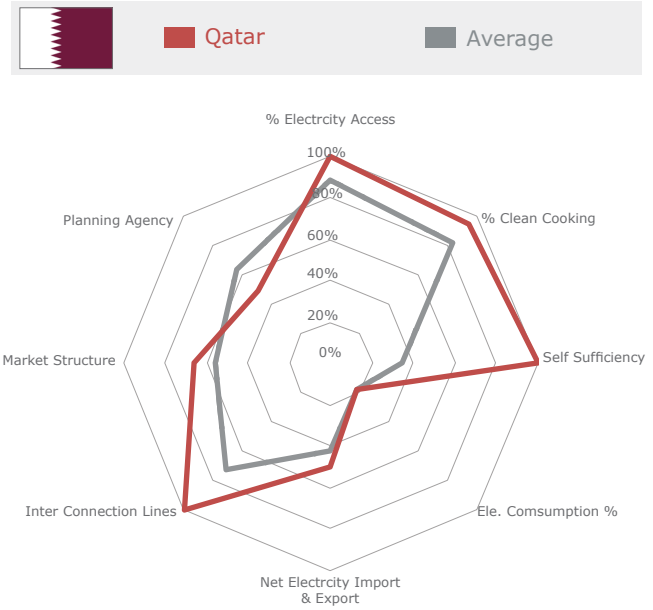

Libya
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%

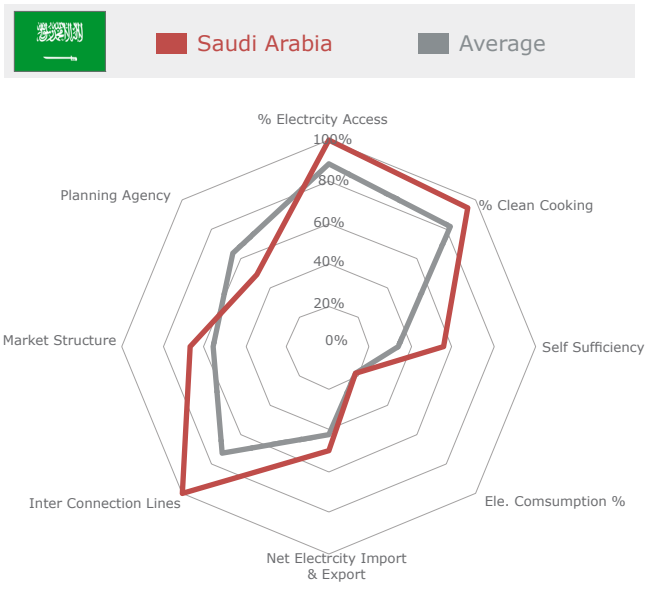

Mauritania
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%

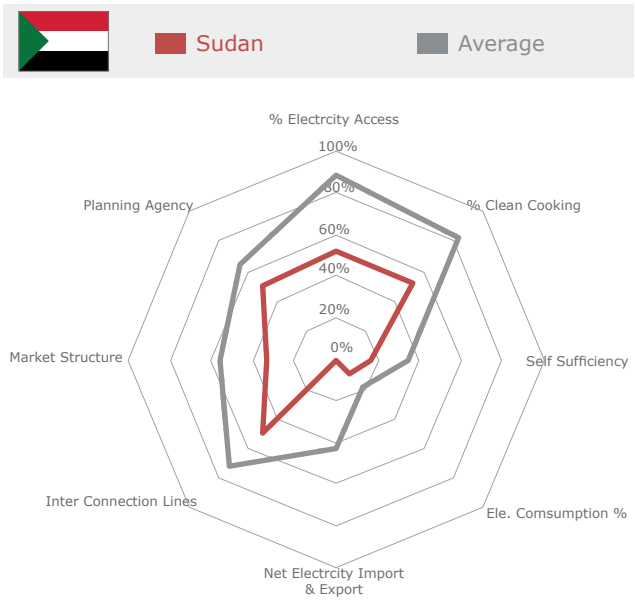

Morocco
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%

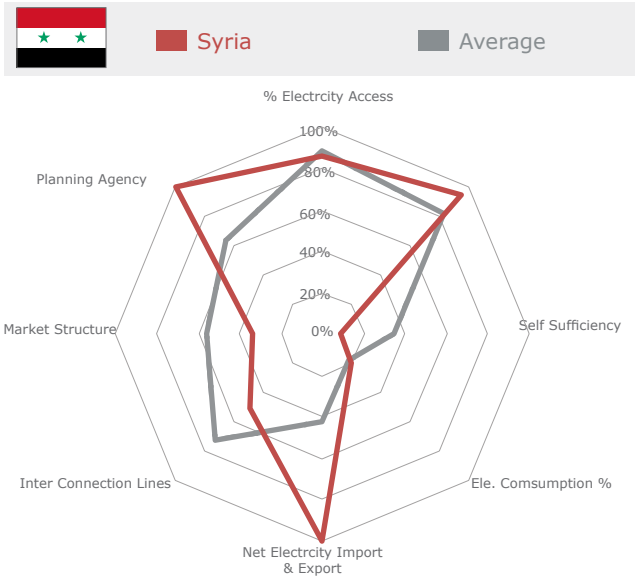

Oman
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%

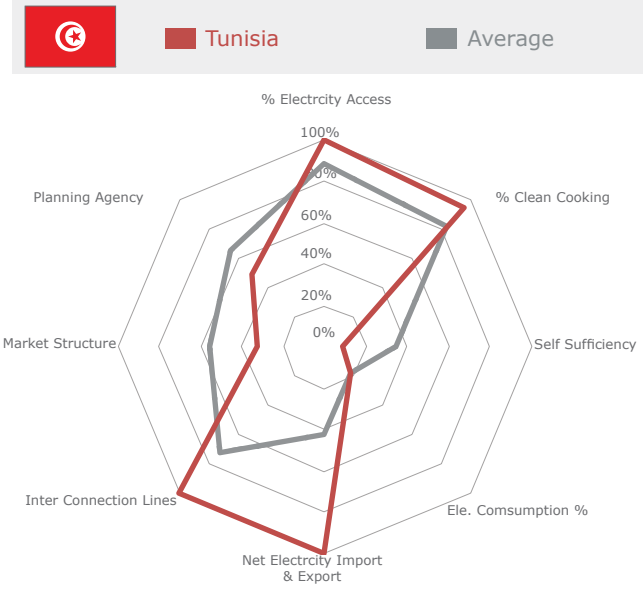

Palestine
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%

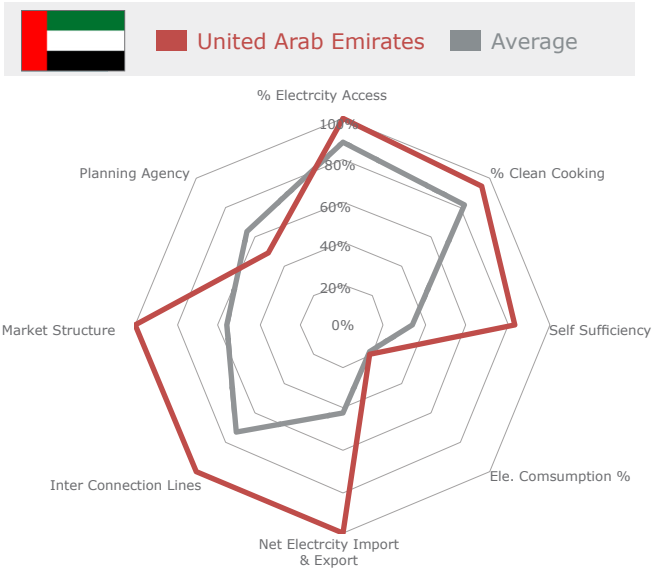

Qatar
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%

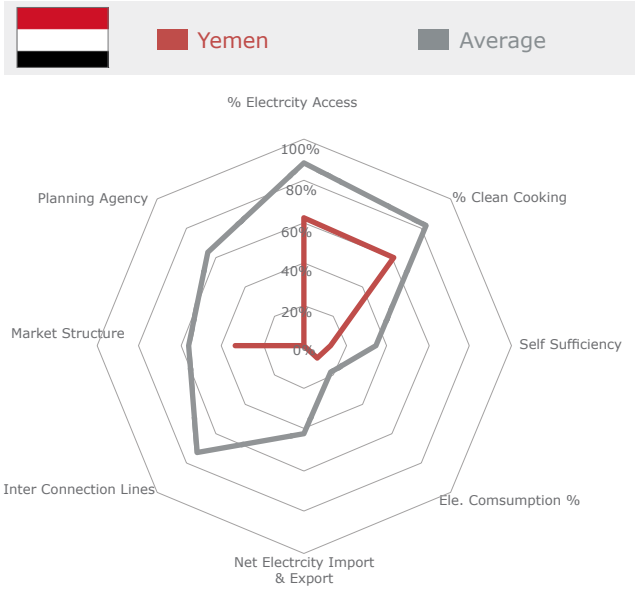

Saudi Arabia
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%


Sudan
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%


Syria
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%


Tunisia
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%


United Arab Emirates
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%


Yemen
Average
% Electrcity Access
% Clean Cooking
Self Sufficiency
Ele. Comsumption %
Net Electrcity Import & Export
Inter Connection Lines
Market Structure
Planning Agency
100%
80%
60%
40%
20%
0%

1 Introduction

Arab Future Energy Index for Energy Access (AFEX EA) is the newest addition to the AFEX portfolio. AFEX used to be published and assess renewable energy in AFEX RE and energy efficiency in AFEX EE. AFEX EA -similar to the other AFEXs- assess the energy access in the pan-Arab region countries. AFEX EA utilize qualitative and quantitative factors and indicators to assess different aspects of energy access and security.

AFEX EA goes beyond the standard definition of energy access that is concerned with the percentage of population that have access to electricity according to predefined criteria. AFEX EA examines also the countries self-sufficiency in Energy. In addition, electrification aspect is present. AFEX EA assess the electrification rate, the net electricity trade in the Arab countries and the existence of interconnection lines between Arab countries. The final dimension is the institutional capacity and assess the ability for grid expansion planning and the current market structure.

