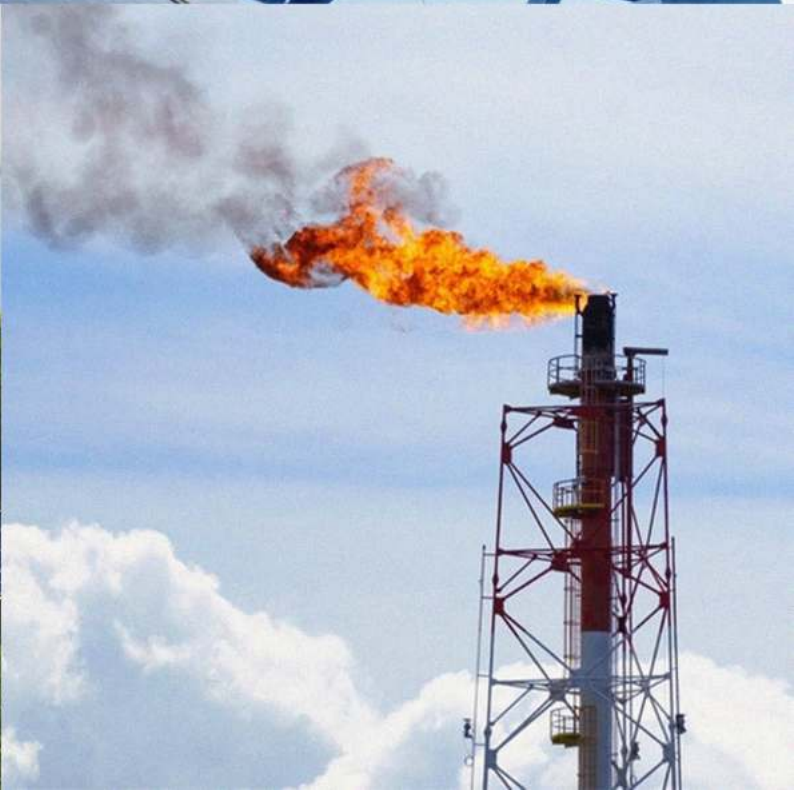


Egypt Energy Outlook Report



Egypt: Determining the Shape & Pace of Energy Market

The global energy landscape is experiencing a huge transformation. Countries are exploring sustainable substitutes to current energy generation methods, diversifying their investments and pouring funds into the development of renewable technology. Also, governments are putting energy security at the forefront of their agendas.

While this has meant efforts to diversify the energy mix away from fossil fuels and towards renewable energy, it has also driven countries to diversify the sources of their energy imports. This has placed Egypt in a good position to make a significant contribution to energy security regionally & globally.

Our latest Report on Egypt's Energy Outlook will be tackling **4 main questions** in this regard;



The energy sector is closely linked to managing fiscal deficits. In fact, in MENA Region, the countries with the largest fiscal deficits are also those with the highest levels of energy subsidies.

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Why Is Egypt a Potential Regional Energy Hub?

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What Could Egypt Export?

03
To **Which** Countries?

04
How Could Egypt Boost its Energy Exports?

Egypt has been racing to become a **Regional Energy Hub** but Chances are Getting Higher, **Why?**



1. Abundant Natural Resources

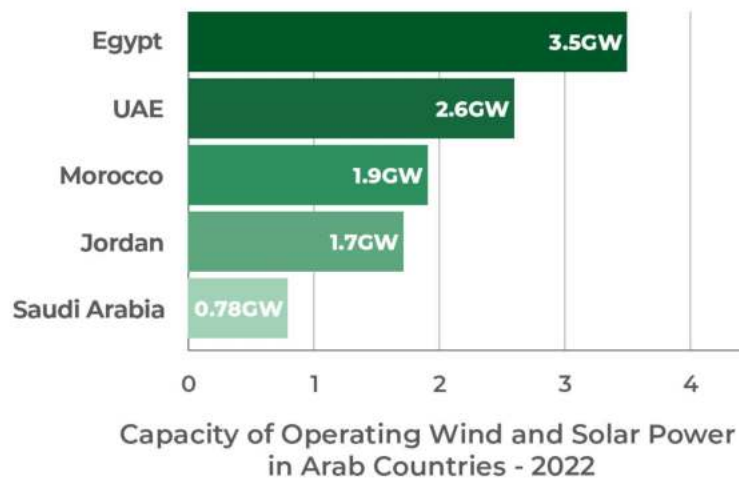
A. Natural Gas

Egypt is the third largest dry natural gas producer on the continent following Algeria and Nigeria. According to the Oil & Gas Journal (OGJ), Egypt held proven natural gas reserves of 63 trillion cubic feet, as of January 2021. Egypt's natural gas production rose significantly as a result of large natural gas discoveries, such as the Zohr, Atoll, and West Nile Delta projects that were fast-tracked for development. Also, Egypt is a member of the East Mediterranean Gas Forum (EMGF), which was established in 2020 to coordinate efforts among the 8 member states to make joint use of natural gas discoveries in the eastern Mediterranean. Egypt achieved self-sufficiency of natural gas 3 years after discovering the Zohr gas field in 2015, representing 40% of Egypt's total gas output. Also, the resumption of Damietta's liquefaction plant after 8 years of closure, as well as running the Idku plant at full capacity, led to a high volume of natural gas production. Yet, the natural gas in Egypt still requires exploration efforts. The country's gas exploration plan for the fiscal year 2022/2023 is expected to add 150 million cubic meters to gas production per day.



