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Egypt

Power & Renewables Report

Includes 10-year forecasts to 2033

Contents

Key View

Key View: *Egypt's power sector is set for significant growth, driven by ambitious government initiatives and strategic investments. The outlook for Egypt's power sector is positive due to substantial growth potential and ambitious government initiatives. The Integrated Sustainable Energy Strategy aims for a 42% renewable energy mix by 2030, focusing on non-hydropower renewables and reducing gas dependency, with solar and wind power driving this growth. Over the next decade, Egypt's total power generation is projected to grow annually by 4.0%, increasing from 231.3TWh in 2024 to 321.5TWh in 2033, and total capacity is expected to rise by 15.8GW. The construction of the El Dabaa nuclear plant will further boost capacity. Investments in grid enhancements and cross-border interconnections, along with partnerships with the EU and within the MENA region, are expected to strengthen Egypt's energy infrastructure and position the country as a regional leader in the energy transition, setting the stage for Egypt as a regional power exporter. However, the overall risk environment in Egypt has deteriorated due to increased external financing needs, high borrowing costs and substantial geopolitical risks stemming from regional conflicts, which have collectively impacted its attractiveness to investors.*

Headline Power Forecasts (Egypt 2023-2028)

Indicator	2023e	2024f	2025f	2026f	2027f	2028f
Generation, Total, TWh	223.2	231.3	239.6	249.3	258.6	268.4
Consumption, Net Consumption, TWh	187.2	192.3	197.9	205.0	213.0	221.9
Capacity, Net, MW	59,775.8	60,776.9	62,891.0	65,046.6	66,132.5	67,330.7

e/f = BMI estimate/forecast. Source: National sources, BMI

Latest Updates And Structural Trends

- Over the next decade, we expect that total power generation in Egypt will increase by an annual average of 4.0% from 231.3TWh in 2024 to 321.5TWh in 2033. Total capacity is expected to increase by 15.8GW over the next decade. Net consumption will rise from 192.3TWh in 2024 to 267.6TWh in 2033. Consumption growth will be driven by increased electrification from hydrogen, an increase in the use of cooling systems and urbanisation.
- Non-hydropower renewables will be the fastest growing segment of Egypt's power market. Our forecast shows an increase of 13.0GW over the next decade, with onshore wind contributing under 6GW to the non-hydropower renewables capacity growth and solar contributing over 7GW. As Egypt diversifies its power market, we expect thermal power capacity, of which gas power is dominant, to decrease its share in total capacity from 87.2% in 2024 to 71.3% by 2033.
- Wind power growth will be supported by projects such as the ACWA Power and Hassan Allam Utilities's 1.1GW wind project. The companies have signed a 25-year land usufruct agreement with the New and Renewable Energy Authority for the wind power project. The USD1.5bn power plant will come up at the Gulf of Suez and Gebel El Zeit. Under the agreement, the consortium will work during the development phase to complete site studies and secure project finance.
- The New and Renewable Energy Authority and the Sovereign Fund of Egypt are preparing to launch the Phase II of the Zafarana wind farm for bidding in H2 2024. The tender process is part of Egypt's broader efforts to advance its renewable energy capabilities, including the agreements with Siemens and Jabal Al-Zeit stations, estimated at USD350.0mn. The project includes wind farms with a 545MW capacity and 700 turbines, developed through international collaborations.
- AMEA Power has finalised installation of the first wind turbine in its Amunet wind farm, located in Egypt's Gulf of Suez. The USD709.0mn project, situated in Ras Ghareb 318km south of Cairo, will house a total of 70 wind turbines. Amea Power has collaborated with a consortium of Huadong PowerChina Engineering and PowerChina for the engineering, procurement and construction of the wind farm. The wind farm's output will be integrated into the National Electricity Transmission grid under a 25-year power purchase agreement. The project is backed by international financial institutions and commercial banks.

- Solar power is expected to be driven by Norwegian Scatec ASA, having signed an agreement for a 1GW solar power and 200MW battery. Scatec ASA signed the agreement with the Egyptian Electricity Holding Company during the UN Climate Change Conference in Dubai (COP28).

SWOT

Power & Renewables SWOT

Strengths

- Substantial natural gas resources provide the basis for increased gas-fired power capacity.
- The government plans to attract greater international investment, demonstrating its commitment to boosting competitiveness in the market.
- Financial institutions have proven supportive of Egypt's thermal and non-hydropower renewables development in recent years.
- The expanding transmission interconnection network enables Egypt to export significant volumes of electricity.

Weaknesses

- The state-owned Egyptian Electricity Holding Company dominates the market, limiting opportunities for private sector participation.
- Subsidies are still in place despite ongoing reductions.
- Egypt has a poor track record of developing projects cost-efficiently, a downside that is acute in nuclear power projects such as El-Dabaa.

Opportunities

- Egypt offers a great wealth of potential renewable energy resources, particularly solar.
- Rapid economic and demographic growth will drive continued growth in electricity demand.
- Increasing private sector participation in the power sector is boosting competitiveness and ease of access to the market.
- Government plans to invest heavily in new transmission interconnection projects in order to capitalise on its vast and still-growing excess generation.