AFEX EA carry out the above assessment using three factors and eight indicators. The indicators vary between quantitative indicators (5 indicators) and qualitative indicators (3 indicators) the following table presents the implemented factors and indicators used in AFEX EA.

Table 41: Factors and indicators used in AFEX EA

Energy Access	Electricity access	Percentage of population that have access to electricity
	Clean Cooking Access	Percentage of population that have access to clean fuels and technology for cooking
	Self-Sufficiency	Total energy produced by the country over the total primary energy supply (TPS)
Electrification	Electrification rate	Electricity consumption % in the total final consumption (TFC)
	Net Electricity trade	Net electricity imports and export (Electricity Export – Electricity Import)
	Interconnection	Inter connection lines with neighboring countries
Institutions	Market structure	Type of market structure
	Planning Institution for grid expansion	Existing, non-existing

2 Energy Access

Energy is pivotal for a country's economic development and its citizens wellbeing. Energy access is necessary for the provision of industrial activities, lighting, heating, cooking, transport, and telecommunications services. In addition, clean water, sanitation and healthcare need energy to be provided. There are several estimations when it comes to the number of populations that do not have Electricity Access (EA). ESCWA estimated this number at 30 million people[38] in the Arab region. while IEA estimated that number by 55 million[39] . This section assesses the energy access dimension in Arab countries. Table below exhibits the selected three indicators to assess this factor.

Table 42: TES and GDP change 2015-2019

Factor	Indicator	Measuring Unit
Energy Access	Percentage of population that have access to electricity	%
	Percentage of population that have access to clean fuels and technology for cooking	%
	Total energy produced by the country over the total primary energy supply (TPS)	%

2.1 Electricity Access

There are several definitions for electricity access. The simplest one is "Household access to a minimum level of electricity". Another more elaborated definition is "Household access to safer and more sustainable (i.e. minimum harmful effects on health and the environment as possible) electricity, cooking and heating fuels and stoves". As explained before, energy is crucial for human wellbeing. This factor measures the percentage of population that has access to electricity inside a country. Nevertheless, it must be stressed that this indicator does not measure electricity interruption. For example, in Lebanon, the electricity access is 100%, however it is not adequately available as the people must bear the brunt of electricity outage for long hours.

IEA has set the threshold of sufficient electricity to power a household. It considers annual electricity consumption of 1,250 kWh per household with standard appliances, and 420 kWh with efficient appliances. However, because the difficulty of gathering exact detailed data, IEA considers those that have a connection to an electricity grid or have a renewable stand-alone system or mini-grid connection of sufficient capacity to deliver the minimum bundle of energy services that are enough to power four lightbulbs operating at five hours per day, one refrigerator, a fan operating 6 hours per day, a mobile phone charger and a television operating 4 hours per day.

Only six Arab countries have low electricity access: Djibouti, Libya, Mauritania, Sudan, Syria, and Yemen. The rest have almost 100% access to electricity. High rates of electricity access will ease the transformation to full electrification as explained in the next chapter.

Table 43: Electricity access percentage

Country	Electricity access
Algeria	100%
Bahrain	100%
Djibouti	62%
Egypt	100%
Iraq	100%
Jordan	100%
Kuwait	100%
Lebanon	100%
Libya	70%
Mauritania	47%
Morocco	100%
Oman	100%
Palestine	100%
Qatar	100%
Saudi Arabia	100%
Sudan	55%
Syria	89%
Tunisia	100%
UAE	100%
Yemen	74%

Source: Tracking SDG7: The Energy Progress Report 2023

[37] ESCWA, Energy Vulnerability in the Arab Region, United Nations Economic and Social Commission for Western Asia, 2019
[38] IEA, World Energy Outlook, International Energy Agency, 2020

2.2 Clean Cooking Access

Clean cooking access can be defined as "access to (and primary use of) modern fuels and technologies, including natural gas, liquefied petroleum gas (LPG), electricity and biogas, or improved biomass cookstoves (ICS) that have considerably lower emissions and higher efficiencies than traditional three-stone fires for cooking". The traditional cooking fuels that are not considered for clean cooking are coal, kerosene, fuelwood, charcoal, tree leaves, crop residues, and animal dung. In IEA world energy outlook 2019, the estimated population without clean cooking access is 51 million[39].

There are several hazards of using traditional fuel for cooking. Starting with health hazards mainly for women who are responsible for cooking due to the exposure to harmful smoke and emissions that cause problems and damage to respiratory system. In addition, the environmental hazards and low local air quality that result from inefficient fuel burning. Fortunately, most of the Arab countries have high access to clean cooking. Only four Arab countries have low rates of clean cooking access.