B. Renewable Energy:

Egypt enjoys an abundance of renewable energy resources – solar, wind, biomass and hydro. Egypt is leading the Arab world in terms of operating wind and solar power which reached a capacity of **3.5 gigawatts (GW)**.



Solar Energy:

Egypt is one of the most promising regions for harvesting solar energy, both for electricity and thermal generation. Between 2018 and 2019, the total electricity produced through solar energy increased from 0.529 billion KW to 1.465 billion KW (by 177%). Capitalizing on Egypt's high solar energy potential, in 2019, the Benban Solar Park was inaugurated to become the world's largest operational photovoltaic (PV) solar park with 40 solar plants, constructed in cooperation with the private sector and is "expected to avoid 2 million tons of greenhouse gas emissions a year", according to the IFC World Bank Group.

Wind Energy:

Egypt is endowed with vast wind resources, which can be utilized for electricity generation. In November 2019, Egypt's largest wind power generation complex, the 262.5-MW Ras Ghareb wind farm near the Gulf of Suez, also came online. The wind power facility generates enough electricity to supply 500,000 households.

Biomass:

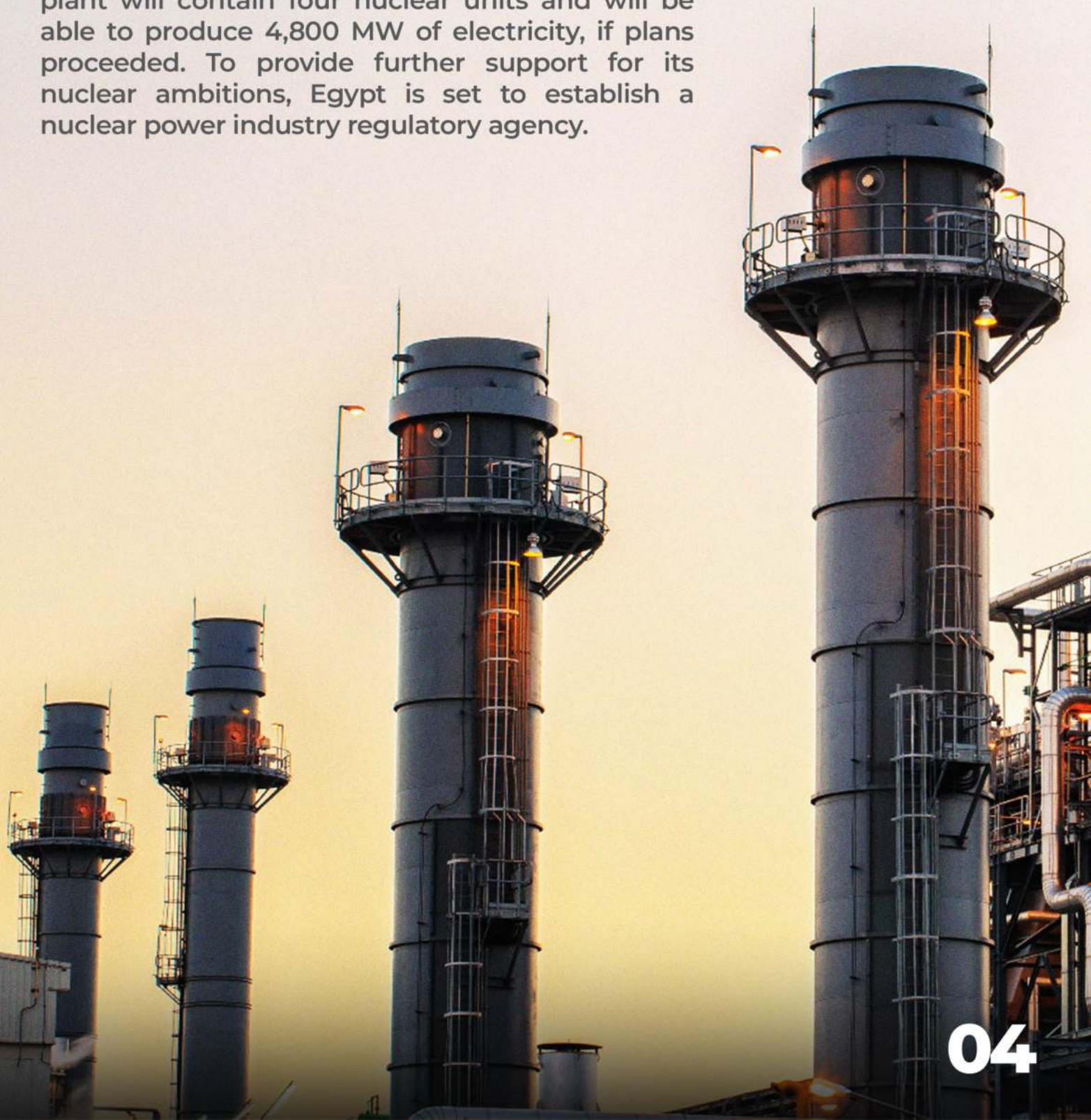
More than 30 million tonnes of solid biomass waste are produced annually from both agriculture and municipal resources that could be used for biofuel. In August 2021, the government announced a \$2m investment to build various new biomass power plants with international investors. The plants are expected to have the capacity to transform 600 tonnes of waste per day into power for local population.