Threats

- Thermal power generation costs in Egypt are well below those of renewable energy schemes, which may inhibit diversification.
- Historically unstable political and security environment, which acts as deterrent for foreign investors.
- Despite recent stabilisation of the government's financial situation, its room for fiscal manoeuvring remains constrained.
- The vast oversupply of electricity may prompt the suspension or cancellation of projects in the pipeline.

Industry Forecast

Egypt Snapshot

Market Snapshot: Economic And Demographic Data (Egypt 2022-2027)

Indicator	2022	2023e	2024f	2025f	2026f	2027f
Nominal GDP, USDbn	409.3	330.7	310.1	340.3	370.7	403.9
Real GDP growth, % y-o-y	6.7	3.8	3.2	4.2	4.0	4.0
GDP per capita, USD	3,687	2,933	2,708	2,927	3,140	3,370
Population, mn	110.99	112.72	114.48	116.28	118.06	119.84

e/f = BMI estimate/forecast. Source: National sources, BMI

Market Snapshot: Economic And Demographic Data (Egypt 2028-2033)

Indicator	2028f	2029f	2030f	2031f	2032f	2033f
Nominal GDP, USDbn	440.5	480.6	524.7	573.1	626.2	684.6
Real GDP growth, % y-o-y	4.0	3.9	3.9	4.0	4.0	4.1
GDP per capita, USD	3,621	3,895	4,192	4,515	4,865	5,245
Population, mn	121.61	123.38	125.15	126.92	128.71	130.51

f = BMI forecast. Source: National sources, BMI

Market Snapshot: Power & Renewables Sector

Access to electricity, % of population	100
Quality of electricity supply (score)	91.8/100
Quality of electricity supply (rank)	77/124

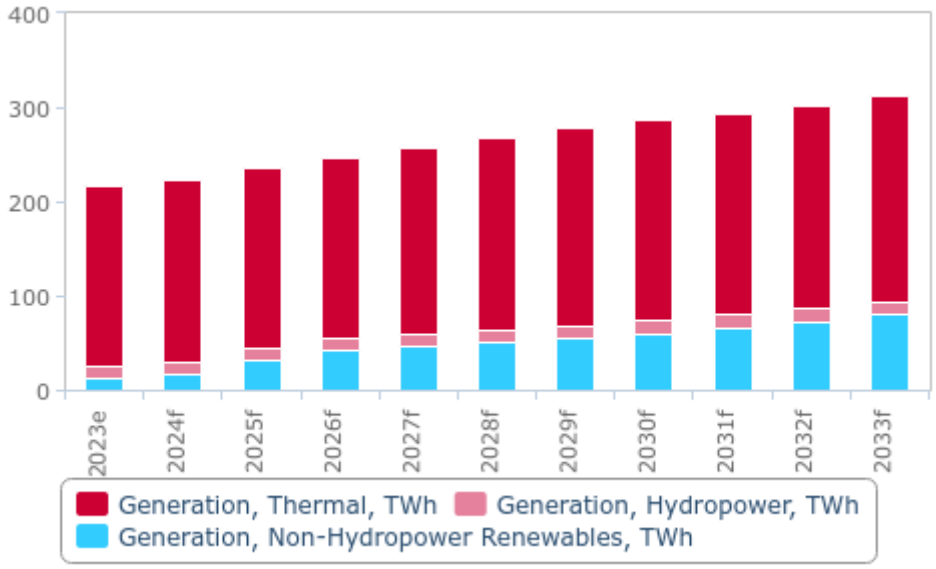
Source: World Economic Forum - Global Competitiveness Report 2019, World Bank, BMI

Egypt Power & Renewables Forecast Scenario

Key View: *We maintain a positive outlook on Egypt's power sector due to its significant growth potential and ambitious government initiatives. The Integrated Sustainable Energy Strategy aims for a 42% renewable energy mix by 2030, focusing on expanding non-hydropower renewables and reducing reliance on gas. Non-hydropower renewables is expected to be the fastest-growing segment in the market. The construction of the El Dabaa nuclear plant will further boost capacity towards the end of our forecast period. Investments in grid enhancements and cross-border interconnections are anticipated to strengthen Egypt's energy infrastructure. Partnerships with the EU and intra-regional partnerships within the MENA is projected to expand generation capacity and trade, positioning Egypt as a key regional leader in the energy transition.*

Thermal Power To Remain Dominant, Renewables Growing

Egypt - Total Generation By Type, TWh (2023-2033)



e/f = BMI estimate/forecast. Source: EIA, IRENA, local sources, BMI

Thermal Forecasts

Latest Updates

- Egypt is expected to increase LNG exports in 2024 as lower gas production output and increased electricity demand in the summer of 2023 resulted in very low LNG exports. In November 2023, the Egyptian government announced that it would extend the national power cuts introduced in 2023; the increase in LNG exports poses a downside risk to power generation given Egypt's power dependence on natural gas.
- The Sidi Krir and El-Atf power plants are expected to be upgraded to improve gas turbine efficiency. The plant upgrades will be conducted by Mitsubishi Power. Upon completion of plant upgrades, the gas turbine efficiency is expected to improve by 2.5% an average with an increase in power generation of 6.0%.