Table 44: Clean cooking access

Country	Electricity access
Algeria	>95%
Bahrain	>95%
Djibouti	10%
Egypt	>95%
Iraq	>95%
Jordan	>95%
Kuwait	>95%
Lebanon	>95%
Libya	NA
Mauritania	43%
Morocco	>95%
Oman	>95%
Palestine	NA
Qatar	>95%
Saudi Arabia	>95%
Sudan	54%
Syria	>95%
Tunisia	>95%
UAE	>95%
Yemen	61%

Source: IEA, World Energy Outlook-2021, based on WHO data

2.3 Self Sufficiency

The energy self-sufficiency rate is the ratio between national primary energy production which can include oil production, natural gas production, coal production, nuclear, and renewable energies to the total primary energy supply in the same year. This ratio may be calculated for each of the broad energy types or overall, for all types of energy. A percentage of over 100% indicates that the national production surplus in relation to domestic demand and therefore net exports.

Self-sufficiency is indicated if the country is net importer of exporter of energy. A percentage above 100% indicates that the country is a net exporter, and a percentage lower than 100% indicates that the country is a net importer. Arab countries vary greatly, 9 countries (oil rich countries) are net exporters: Algeria, Bahrain, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, and UAE. Egypt and Sudan are near 100% ratio, which means they are nearly energy self-sufficient. Jordan, Lebanon, and Palestine have a self-sufficient ratio below 10% which means they import most of their energy needs.

Table 45: Energy self-sufficiency rates

Country	Self Sufficiency %
Algeria	236%
Bahrain	156%
Djibouti	36%
Egypt	97%
Iraq	451%
Jordan	7%
Kuwait	437%
Lebanon	3%
Libya	352%
Mauritania	28%
Morocco	10%
Oman	349%
Palestine	4%
Qatar	543%
Saudi Arabia	298%
Sudan	76.4%
Syria	48%
Tunisia	45%
UAE	451%
Yemen	66%

Source: Calculated from IEA data.1: IRENA 2018 data

[39] IEA, World Energy Outlook, International Energy Agency, 201

2.4 Final Scores and Ranking for Energy Access

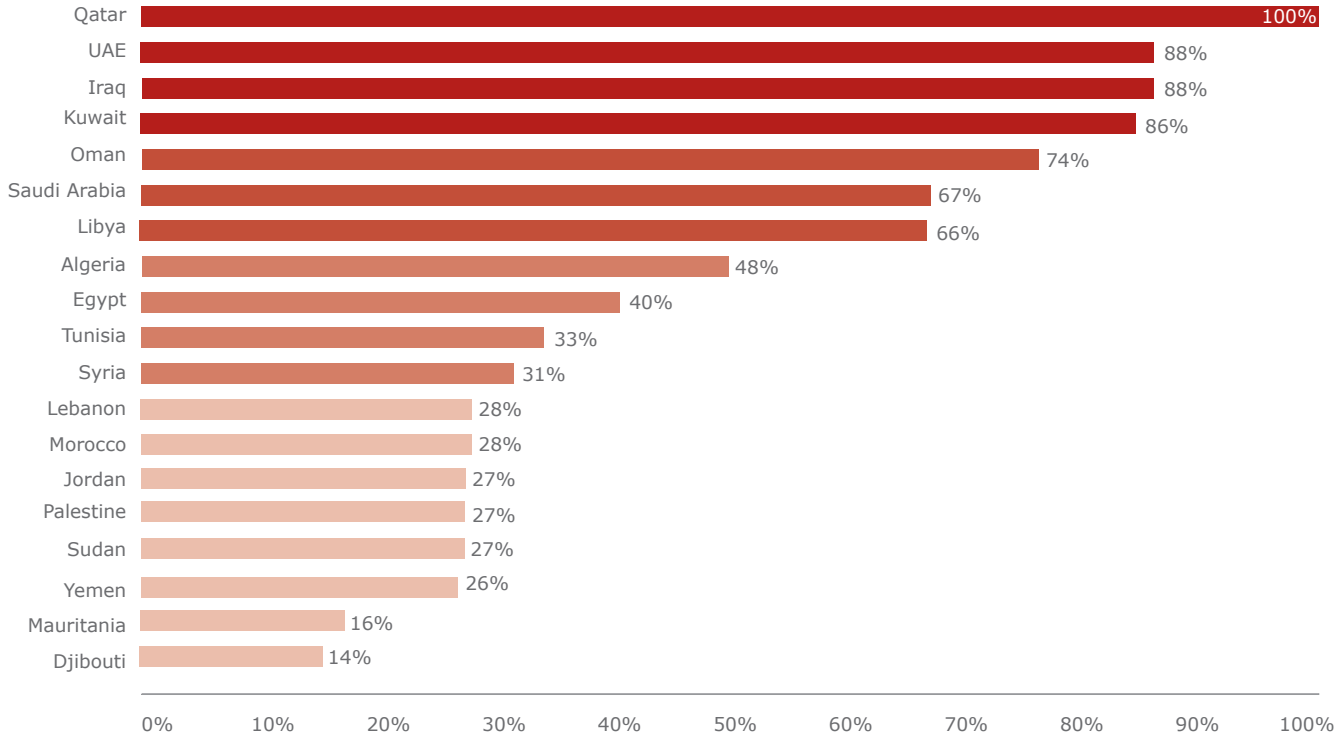


Figure 25: Countries ranking in Energy Access dimension

3 Electrification

Electricity is the driving force behind sustainable development. Electricity provides energy for industries to produce goods, and to other sectors to provide services. Sustainable development goal number seven ensures access to affordable, reliable, sustainable, and modern energy. By increasing access to renewable electricity, this target can be achieved.