C. Nuclear Power:

Regarding the leaps that have been taken in nuclear power, the GoE, in partnership with the Russian Company Rosatom, is working on the construction of a nuclear power plant in Al-Dabaa in Matrouh Governorate (northwest). The first unit of this project is planned to enter force in 2026. The plant will contain four nuclear units and will be able to produce 4,800 MW of electricity, if plans proceeded. To provide further support for its nuclear ambitions, Egypt is set to establish a nuclear power industry regulatory agency.



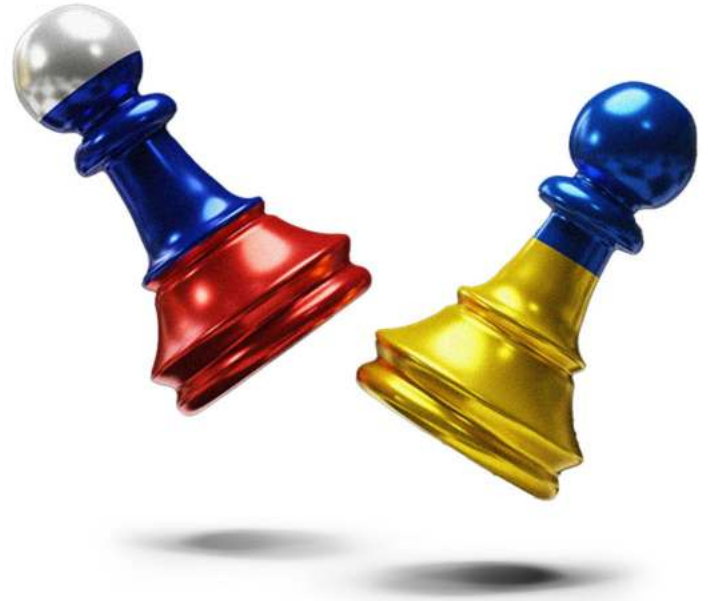
ROSATOM



2. Global Energy Changes are in our Favor

A. Global Energy Crisis

Following the Russian-Ukrainian war, European countries have been facing an energy crisis, with Russia dropping supply by up to 60% in gas deliveries since June 2021. Europe is highly dependent on energy imports from Russia where it got 40% of its natural gas, close to 45% of its total imports in 2021. Energy shortages have led to an increase in energy prices, where natural gas prices have increased in Europe by 127.6% since the Russian invasion of Ukraine. Europe's energy costs are approximately 2% of GDP in normal times, but they have soared to an estimated 12% on the back of surging prices.



Europe is now in a race against time to find a replacement for Russia's natural gas. In March, the EU announced a strategy called REPowerEU, which aims to reduce Europe's dependence on Russian natural gas by two-thirds over a year and to make it independent of Russian fossil fuels by 2030. Kadri Simson, the EU commissioner for energy, has announced plans for Europe to replace the natural gas it exports from Russia with gas from alternative exporters such as Azerbaijan, the US, Canada, Norway, Israel and, most importantly, Egypt.

The impact of the current energy crisis will not be limited to Europe alone. Rises in gas prices are already being felt hard on low-income energy importers in Africa, Southeast Asia, and Latin America. Also, although the MENA region is a major energy producer, many of the MENA countries are struggling to meet growing domestic energy demand. So, the energy crisis is an opportunity for other gas exporters around the world, including Egypt.

Besides, JP Morgan's research shows a \$400 billion oil underspend to 2030 and paints a grim picture in which all energy investment -- in both fossil and non-fossil fuels -- needs to grow at a faster rate than the prevailing investment implies.



"What all oil companies have in common is the investment cuts and project delays that will swing the oil market into a deficit and prices will soar to three-digit territory." -Christyan Malek, head of EMEA oil and gas research at J.P. Morgan

The fact that higher oil prices and growing energy security concerns haven't translated into a strong recovery in spending should cause alarm bells to ring even louder.

B. Green Direction

Most green plans are still in their infancy, but the direction is clear. Although Fossil fuels still account for more than 80% of global energy production, cleaner sources of energy are gaining ground.



IRENA

The International Renewable Energy Agency (IRENA) estimates that 90% of the world's electricity can and should come from renewable energy by 2050.

Against the backdrop of rapidly growing energy demand due to population growth, changing consumer behavior, increasing urbanization, etc. renewable energy is gaining global attention. For example, in the MENA Region, there has been a significant increase in industrialization, water desalination, and the increased use of electricity for cooling, which made dependence on renewable energy inevitable. Also, hydrogen imports have become an important pillar of Europe's energy strategy (European Commission, 2020).