Structural Trends

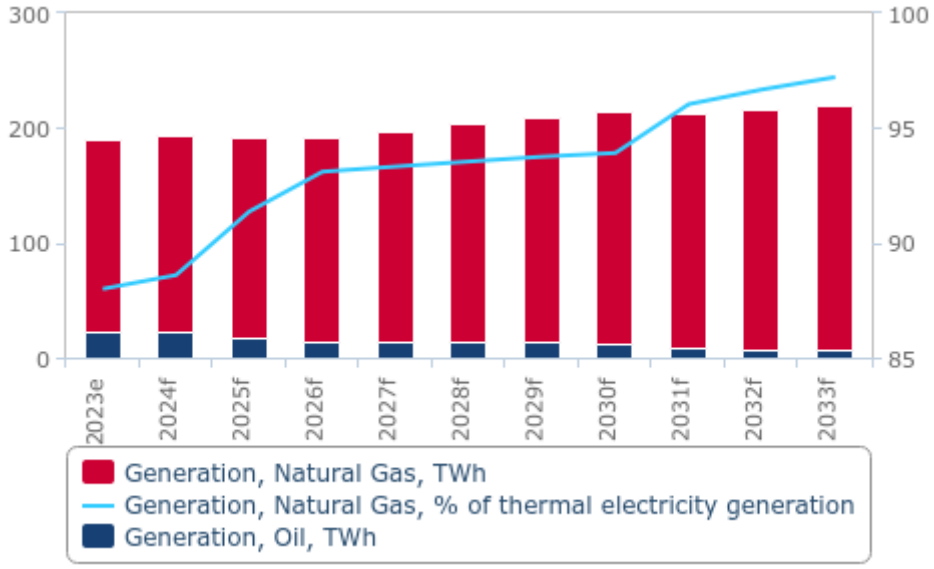
Egypt's thermal power generation is heavily reliant on gas-fired plants, which we expect to supply 83.2% of the nation's electricity generation by the end of 2024, although this share is projected to decrease to 74.1% by 2033 as the country implements its Energy Wealth Initiative. Unveiled during COP27, this initiative includes plans to decommission around 5,000MW of inefficient gas-powered generation by 2035 to improve efficiency and sustainability. However, Egypt faces significant challenges due to declining natural gas production, which has reached its lowest level in over six years as of mid-2024. This decline comes amid soaring summer electricity demand driven by high cooling needs, exacerbating power shortages. To address the shortfall, Egypt has had to import USD1.2bn worth of mazut fuel oil and natural gas. The country successfully secured five out of the 21 LNG cargoes it sought for the summer of 2024. In a bid to stabilise the power supply, on July 17 2024 Prime Minister Mostafa Madbouly announced that Egypt would halt summer load shedding following the arrival of some natural gas shipments. These steps highlight Egypt's ongoing efforts to balance the immediate need for reliable power with long-term sustainability goals.

Our outlook for coal-fired power in Egypt remains bearish, with the sector falling out of favour and not anticipated to feature in the country's energy mix for the foreseeable future. This shift has been propelled by advancements in the development of the Zohr Gas Field, which is expected to enhance Egypt's natural gas supply, reducing any reliance on coal for electricity generation.

In terms of oil-fired power, Egypt generated an estimated 9.9TWh from this sub-sector at the end 2022. Despite the presence of an established oil-fired power segment, the Egyptian government has not indicated any major intentions to expand this area. The strategy aligns with the broader goal to curtail domestic consumption of crude oil and mitigate the need for a substantial increase in oil imports over the coming years. In light of these factors, our projections indicate a gradual decrease in oil-fired power generation, anticipating a drop to 2.6TWh by 2033, which would represent a fall less than 1.0% of the total electricity generated, from 4.5% in 2022.

Natural Gas To Remain Primary Source Power In Egypt

Egypt - Thermal Power Generation By Type & Natural Gas' Share Of Total Generation (2023-2033)



e/f = BMI estimate/forecast. Source: CEA, EIA, local sources, BMI

Nuclear Forecasts

Latest Updates

- In May 2024, Atomstroyeksport announced that it had installed the first tier of the inner containment: Vnutrennei Zatsitnoi Obolochki at Egypt's El Dabaa Nuclear Power Plant. The structure of 12 segments weighing 60-80 tonnes is a key component, and was overseen by the Egyptian Nuclear Power Plant Authority and inspected by NPPA Board Chairman Amged El-Wakil and Rosatom Deputy General Director Andrey Petrov.
- The Governments of Egypt and Russia have laid the foundation stone for the fourth and final unit at the 4.8GW Dabaa nuclear power plant in Egypt. Russia-based Rosatom is responsible for the construction of the USD30.0bn power plant, which will consist of four power units.