For assessing the electrification in the Arab countries three factors were selected. Electrification rate, electricity export and import, and electricity interconnection lines.

Table 46: Electrification factors

Factor	Indicator	Measuring Unit
Electrification	Electricity consumption in the total final consumption (TFC)	%
	Net electricity import and export	Electricity Export – Electricity Import
	Inter connection lines with neighboring countries	Exist / not exist

3.1 Electrification Rate

Electrification refers to the process of replacing technologies that use conventional fossil fuels (coal, oil, and natural gas) with technologies that use electricity as a source of energy. Electrification can potentially reduce carbon dioxide (CO_2) emissions depending on the resources used to produce electricity. If renewable energy is used to produce electricity, all sectors such as transportation, buildings, and industrial sectors can be decarbonized.

The indicator electrification rate measures the percentage of electricity consumption of the total final consumption. The higher the percentage, the more the country approaches total electrification. Bahrain has the highest percentage with 42% followed by Lebanon with 32%. Four countries have a percentage between 20% and 30%.

Table 47: Electricity consumption percentage in TFC

Country	Electricity consumption
Algeria	14%
Bahrain	41%
Egypt	22%
Iraq	16%
Jordan	25%
Kuwait	28%
Lebanon	32%
Libya	14%
Mauritania	-
Morocco	17%
Oman	12%
Qatar	18%
Saudi Arabia	18%
Sudan	9%
Syria	20%
Tunisia	18%
UAE	19%
Yemen	8%
UAE	>95%
Yemen	61%

Source: Calculated form IEA data, focal points

3.2 Electricity Import and Export

Neighboring countries export and import electricity using the interconnection lines between them. There are different purposes for this trade. In some cases, countries do not have the required installed capacities to cover the demand. In other cases, they trade electricity at peak power especially if the peak power periods are different between the trading countries.

Countries that have a net positive balance between electricity exports and imports have more potential to reach high electrification rate since they have the required resources. While the countries that import large amounts of electricity will find hardship in reaching full electrification. There is a special case which is Syria that has less than 100% electricity access, however it exports electricity to Iraq and Lebanon.

Table 48: Electricity imports and exports in Arab countries

Country	Electricity export (MWh)	Electricity import (MWh)	Net import/export (MWh)
Algeria	673,037	531,096	141,940
Bahrain	446,932	651,926	(204,994)
Egypt	359,990	73,887	286,103
Iraq	-	14,179,603	(14,179,603)
Jordan	98,053	239,160	(141,107)
Lebanon	-	89,720	(89,720)
Libya	-	464,987	(464,987)
Morocco	1,453,293	525,819	927,474
Sudan	-	700,000	(700,000)
Syria	346,935	-	346,935
Tunisia	630,816	471,653	159,162
UAE	256,937	244,715	12,222

Source: IEA, RCREEE focal points

3.3 Interconnection Lines

Electricity trading is done through interconnection lines. Establishing interconnection lines across countries has several advantages. First it enables countries to avoid building new power plants. This can be achieved by trading electricity across interconnected grids without impacting their security and reliability. In addition, interconnection lines eliminate the need for standby capacity to meet fluctuations in demand, which in turn reduces the costs. And finally, it enables lowering of the overall level of environmental pollution in the region. All the above advantages help to increase electrification in the Arab countries.

Arab countries have three power pools for electricity trading. The Maghreb pool which includes Algeria, Libya, Morocco, and Tunisia. The EIJLPST pool which includes Egypt, Iraq, Jordan, Libya, Lebanon, Palestine, Syria, and Turkey. And finally, the Gulf power pool that includes Bahrain, Kuwait, Qatar, and Saudi Arabia. Table 49 summarizes the existing interconnection lines between Arab countries.

Table 49: Interconnection lines in Arab countries indicators

Country	Countries with connection	Voltage level (KV)
Algeria	Morocco, Tunisia	400KV (Morocco, Tunisia) 225KV (Morocco, Tunisia) 150KV, 90KV (Tunisia)
Bahrain	Saudi Arabia	400KV
Djibouti	Ethiopia	220KV
Egypt	Jordan, Libya, Palestine, Sudan	400KV (Jordan) 220KV (Libya, Palestine, Sudan)
Iraq	Syria, Iran, Turkey	400KV (Iran) 220KV (Syria)
Jordan	Egypt, Syria	400KV (Egypt, Syria) 220KV (Syria)
Kuwait	Saudi Arabia	400KV
Lebanon	Syria	400KV, 200KV, 66KV
Libya	Egypt, Tunisa	220KV
Mauritania	Mali, Senegal	225KV,90KV
Morocco	Algeria, Spain	400KV (Algeria, Spain) 220KV (Algeria)
Oman	UAE	220KV
Palestine	Egypt, Ethiopia	220KV
Qatar	Saudi Arabia	400KV
Saudi Arabia	Bahrain, Kuwait, Oman, Qatar, UAE	400KV
Sudan	Egypt	220KV
Syria	Iraq, Jordan, Lebanon, Turkey	400KV (Jordan, Lebanon) 220KV (Iraq, Jordan, Lebanon)
Tunisia	Algeria, Libya	400KV (Algeria) 220KV (Libya)
UAE	Oman, Saudi Arabia	400KV (Saudi Arabia)