Renewable energy is actually the cheapest power option in most parts of the world today. Prices for renewable energy technologies are dropping rapidly. According to a UN report, the cost of electricity from solar power fell by 85% between 2010 and 2020. Costs of onshore and offshore wind energy fell by 56% and 48% respectively. Falling prices make renewable energy more attractive – including to low- and middle-income countries, where most of the additional demand for new electricity will come from. Thus, Egypt could benefit from emerging synthetic fuel markets and profit from energy carrier exports to neighboring countries.



C. Increasing Energy Demand



According to BP (2019), the Middle East will face an annual increase in energy demand of around 2% until 2040.

The power, transport, industrial, and non-combusted sectors are mainly responsible for the high increase in final energy consumption. Energy demand is increasing due to the installation and expansion of seawater desalination capacities in most MENA countries; the electricity demand for seawater desalination is expected to triple by 2030 compared to the 2007 level in MENA region.

Furthermore, the energy intensity in many MENA countries is high, due to low insulation quality in buildings, technical inefficiencies of cooling and heating technologies, and distribution infrastructure. The electricity losses in distribution are between 11% and 15% in stable MENA countries compared to 4% in Germany (The World Bank, 2019).

Besides the Mena Region, global electricity demand is projected to triple by 2050 as sectors electrify and hydrogen-based fuels increase their market share due to decarbonization, according to McKinsey Report "Global Energy Perspective 2022". For natural gas demand, it's projected to grow another 10–20% between 2022-2035. After 2035, gas demand will likely be subject to larger uncertainties, driven especially by growth in renewables and government policies to decarbonize the industrial and buildings sectors.



What Could Egypt Export?

A. Green Hydrogen & Green Ammonia

Egypt now seeks to build on the growing momentum of its renewables sector to become a global leader in the production of green hydrogen and its derivatives. Egypt's government is establishing the Suez Canal Economic Zone (SCZone) as a regional green energy hub. Egypt has recently adopted a vision to be a global and regional hub for green hydrogen production, storage and export. Last August, Egypt signed 7 Memoranda of Understanding (MoUs) with local and international companies to establish industrial complexes to produce green hydrogen in Ain Sokhna Industrial Zone within SCZONE. Global companies have signed USD 10 bn worth of preliminary agreements for green ammonia and hydrogen projects in Ain Sokhna in the past 3 months. The partnerships include countries like the UAE, India, France, the US, and Norway. Production in the SCZone will focus on producing for foreign markets.

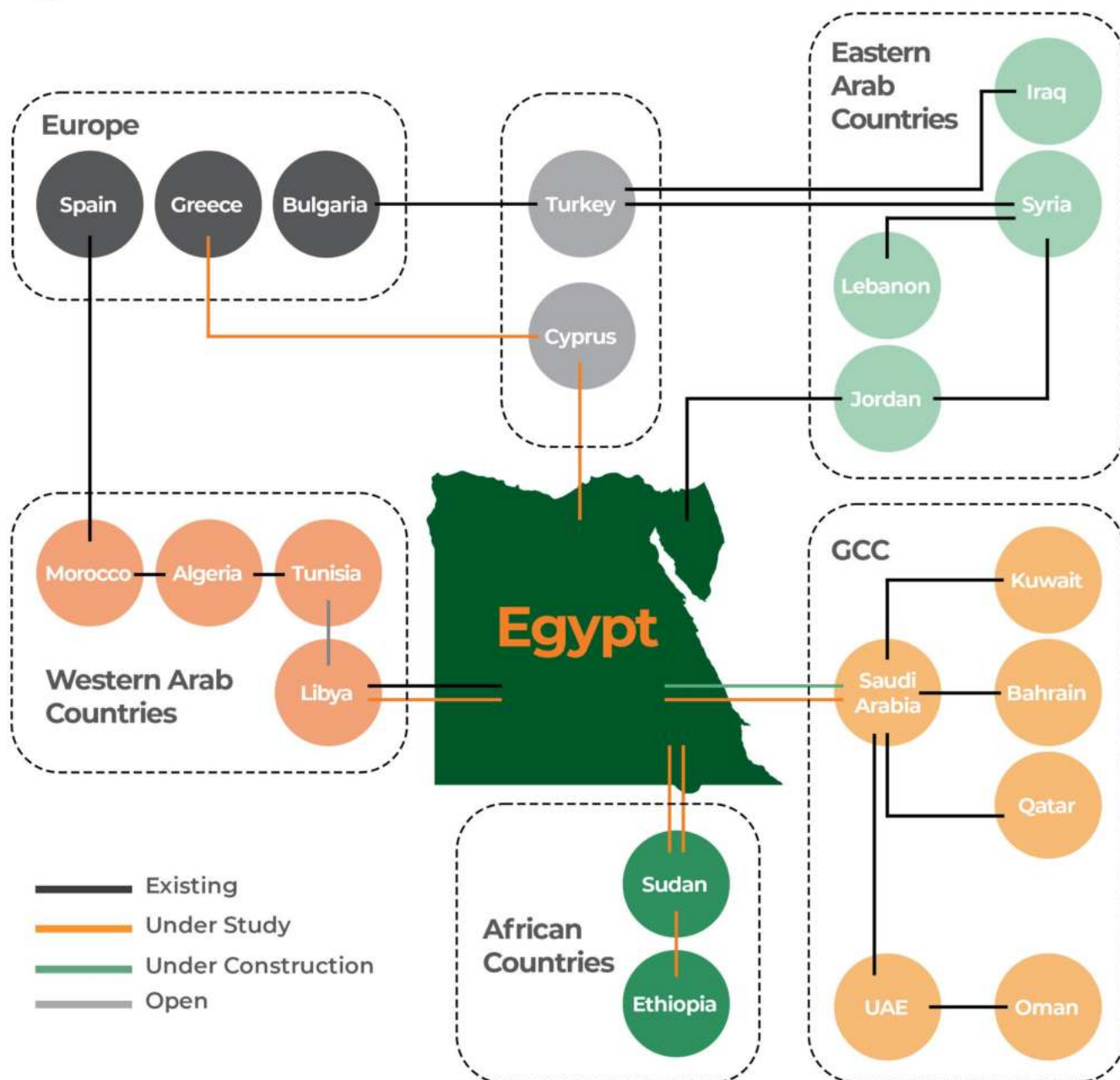
In fact, Egypt's green hydrogen project plans currently amount to almost 12 GW, equivalent to more than 1.57 million tons of green hydrogen. Not only do these projects rank Egypt among the top 3 green hydrogen pipelines globally, but if implemented fully, they could provide one-sixth of the 10 million tons of green hydrogen the EU plans to import by 2030.