Structural Trends

In November 2015, Russian state nuclear corporation Rosatom and the Nuclear Power Plants Authority (NPPA) signed a preliminary agreement for the construction of the El Dabaa nuclear power plant 160km west of Alexandria. Under the agreement, Russia would build the plant and extend USD25.0bn in export financing to cover 85% of the construction costs, with the remainder financed by the Egyptian government. The loan will be paid back over a period of 35 years starting in October 2029, with electricity sales covering the costs of the loan. In October 2018, the USD700.0mn contract to deliver the turbine island equipment was awarded to AAEM - a limited liability company wholly owned by General Electric and Atomenergomash - representing a significant milestone in the planning and development of El Dabaa. In early 2020, Rosatom awarded contracts for the project's construction to Egypt-based firms Petrojet, Hassan Allam Holding and Arab Contractors.

The war between Russia and Ukraine poses a significant risk to the plant's progress, especially with the early stage of development. Having been disconnected from the SWIFT banking system, experts have highlighted a significant risk to Russia's ability to distribute finances to Egypt for the project. The possibility of more wide-reaching global sanctions may pose a challenge to the project, as stakeholders may face similar ultimatums to either cut ties with Russian nuclear and energy firms and avoid payments to the Russian government, or face sanctions themselves. In the absence of these ultimatums, the Egyptian and Russian governments have reiterated their commitment to the project and stated that work will continue as planned.

In November 2022, construction began for the 1.2GW second unit of the 4.8GW Russia-based Rosatom El-Dabaa nuclear power plant. The current schedule for the project states that completion will only be reached in 2030. We have featured the nuclear power plant in the later years of our forecast period, as we do not anticipate that the project would have to run completely on schedule without any delays, as nuclear power projects are prone to delays and cost-overruns. In March 2023, ENRRA granted the construction permit for the third 1.2GW power unit of a nuclear plant in El-Dabaa, Egypt. The power plant consists of four power units each with a capacity of 1.2GW, with VVER-1200 reactors (pressurised water reactor) of generation III. Russia's state-owned Rosatom started the construction in July 2022, and the project is expected to be completed by 2030.

Power Storage

Latest updates

- In May 2024, the Egyptian Electricity Holding Company (EEHC) launched a tender for the development of an 8.2MW solar power plant and a 2MW/4MWh battery energy storage system in Siwa Oasis, located in western Egypt. By June 3 2024, both local and international companies were invited to submit expressions of interest for the design, construction and operation of the facility.
- Egyptian Electricity Holding Company has signed an agreement with Scatec to build a 1GW solar and 200MW battery storage facility in Egypt. This project would be the first of its kind in the market. The African Development Bank has also signed a letter of

intent to finance the project.
- China Energy has signed a contract to prepare a technical and financial study for a power storage and pumping station in Egypt. The 2GW battery energy storage system will be developed on a build-own-operate basis.

Structural Trends

Egypt is proactively advancing its energy sector towards enhanced sustainability and efficiency, with energy storage emerging as a pivotal component. The country has initiated an ambitious introduction of pumped hydro storage into its energy infrastructure. Central to this is the proposed 2GW pumped hydropower plant, for which a feasibility study agreement with China Energy has been signed. This study will assess various facets of the project, which, if approved, will be developed using the build-own-operate (BOO) model, reflecting Egypt's receptiveness to novel financing mechanisms.

Moreover, the Egypt Electricity Holding Company (EEHC) has signed a contract with China's Sinohydro to develop a 2,400MW pumped storage hydro project in the Suez area, set to commence construction in June 2024. This initiative, financed entirely through a concession agreement, represents Egypt's first foray into pumped hydro storage, supplementing its longstanding reliance on hydroelectric power from the Aswan High Dam and other hydro plants.

On the battery storage front, Egypt is exploring solutions to its significant electricity oversupply, which threatens to constrain renewable energy generation and hinder renewable targets. Despite the potential benefits of lithium-ion battery technology for grid integration of renewables, its widespread adoption in Egypt faces hurdles. These include the high costs associated with large-scale deployment, the technology's nascent development stage and the questionable necessity in the context of Egypt's current energy surplus.

However, the anticipated increase in renewable energy's share to 40%-50% of the energy mix signals that battery storage will eventually become critical. Presently, it could be particularly viable in remote, grid-isolated areas. The EEHC's initiative to develop an 8.2MW solar plant with a 2MW/4MWh battery storage system in Siwa Oasis is a promising development for Egypt's energy sector. The project aims to enhance the existing microgrid and 10MW photovoltaic system on the 16-hectare site, thereby increasing electricity supply to local rural areas.

Non-Hydropower Renewables

Latest updates

- Egypt and the UAE have agreed to strengthen their cooperation in renewable energy, aiming to add 4GW of clean power to Egypt's grid. This plan, discussed by Egyptian Prime Minister Mostafa Madbouly and UAE Minister Sultan Al Jaber, highlighted the need to integrate renewable energy into the national grid, localise related industries and involve the private sector.
- Egypt currently expects to receive a USD700.0mn finance package from the World Bank to enhance its renewable energy initiatives and improve efficiency in the electricity sector. This funding is part of the World Bank's Development Policy Financing (DPF) programme.