Source: Xiao-Ping ZHANG, 2017

3.4 Final Scores and Ranking for Electrification Factor

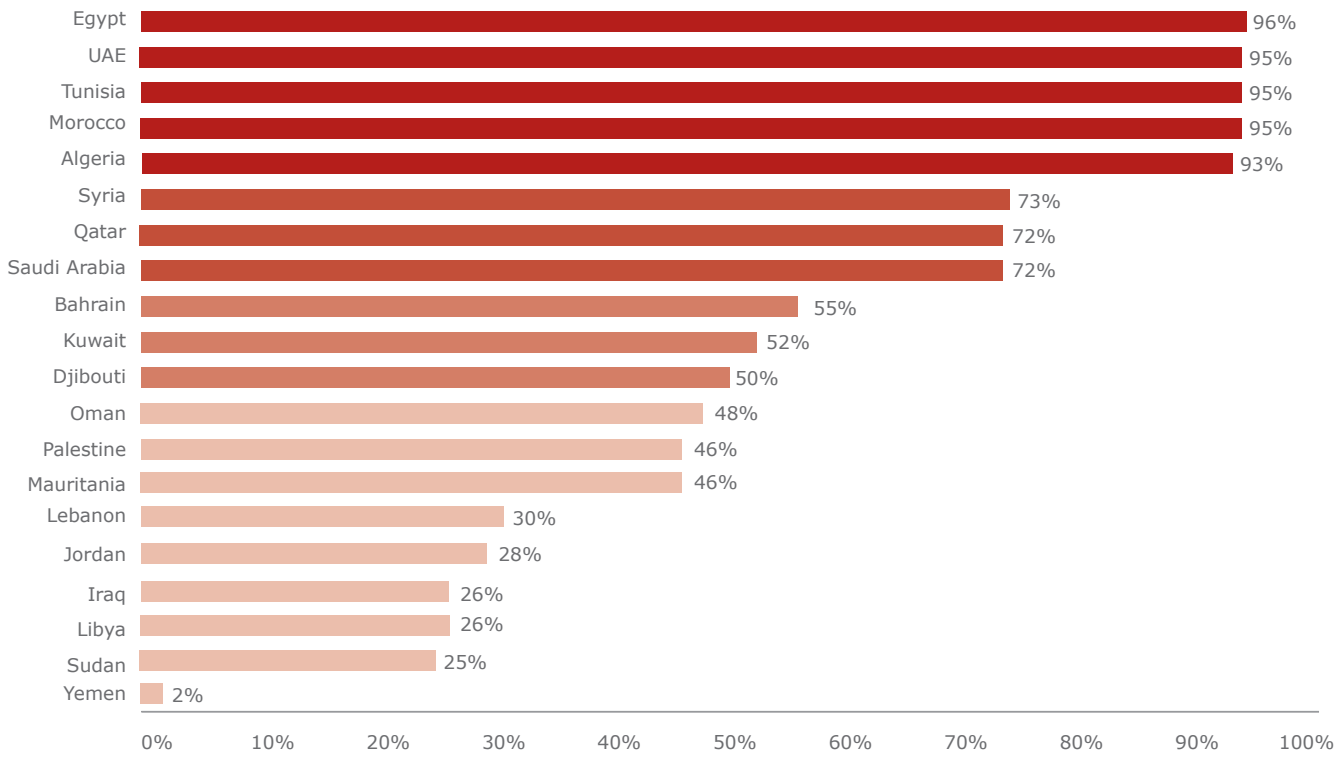


Figure 26: Countries ranking of electrification dimension

4 Institutions

This section assesses the institution readiness for energy access. The better the institutional setup, the faster, more reliable, and more sustainable energy access goals will be achieved. Two indicators are selected. Market structure and the existence of planning institution for grid expansion. Market structure will determine how the grid expansion will be done and financed. The planning institution will ensure that the grid expansion is planned for new and expanding communities. Table 50 summarizes the chosen indicators.

Table 50: EA Institution indicators

Factor	Indicator	Measuring Unit
Institutions	Market structure	Type of market structure
	Planning Institution for grid expansion	Existing, non-existing

4.1 Market Structure

Market structure indicator is used to assess how energy access will be financed and executed. At one end, in the vertically integrated market, the government will be responsible for all activities required such as generation, transmission, and distribution to provide reliable energy access to the citizens. At the other end, wholesale market and retail market, the private sector will finance all or part of energy access activities.