Besides, Egypt is the world's seventh largest ammonia producer, just behind Saudi Arabia, which is the largest producer in the MENA region. In terms of storage, storing green hydrogen as green ammonia is one of the cheapest options. Already a major ammonia producer, Egypt could utilize part of its existing ammonia storage and transportation infrastructure for green ammonia. As such, green ammonia is likely to form a central part of Egypt's low carbon hydrogen strategy for both domestic use and exports.



B. Electricity

Egypt is trying to make use of its power surplus. The total capacity produced by Egypt is about 59,200 MW and the maximum consumption on the electrical network is about 33,000 MW. Egypt, which has achieved an electricity surplus of more than 25%, is implementing electricity linkage projects with African and European countries to enhance the sector's reliability and allow for the exchange of generated electricity at the subregional level. For example, Egypt is working with Cyprus and Greece on a project to connect their electrical grids. It is also working with Greece to build a major subsea communications transmission cable to link North Africa to Europe. The country has already linked its electrical grid with Sudan, Libya and Jordan, with a scheduled plan to establish more power linkages with other Arab and African countries.



The Ministry of Electricity and Renewable Energy has also worked to upgrade Egypt's Electricity Infrastructure:

Transmission Grids:

Went from 2364 kilometers of total length of 500 KV grid in 2014 to 6006 kilometers by end of 2020. Also, over the past 5 years, EETC has invested heavily in grid extensions to improve the voltage profile and enhance the network reactive power capacity.

Substations:

In 2014, Egypt had 18 substations of 9800 MVA total 500 KV capacity. By end of 2020, the country added 30 substations with a total of 44250 MVA, more than 4 times the existing one in 2014.

Distribution Grids:

The government invested around EGP 24 billion in the distribution grid between 2017 and 2020. The government is also working on modernizing 47 distribution control centers around the country.