Structural Trends

Egypt is significantly ramping up its renewable energy ambitions, aiming to elevate the renewable share of its power generation to 58% by 2040, according to its updated strategy for expanding green power. This marks a substantial increase from the previous target of generating 42% of power through renewables by 2030. We currently forecast the market to achieve 15% of total generation at 44TWh, falling short of both their current and updated target.

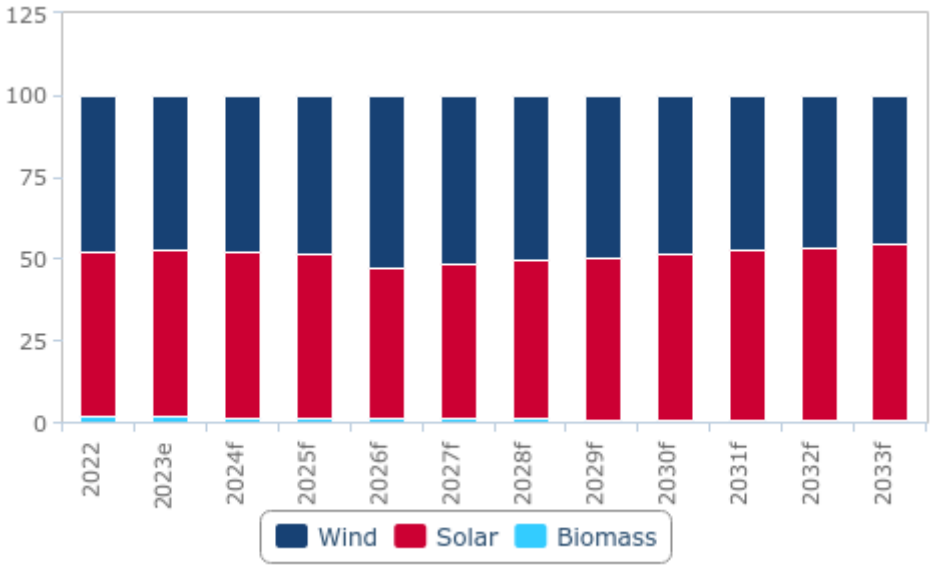
In a bid to achieve these ambitious targets, Egypt has forged a strategic partnership with the UAE. During a meeting between Egyptian Prime Minister Mostafa Madbouly and UAE's Minister of Industry and Advanced Technology Sultan Al Jaber, both nations agreed to add 4GW of clean power to the Egyptian grid. Prime Minister Madbouly emphasised the critical role of renewable energy for Egypt's future, stressing the urgency of integrating renewable energy into the national grid and localising related industries, such as solar panel manufacturing and wind energy components. The collaboration aims to leverage strong political ties and involve the private sector to ensure successful project implementation.

Private sector investments in Egypt's renewable energy projects currently amount to USD4.4bn, with these efforts aiming to boost the country's renewable energy capacity to 10GW by 2025. However, our current forecasts suggest that Egypt may fall slightly short of this goal, achieving approximately 7GW by the same time and 18GW by 2033. Despite this, solar energy investors have managed to achieve a highly competitive rate of USD2.0 cents/kWh, while wind energy projects stand at USD2.5 cents/kWh, underscoring the cost-effectiveness of renewable energy in Egypt.

Further bolstering its renewable energy initiatives, Egypt is set to receive a USD700.0mn finance package from the World Bank. This funding, part of the World Bank's Development Policy Financing (DPF), is aimed at scaling up Egypt's renewable energy efforts and enhancing efficiency in the electricity sector. The financial support is expected to play a crucial role in advancing Egypt's economic reforms and green transition.

Solar Power Leads Renewables Generation Capacity

Egypt - Non-Hydropower Renewables Capacity By Type, % share of mix (2022-2033)



e/f = BMI estimate/forecast. Source: EIA, IRENA, BMI

Solar Forecasts

Latest Updates

- In April 2024, Egypt's Ministry of Petroleum and Mineral Resources announced plans to build two solar power stations worth EGP1.0bn (USD20.6mn), funded by the EU. The first project at Assiut Oil Refining Company will cost EGP550.0mn and have a capacity of 10MW, expected to be completed in 11 months. The second project at the Egyptian General Petroleum Corporation will also cost EGP550.0mn and have a capacity of 6.5MW, with both projects financed through EU grants.

- Scatec has signed a deal for the development of a 1GW solar project to supply clean energy for the operation of Egypt Aluminium's complex in the city of Nagaa Hammadi in Egypt. Under the terms of the agreement, the solar park will be built in two phases, each with a capacity of 500MW. Phase I is expected to be completed within 18 months from the date of signing, and Phase II within 24 months.
- China Electric Power Equipment and Technology has signed a memorandum of understanding (MOU) with New and Renewable Energy Authority and Egyptian Electricity Holding to develop a 10GW solar energy project in Egypt. The proposed facility is expected to produce 29.7TWh of electricity per year.
- Norwegian Scatec ASA has signed an agreement for a 1GW solar power and 200MW battery. Scatec ASA signed the agreement with the Egyptian Electricity Holding Company (EEHC) during the UN Climate Change Conference in Dubai (COP28).
- ACWA power was expected to complete construction on its 200MW Kom Ombo solar project in Egypt by April 2024. The construction of the solar farm, totalling approximately USD182.0mn (EUR167.1mn), achieved financial close in August 2023. Kom Ombo will supply 130,000 households and offset 280,000 tonnes of carbon dioxide per year.