Approximately half of Arab countries have vertically integrated electricity market. Which means the government is accountable for providing electricity or delivering energy to its citizen. This will require financial resources that will burden fiscal budget and may delay the process if there are no sufficient funds. The other half is single buyer market (sometimes with unbundled transmission, and sometimes with bundled transmission and distribution). In this type of market, private sector finances part of delivering energy to customers by installing power generation plants and selling electricity to the government.

Table 51 exhibits the electricity market type in the Arab countries.

Table 51: Electricity market structure in Arab countries

Country	Market Structure	Notes
Algeria	Single buyer + unbundled transmission and distribution	Sonelgaz (Algerian Company of Electricity and Gas) is a holding company that have multiple subsidiaries responsible for generation, transmission, distribution….
Bahrain	Single buyer	IPP sells electricity to Electricity & Water Authority (EWA) who is responsible for generation, transmission and distribution activities
Djibouti	Vertically integrated	
Egypt	Single buyer + unbundled transmission and distribution	EEHC (Egyptian Electricity Holding company) is a holding company that have multiple subsidiaries responsible for generation, transmission, distribution….
Iraq	Vertically integrated	Ministry of Electricity of Iraq is responsible of all activities
Jordan	Single buyer	IPP and state-owned power plants sells electricity to NEPCO who is state owned and responsible for transmission. There are three private sector distribution companies
Kuwait	Single buyer	IWPP and captive generation sell electricity to the Ministry of electricity and renewable energy who is responsible for transmission and distribution
Lebanon	Vertically integrated	Electricite Du Liban, EdL (Electricity of Lebanon) is responsible for generation, transmission, and distribution
Libya	Vertically integrated	General Electricity Company of Libya (GECOL) is responsible for generation, transmission, and distribution
Mauritania	Vertically integrated	SOMELEC (Société Mauritanienne d'Électricité) is responsible for the production, purchase, transmission, distribution, and marketing of electricity in urban and peri-urban areas throughout the national territory.
Morocco	Single buyer	Office National de l'Electricité et de l'Eau Potable (ONEE) owns the complete transmission network and much of the distribution network and is the main retail supplier, ONEE acts as the single buyer in the sector and owns and operates an important share of the generation capacity
Oman	Single buyer	Nama Holding, which is the holding company of Nama Group. Nama Group acts as the sole provider of electricity distribution, supply, transmission, and procurement. In the generation business, two generation companies operate under Nama Group, while other companies are Independent Private Projects (IPPs) contracted by Oman Power and Water Procurement Company (OPWP)

Country	Market Structure	Notes
Palestine	Vertically integrated	Palestine Energy and Natural Resources Authority (PENRA) is responsible responsible for the production, purchase, transmission, distribution
Qatar	Single buyer	KAHRAMAA has the responsibility of being the sole transmission and distribution system owner and operator (TDSOO) for the electricity and water sector in Qatar. KAHRAMAA buy electricity from IPWP
Saudi Arabia	Single buyer	Saudi Electricity Company (SEC) is responsible for generation – along with other IPP -, transmission, and distribution.
Sudan	Single buyer + unbundled transmission and distribution	Sudanese Electricity Holding Company (SEHC) oversee and own four of the subsidiary companies. Within the unbundled structure, each subsector (generation, transmission, distribution) is self-contained and has a clear technical function. The Renewable Energy General Directorate is under the umbrella of the Sudanese electricity holding company directly.
Syria	Vertically integrated	Ministry of electricity supervises three institutions. Each supervised institution is responsible for one activity (generation, transmission, distribution)
Tunisia	Vertically integrated	Société Tunisienne de l'Electricité et du Gaz (STEG) is responsible for the three activities, generation, transmission and distribution
UAE	Single buyer + unbundled transmission and distribution	Emirates Water and Electricity Company (EWEC) has the authority to purchase, sell, plan, regulate and manage the commercial exchange, offer and demand of productive energy and the water and electricity produced and to enter agreements with the licensed producers and the licensed distributors.
Yemen	Vertically integrated	Ministry of electricity and energy along with Public Electricity Corporation are responsible for generation, transmission, and distribution and purchases electricity from private sector.

4.2 Institution for Transmission and Grid Expansion Planning

With the continually increasing populations, government and people search for new places, houses, cities to live and work. These new places need electricity for well-being. The existence of planning institutions that plan how grid expansion will be carried out to secure reliable connection to the grid facilitates this objective. Fortunately, all Arab countries have institutions that plan for grid expansion. Table 52 summarizes the institutions that are responsible for grid expansion in each country.