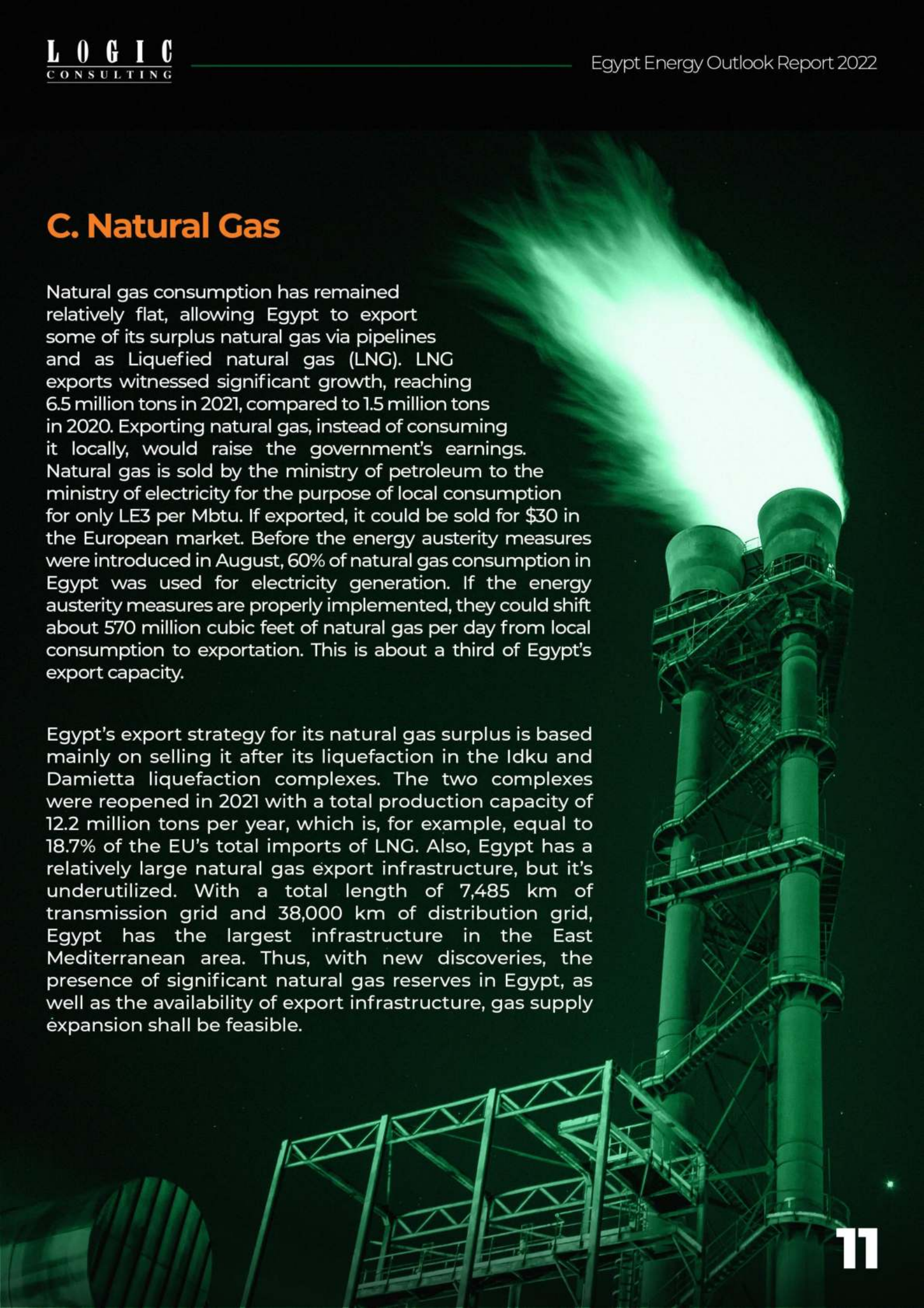
Electricity Stations:

Constructing 26 new electricity stations with a total capacity of 26,000 MW which represents 12 times more than the generated electricity from the High Dam.

C. Natural Gas

Natural gas consumption has remained relatively flat, allowing Egypt to export some of its surplus natural gas via pipelines and as Liquefied natural gas (LNG). LNG exports witnessed significant growth, reaching 6.5 million tons in 2021, compared to 1.5 million tons in 2020. Exporting natural gas, instead of consuming it locally, would raise the government's earnings. Natural gas is sold by the ministry of petroleum to the ministry of electricity for the purpose of local consumption for only LE3 per Mbtu. If exported, it could be sold for \$30 in the European market. Before the energy austerity measures were introduced in August, 60% of natural gas consumption in Egypt was used for electricity generation. If the energy austerity measures are properly implemented, they could shift about 570 million cubic feet of natural gas per day from local consumption to exportation. This is about a third of Egypt's export capacity.

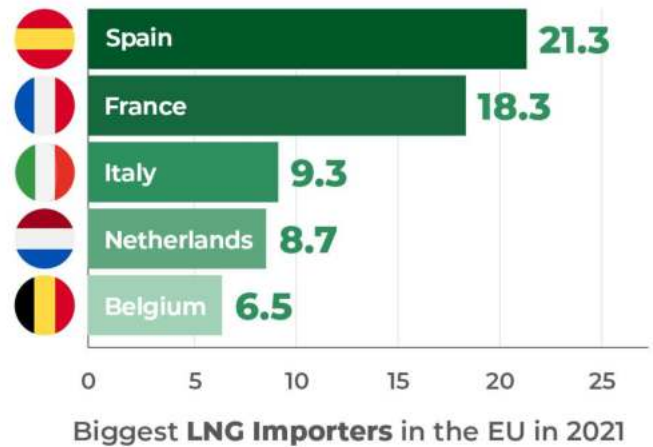
Egypt's export strategy for its natural gas surplus is based mainly on selling it after its liquefaction in the Idku and Damietta liquefaction complexes. The two complexes were reopened in 2021 with a total production capacity of 12.2 million tons per year, which is, for example, equal to 18.7% of the EU's total imports of LNG. Also, Egypt has a relatively large natural gas export infrastructure, but it's underutilized. With a total length of 7,485 km of transmission grid and 38,000 km of distribution grid, Egypt has the largest infrastructure in the East Mediterranean area. Thus, with new discoveries, the presence of significant natural gas reserves in Egypt, as well as the availability of export infrastructure, gas supply expansion shall be feasible.



To Which Countries?