Structural Trends

Egypt's solar power sector is poised for significant growth, driven by ambitious government targets, substantial international funding and a robust project pipeline. Supported by the current Integrated Sustainable Energy Strategy, Egypt aims to achieve a 42% renewable power generation by 2030, with non-hydropower renewables expected to grow by 82.0%, or 21.3GW. This includes a specific target of 22.0% of total capacity for solar, up from 3.0% in 2022. We currently forecast a 62.0% growth in non-hydropower renewables to account for 18.6GW by 2030, and for solar to fall short of the target, accounting for under 10% of total capacity by 2030. We expect solar to become the largest source of non-hydropower renewable generating capacity, accounting for about 13% by the end of our forecast period.

This ambitious target is supported by the Egyptian Solar Plan, which seeks to install 3.5GW of solar power by 2027, with two-thirds of this capacity driven by private investment through competitive bidding and other incentivising schemes. The country's natural advantages, including high solar irradiance and extended sunlight hours, coupled with growing private sector engagement, are key drivers of this growth. Notably, Elsewedy Electric T&D's contract for the 36MW phase of the D'jermaya solar PV complex in Chad exemplifies Egypt's expanding influence in the African renewable energy sector. The recent announcement of two new solar power stations worth EGP1.0bn (USD20.60mn) and financed by the EU through grants is also testament to the country's commitment to expanding its renewable energy footprint.

Egypt's renewable energy ambitions are bolstered by the Nexus of Water, Food and Energy programme, which aims to channel USD10.0bn into renewable projects, targeting the installation of 10GW over the next five years. These projects are part of a strategic initiative to replace 5GW of thermal power stations with renewable sources, thus facilitating Egypt's goal of a 42% renewable share by 2030. The programme's innovative financing mechanisms, including grants, debt swaps and concessional loans, demonstrate Egypt's commitment to leveraging diverse funding sources to realise its renewable energy potential. As of now, 3.7GW of capacity has been initiated under this programme, underscoring Egypt's serious strides towards a greener future. This proactive approach is expected to solidify Egypt's status as a regional leader in renewable energy and contribute significantly to global sustainability efforts

Wind Forecasts

Latest Updates

- Norway's Scatec and a consortium led by Orascom Construction have secured land for two major wind power projects in Egypt's Sohag Governorate, totalling 8.0GW and representing USD9.0bn in foreign direct investment. These projects are among the largest onshore wind developments in the Middle East and globally. Scatec will develop a 5GW project independently, while the Orascom-led consortium, in collaboration with the New and Renewable Energy Development Authority, will develop a 3GW

project in phases under a Build-Own-Operate (BOO) model.

- AMEA Power has finalised installation of the first wind turbine in its Amunet wind farm, located in Egypt's Gulf of Suez. The USD709.0mn project, situated in Ras Ghareb 318km south of Cairo, will house a total of 70 wind turbines. Amea Power has collaborated with a consortium of Huadong PowerChina Engineering and PowerChina for the engineering, procurement and construction of the wind farm. The wind farm's output will be integrated into the National Electricity Transmission grid under a 25-year power purchase agreement. The project is backed by international financial institutions and commercial banks.
- The New and Renewable Energy Authority and the Sovereign Fund of Egypt are preparing to launch the Phase II of the Zafarana wind farm for bidding in H2 2024. The tender process is part of Egypt's broader efforts to advance its renewable energy capabilities, including the agreements with Siemens and Jabal Al-Zeit stations, estimated at USD350.0mn. The project includes wind farms with a 545MW capacity and 700 turbines, developed through international collaborations.
- A consortium of ACWA Power and Hassan Allam Utilities have signed a 25-year land usufruct agreement with the New and Renewable Energy Authority for a 1.1GW wind project in Egypt. The USD1.5bn power plant will come up at the Gulf of Suez and Gebel El Zeit. Under the agreement, the consortium will work during the development phase to complete site studies and secure project finance.

Wind Power Growth Surge

Egypt's wind power sector is on a trajectory to become a dominant force within the renewable energy landscape, reflecting a broader trend in the MENA region's shift towards sustainable power sources. The Egyptian Integrated Sustainable Energy Strategy is the driving force behind this shift, targeting 42% renewable power capacity by 2035. Within this framework, non-hydropower renewables are anticipated to see an 82% capacity growth, or 21.3GW, over the next 10 years. Notably, the wind power segment is receiving significant attention, with the Egyptian Cabinet approving a 500MW wind project by AMEA Power LLC in Ras Ghareb. In tandem, Maersk International's acquisition of a 51% stake in the Zaafarana wind farm highlights the growing confidence and investment from global conglomerates in Egypt's renewable potential.