Table 52: Electricity grid planning entity in Arab countries

Country	Voltage level Entity ame
Algeria	Sociéte Nationale de l'Électricité et du Gaz (Sonelgaz)
Bahrain	Electricity & Water Authority (EWA)
Djibouti	Ministry of Energy and Natural Resources
Egypt	Egyptian Electricity Holding Company (EEHC)
Iraq	Planning and Study Office, Ministry of Electricity
Jordan	Transmission planning section, National Electric Power Company (NEPCO)
Kuwait	Ministry of Electricity & Water& Renewable Energy, Electrical Transmission Networks Sector
Lebanon	Ministry of Energy and Water and Electricité du Liban (EDL)
Libya	General Electricity Company of Libya (GECOL)
Mauritania	La SOMELEC (Société Mauritanienne d'Électricité), Direction Centrale Productions & Transport
Morocco	ONEE
Oman	Oman Electricity Transmission Company (OETC)
Palestine	Palestinian Electricity Transmission Company (PETL)
Qatar	Qatar General Electricity and Water Corporation (KAHRAMAA)
Saudi Arabia	Ministry of Energy, Industry and Mineral Resources (MEIM); Saudi Electric Company
Sudan	Sudanese Electricity Holding Company within the Ministry of Energy nd Oil
Syria	public Establishment for transmission and Distribution of electricity
Tunisia	Société Tunisienne de l'Electricité et du Gaz (STEG)
UAE	Ministry of Energy and infrastructure
Yemen	Ministry of Electricity

List of Abbreviations

ADEREE	National Agency for the Development of Renewable Energy and Energy Efficiency
ADME	Agence Djiboutienne de Maîtrise de l'Énergie
AFD	French Development Agency
AFEX	Arab Future Energy Index
ANME	Tunisian Agency for Energy Conservation
APRUE	Algerian National Agency for the Promotion and Rationalization of Use of Energy
CDER	Algerian Center for Development of Renewable Energy
CNI	National Investment Council
CO_2	Carbon Dioxide
CREG	Commission Algérien de Régulation de l'Electricité et du Gaz (CREG)
CSP	Concentrated Solar Power
EA	Electricity Access
EBRD	European Bank for Reconstruction and Development
EDL	Electricité du Liban
EE	Energy Efficiency
EETC	Egyptian Electricity Transmission Company
EgyptERA	Egyptian Electric Utility and Consumer Protection Agency
EIB	European Investment Bank
EMRC	Energy and Minerals Regulatory Commission
EPC	Engineering, Procurement and Construction
ESCO	Energy Service Company
EU	European Union
EUR	EURO
EWA	Bahrain Electricity & water Authority
FIT	Feed-In Tariff
FNME	National Fund for Energy Management
FTE	Fund for Energy Transition
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GECOL	General Electricity Company of Libya
GEFF	Green Environment Financing Facility
GHI	Global Horizontal Irradiation
GSAS	Global Sustainability Assessment System
GW	Gigawatt
GWh	Gigawatt hour
IEA	International Energy Agency
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contribution
IRENA	International Renewable Energy Agency
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
KAHRAMAA	Qatar General Electricity & Water Corporation
KAPP	Kuwait Authority for Partnership Projects
KISR	Kuwait Institute for Scientific Research
kWh	Kilowatt hour
kWh	Kilowatt hour
LAS	League of Arab States
LCEC	Lebanese Center for Energy Conservation

MAD	Moroccan Dirham
MASEN	Moroccan Agency for Solar Energy
MEMR	Ministry of Energy and Mineral Resources
MEPS	Minimum Energy Performance Standard
MW	Megawatt
MWh	Megawatt hour
NDC	Nationally Determined Contribution
NEEAP	National Energy Efficiency Action Plan
NEEP	Saudi National Energy Efficiency Program
NEEREA	Lebanese National Energy Efficiency and Renewable Energy Action
NEPCO	National Power Electric Company
NERC	National Energy Research Center in Jordan
NOGA	National Oil and Gas Authority of Bahrain
NREA	New and Renewable Energy Authority
NREAP	National Renewable Energy Action Plan
NREP	National Renewable Energy Program
EgyptERA	Egyptian Electric Utility and Consumer Protection Agency
OECD	Organization for Economic Co-operation and Development
ONEE	National Office of Electricity and Drinking Water
PEA	Palestinian Energy Authority
PEC	Public Electricity Corporation
PETL	Palestinian Electricity Transmission Company Ltd
PPA	Power Purchase Agreement
EWA	Bahrain Electricity & water Authority
QEERI	Energy and Environment Research Institute
QSTP	Qatar Science & Technology Park
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RE	Renewable Energy
REAOL	Renewable Energy Authority of Libya
SDG	Sustainable Development Goals
SPV	Special Purpose Vehicle
SWH	Solar Water Heater
TFC	Total Final Consumption
Toe	Ton of Oil Equivalent
UAE	United Arab Emirates
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nation Industrial Development Organization
USD	United States Dollar
VAT	Value Added Tax

List of Figures

List of Table

Hydro Power Building (7th Floor)
Block 11 - Piece 15, Melsa District
Ard El Golf, Nasr City, Cairo, Egypt
Telephone: +20 2 2415 4755
Fax: +20 2 2415 4661

مبنى المحطات المائية (الدور ٧)
بلوك ١١ - قطعة ١٥، عمارات ملسا
أرض الجولف، مدينة نصر، القاهرة، مصر
الهاتف: ٤٧٥٥ ٢٤١٥ ٢ ٢٠+
الفاكس: ٤٦٦١ ٢٤١٥ ٢ ٢٠+

www.rcreee.org