A. Europe

Europe is a net importer of natural gas, with demand far exceeding the region's total proven reserves, resulting in a greater reliance on natural gas from other supplying countries. Egypt is well-positioned to profit from the present energy crisis in Europe and might soon get to be a major energy exporter to the EU if it is able to sell LNG in large quantities to the EU. Egypt and Greece's deepening relations can unlock further opportunities in exporting energy to European markets. Lying between the Egyptian gas fields and ports and Europe, Greece can act as the main gateway to Europe for Egypt's energy exports. The prospective interconnections would serve to transfer electricity generated from renewable energy sources to Europe.



Since Egypt is not connected to the EU by gas pipelines, its exports can only be in the form of LNG, which some European countries may not be able to process at present due to lack of infrastructure. These countries, including Germany, Netherlands, Italy, and Belgium, are heavily dependent on piped natural gas (PNG) imports. Yet, in the long haul, there might be big changes in EU gas imports from PNG to LNG, allowing Egypt to become one of the continent's top suppliers. This is dependent on Egyptian authorities' ability to boost output, sign more derivative contracts, and implement more efficient new programs to maximize the value of its energy excess.

According to the Information and Decision Support Center (IDSC), Egypt is the only country in eastern Mediterranean region that is having a strong infrastructure, enabling it to export natural gas to the EU through liquefaction plants in Idku and Damietta. Yet, Egypt still faces competition for the export of LNG from Qatar and Oman, as well as from Russia, Norway, and Algeria – the traditional exporters of natural gas to the EU.

B. Africa

Several steps have been taken to explore the possibility of building interconnections with countries in sub-Saharan Africa. African countries — especially Nile Basin countries — have acute electricity shortages. In December 2019, President El-Sisi announced that Egypt was prepared to export 20% of its surplus electricity to African nations. Beyond Libya, Egypt is poised to contribute to the electrification of sub-Saharan Africa where access to electricity averages under 50%. For example, Sudan, Egypt's neighbor to the south, has an access to electricity rate of 60%. Also, through Libya and Sudan, Egypt could theoretically export electricity to neighboring countries such as Chad whose 2018 access to electricity rate stood at only 12%. Egypt also turned to Djibouti & Burundi, where agreements were done to increase Egyptian investments and to allow Egyptian companies to contribute to infrastructure projects and electricity projects.



Despite major gas discoveries in several parts of the continent, many African countries still do not have direct access to large resources, and so need to rely on gas imports. Côte d'Ivoire and Ghana are the ones that are most actively exploring import options (although Ghana has some domestic production). For these countries, the key task is to obtain the gas they need at competitive prices while ensuring security of supply.

C. Arab Countries

Power demand in the Arab region is expected to grow by 3.3% each year until 2035 while populations are increasing at an even faster rate. Some countries such as Kuwait, Oman, Qatar, Saudi Arabia and the UAE have a 3.5% population growth rate.



IHS Markit®

IHS expects that the Middle East will need 277 gigawatts (GW) of additional capacity to boost installed capacity to 483 GW by 2035.

The rapid increase in energy demand, for electricity in particular, is arguably the most notable trend in the region. Whereas global electricity demand has been increasing by around 2.9% on average annually, the increase was much larger in the MENA countries, at 6% annually during the 1990–2015 period. The demand for electricity in the region is expected to increase due mainly to economic development and population growth, combined with increasing needs for water desalination and air conditioning. Other countries such as Jordan, Lebanon, Morocco, the Syrian Arab Republic and Tunisia are net importers whose domestic energy mix has historically been more diversified, though it remains heavily dependent on imported fossil fuels. Besides, some countries' energy demand is rapidly outpacing supply, like Iraq. In Iraq, the peak in electricity demand during the summer has long been a serious problem. Usage rises from around 22.6 gigawatts (GW) in winter to up to 34.8GW in summer — almost 12GW above what the country can produce, meaning blackouts are common.



Still the region lags behind other mature markets in intra-regional electricity trading. The region has several interconnections, yet trade remains minimal and often only takes place in response to emergencies and outages. The governments are continuing to invest heavily in adding power-generation capacity, while they can cooperate with their neighbors and explore further the potential of electricity trade to relieve some of this pressure.

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According to the World Bank, electricity trade could save the Arab World \$17-25bn and reduce required capacity by 33GW through better mutual utilization of existing capacity – while the GCCIA estimates that GCC trade could achieve savings of up to \$24bn by 2038.



**THE
WORLD
BANK**



Governments could have access to cheaper & reliable electricity given that the cost of generating electricity and infrastructure efficiency differ from one country to another.

How Could Egypt Export More And Make Sustainable Gains From The Current Changes In The Energy Market

1. Focus on Domestic Gas Supply

Egypt needs to focus on domestic gas supply, displacing the use of the still widely used diesel, which is putting a heavy burden on the government as Egypt imports about 25 –30% of its needs of petrol and diesel fuel. The Zohr field has been producing less than initially expected, and fresh offshore exploration is slowing down. Also, Egypt appears to rely on re-exporting gas imported from its regional neighbors, leaving it with the possibility to profit only from transit and liquefaction fees.