Strategic partnerships and large-scale projects are at the forefront of Egypt's wind power expansion. The Ministry of Electricity and Renewable Energy's collaboration with Orascom Construction, ENGIE and Toyota Tsusho for a 3GW wind farm in West Sohag exemplifies the sector's scale and ambition. Egypt is making strides with other notable projects, such as AMEA Power's Amunet wind farm in Ras Ghareb, which will have a capacity of 500MW and is expected to be commissioned by 2025. This project, which includes a battery energy storage system, is part of AMEA Power's broader initiative to add 2GW of renewables in Egypt by 2025. The project, backed by a consortium of international and local companies, underscores the strategic importance of wind power in Egypt's renewable mix. Moreover, the land allocation for a monumental 10GW wind power project by ACWA Power and a similar agreement for a 10GW onshore wind farm by Masdar, Infinity Power and Hassan Allam Utilities marks a significant leap towards realising one of the world's largest wind farms. The onshore megaproject, costing over USD10.0bn, is slated to begin construction by March 2026, and is expected to start generating electricity by 2032. These developments indicate a clear trend: Egypt is not only prioritising renewable energy within its borders, but is also establishing itself as a hub for renewable energy innovation and investment on a global scale.

Wind power is currently Egypt's main source of non-hydro renewable energy growth, but we currently expect it to lose this dominance by the end of the forecast period, accounting for 10.7% of generation capacity by 2033. Despite this, the substantial project pipeline indicates significant growth potential in the near term. However, we note downside risks associated with high capital costs for wind developments.

Electricity Generation And Power Generating Capacity

Total Electricity Generation Data And Forecasts (Egypt 2022-2027)

Indicator	2022e	2023e	2024f	2025f	2026f	2027f
Generation, Total, TWh	218.2	223.2	231.3	239.6	249.3	258.6
Generation, Total, % y-o-y	3.9	2.3	3.7	3.6	4.0	3.7
Generation, Coal, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Coal, % of total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Natural Gas, TWh	183.63	187.12	192.36	196.40	200.33	206.54
Generation, Natural Gas, % of total electricity generation	84.142	83.852	83.160	81.984	80.371	79.872
Generation, Oil, TWh	9.865	9.860	9.565	7.174	5.739	5.710
Generation, Oil, % of total electricity generation	4.520	4.419	4.135	2.994	2.302	2.208
Generation, Nuclear, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Nuclear, % of total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Hydropower, TWh	13.484	13.214	13.082	13.213	13.372	13.532
Generation, Hydropower, % of total electricity generation	6.179	5.922	5.656	5.516	5.365	5.233
Generation, Hydro-Electric Pumped Storage, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Hydro-Electric Pumped Storage, % total electricity generation	0.0	0.0	0.0	0.0	0.0	0.0
Generation, Non-Hydropower Renewables, TWh	11.260	12.961	16.307	22.773	29.816	32.807
Generation, Non-Hydropower Renewables, % of total electricity generation	5.2	5.8	7.0	9.5	12.0	12.7
Generation, Wind, TWh	6.280	7.147	9.069	12.905	18.093	19.595
Generation, Wind, % of total electricity generation	2.878	3.203	3.921	5.387	7.259	7.578
Generation, Solar, TWh	4.635	5.469	6.891	9.510	11.364	12.853
Generation, Solar, % of total electricity generation	2.124	2.451	2.979	3.970	4.559	4.971
Generation, Biomass and Waste, TWh	0.345	0.345	0.347	0.357	0.358	0.359
Generation, Biomass and Waste, % of total electricity generation	0.158	0.155	0.150	0.149	0.144	0.139

e/f = BMI estimate/forecast. Source: National sources, BMI

Total Electricity Generation Data And Forecasts (Egypt 2028-2033)

Indicator	2028f	2029f	2030f	2031f	2032f	2033f
Generation, Total, TWh	268.4	278.8	288.1	300.3	310.4	321.5
Generation, Total, % y-o-y	3.8	3.9	3.3	4.2	3.4	3.6
Generation, Coal, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Coal, % of total electricity generation	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Natural Gas, TWh	212.94	219.54	224.59	229.08	233.66	238.34
Generation, Natural Gas, % of total electricity generation	79.327	78.735	77.959	76.297	75.273	74.130
Generation, Oil, TWh	5.682	5.653	5.625	3.656	3.108	2.642
Generation, Oil, % of total electricity generation	2.117	2.027	1.952	1.218	1.001	0.822
Generation, Nuclear, TWh	0.000	0.000	0.000	5.000	6.000	7.200
Generation, Nuclear, % of total electricity generation	0.000	0.000	0.000	1.665	1.933	2.239
Generation, Hydropower, TWh	13.694	13.859	14.025	14.165	14.307	14.450
Generation, Hydropower, % of total electricity generation	5.102	4.970	4.868	4.718	4.609	4.494
Generation, Hydro-Electric Pumped Storage, TWh	0.000	0.000	0.000	0.000	0.000	0.000
Generation, Hydro-Electric Pumped Storage, % total electricity generation	0.0	0.0	0.0	0.0	0.0	0.0
Generation, Non-Hydropower Renewables, TWh	36.118	39.784	43.846	48.349	53.342	58.882
Generation, Non-Hydropower Renewables, % of total electricity generation	13.5	14.3	15.2	16.1	17.2	18.3
Generation, Wind, TWh	21.221	22.983	24.890	26.956	29.194	31.617
Generation, Wind, % of total electricity generation	7.906	8.242	8.640	8.978	9.405	9.834
Generation, Solar, TWh	14.537	16.441	18.595	21.031	23.786	26.902
Generation, Solar, % of total electricity generation	5.415	5.896	6.455	7.004	7.663	8.367
Generation, Biomass and Waste, TWh	0.359	0.360	0.361	0.362	0.362	0.363
Generation, Biomass and Waste, % of total electricity generation	0.134	0.129	0.125	0.120	0.117	0.113