It has also retained the right to use Israeli gas imports domestically if its own demand increases, which could be translated into less exploration efforts. On the demand side, gas demand in Egypt may rise very rapidly. Egypt is already the largest gas consumer in Africa and there is strong potential for further growth, especially in the power sector where gas is the dominant fuel. So, Egypt should work on accelerating exploration and diversifying investors to ensure energy security and sustainable exports' growth over the long-term.

Importing LNG doesn't necessarily mean that Egypt would become an all-year-round importer. It so happens that domestic power demands are stronger in summer when demand in Europe is low, while it's coincidentally quite the opposite in winter-times. This means that Egypt could opt for a seasonal export model.



2. Attract Investments In Gas Exploration, Renewables & Green Hydrogen Facilities

Discovering a new natural gas field does not happen overnight. It needs investments of billions of dollars by international oil companies (IOCs). Moreover, extra foreign direct investment (FDI) should be pumped into the oil and gas industry to secure high production levels of natural gas in the future. Unfortunately, FDI in the Egyptian oil and gas sector registered net outflows of \$ 1.7 billion during the first nine months of FY2021/22, according to the CBE.

Also, there is now a huge importance of attracting foreign investment in green hydrogen as Egypt is seeking to attract more cooperation and investment in green transformation projects, particularly in light of the country's presidency of COP27. Renewable energy projects need to obtain permits and licenses to operate in Egypt. These include different power plant construction permits, a license from the Egyptian Electric Utility and Consumer Protection Regulatory Agency (EgyptERA) for power generation, and an environmental and social impact assessment (ESIA). The power generation license needs to be validated annually and renewed after 5 years. For several large-scale project sites, such as Benban, the Egyptian authorities took specific steps to ease the process of investing in the renewable energy sector, but the private sector still perceives the project planning procedures to be bureaucratic and lengthy.

Thus, the government needs to work on accelerating and increasing FDIs, especially for upstream activities, by making the investment environment more attractive. Minimizing red tape and bureaucracy is key to swift development and utilization. Historically, weak governmental and regulatory infrastructure have led to project delays and investor frustration. This needs to change and should be addressed in line with ongoing reforms.



3. Develop a Strong Infrastructure

Countries with infrastructure for oil and gas, like Egypt, could build on their experience in handling gas and liquid fuels. With the support of power-to-X (PtX) technologies, energy-exporting countries could switch smoothly from a fossil fuel phase to a renewables-based energy system. However, to achieve this goal, the infrastructure would have to be retrofitted on a large-scale for transmission and storage.

The share of renewable energies in the installed capacity – including variable solar PV and wind energy – will increase in the medium to long term. This is expected to present the grid with a variety of technical challenges. In response, Siemens Power Technologies International (PTI) has conducted a study to develop a smart grid roadmap for the Egyptian Transmission Company. This grid expansion and retrofitting is an urgent priority (particularly in terms of transmission) because the generation excess is already difficult to accommodate in the current grid network. Also, due to the constraints of transmission lines and substation capacities, most of the excess generation is currently wasted. To help overcome this problem, a plan is installed to create new and upgraded control centers within the transmission networks.

Also, Egypt also needs to maximize the efficiency of its liquefaction complexes so that they better process additional Egyptian gas or surplus gas from Egypt's regional partners such as Israel and Cyprus. These two countries have agreed to liquefy their surplus gas in Egypt for export to European and Asian markets. It is possible that Iraq and Greece, which currently lack significant capabilities to liquefy gas, could be potential new partners with which Egypt might conclude such agreements.

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Remember: Countries Shall Focus Less on Fossils in the Long-term....



The International Energy Agency (IEA) has been warning for years that oil-producing countries must transform their economies and move away from fossil fuel dependency to renewable energy. That's why countries globally have been moving away from fossil fuel sources and towards renewables. Yet still governments have largely failed to seize their chance to rearrange their energy supplies away from fossil fuels. This risks locking us into another high-carbon decade and keeping the Paris Agreement's 1.5°C limit out of reach. Egypt is now expanding its fossil fuel production, and while this may seem beneficial in the short- medium term to meet the growing energy demand and benefit from gas-exportation opportunities, this pathway is not sustainable. Major trading partners are aiming for carbon neutrality by 2050, which will reduce the demand for fossil fuels and fossil-fuel based products and boost demand for less polluting forms of energy.

Thus, by placing a stronger focus on renewables large-scale and small to medium-sized projects, Egypt could seize the opportunity for economic development within a decarbonizing world economy. There is an urgent need to shift from energy systems based on fossil fuels to systems based on renewable resources to reduce dependence on depleted reserves of fossil fuels. To continue in this direction, renewables must become integrated in the energy system. This will require the support and implementation of flexibility options, ranging from tariff adaptations to grid extension and interconnections with neighboring countries. Also, it needs to work on reducing fossil fuel subsidies or increasing carbon pricing, both of which would drive down emissions. Decreasing energy prices would be a perfect moment to reduce fossil fuel subsidies or introduce/increase a carbon tax. Egypt should not compromise their long-term climate mitigation strategies and should secure a continuous sustainable energy supply and reduce their overall energy demand.