f = BMI forecast. Source: National sources, BMI

Electricity Generating Capacity Data And Forecasts (Egypt 2022-2027)

Indicator	2022e	2023e	2024f	2025f	2026f	2027f
Capacity, Net, MW	59,250.5	59,775.8	60,776.9	62,891.0	65,046.6	66,132.5
Capacity, Net, % y-o-y	0.1	0.9	1.7	3.5	3.4	1.7
Capacity, Conventional Thermal, MW	52,971.0	52,971.0	52,971.0	53,103.4	53,257.4	53,422.5
Capacity, Conventional Thermal, % y-o-y	0.0	0.0	0.0	0.2	0.3	0.3
Capacity, Conventional Thermal, % of total capacity	89.4	88.6	87.2	84.4	81.9	80.8
Capacity, Nuclear, MW	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, MW	2,832.0	2,832.0	2,832.0	2,832.0	2,832.0	2,832.0
Capacity, Hydropower, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, % of total capacity	4.8	4.7	4.7	4.5	4.4	4.3
Capacity, Non-Hydroelectric Renewables, MW	3,440.0	3,965.3	4,966.4	6,948.1	8,949.7	9,870.5
Capacity, Non-Hydroelectric Renewables, % y-o-y	1.5	15.3	25.2	39.9	28.8	10.3
Capacity, Non-Hydroelectric Renewables, % of total capacity	5.8	6.6	8.2	11.0	13.8	14.9

e/f = BMI estimate/forecast. Source: National sources, BMI

Electricity Generating Capacity Data And Forecasts (Egypt 2028-2033)

Indicator	2028f	2029f	2030f	2031f	2032f	2033f
Capacity, Net, MW	67,330.7	68,647.7	70,096.5	72,891.7	74,649.9	76,589.4
Capacity, Net, % y-o-y	1.8	2.0	2.1	4.0	2.4	2.6
Capacity, Conventional Thermal, MW	53,598.8	53,781.1	53,969.2	54,163.5	54,364.0	54,570.8
Capacity, Conventional Thermal, % y-o-y	0.3	0.3	0.3	0.4	0.4	0.4
Capacity, Conventional Thermal, % of total capacity	79.6	78.3	77.0	74.3	72.8	71.3
Capacity, Nuclear, MW	0.0	0.0	0.0	1,200.0	1,200.0	1,200.0
Capacity, Nuclear, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Nuclear, % of total capacity	0.0	0.0	0.0	1.6	1.6	1.6
Capacity, Hydropower, MW	2,832.0	2,832.0	2,832.0	2,832.0	2,832.0	2,832.0
Capacity, Hydropower, % y-o-y	0.0	0.0	0.0	0.0	0.0	0.0
Capacity, Hydropower, % of total capacity	4.2	4.1	4.0	3.9	3.8	3.7
Capacity, Non-Hydroelectric Renewables, MW	10,892.4	12,027.2	13,287.7	14,688.7	16,246.4	17,979.1
Capacity, Non-Hydroelectric Renewables, % y-o-y	10.4	10.4	10.5	10.5	10.6	10.7
Capacity, Non-Hydroelectric Renewables, % of total capacity	16.2	17.5	19.0	20.2	21.8	23.5

f = BMI forecast. Source: National sources, BMI

Electricity Consumption

Structural Changes

Egypt is currently navigating a complex landscape of electricity consumption and supply, driven by rapid industrialisation, increased urbanisation and rising temperatures. Egypt's economic recovery after the Arab Spring boosted electricity demand beyond the level of its total supply, necessitating power imports over recent years. The el-Sisi government's drive to boost electricity output began to register success from 2017, with the completion of several large-scale power projects.

Egypt received record-high heatwaves in the summer of 2023, with temperatures reaching 40 degrees Celsius and higher. The heatwaves have increased electricity consumption through the use of cooling systems and air conditioning. However, the heatwave also brought a harsh reality check to Egyptians, who had enjoyed nearly a decade of reliable electricity supply due to significant investments in the nation's power network. Facing a need to cut costs, the government introduced rolling blackouts, leading to daily power cuts of one or two hours in cities, and three to four hours in villages and estates, even during extremely hot weather. Certain areas with lower population density, including North Sinai, South Sinai, the Red Sea region, Matrouh, and tourist areas like the North Coast and El Alamein, as well as the New Administrative Capital east of Cairo, were excluded from these power cuts.

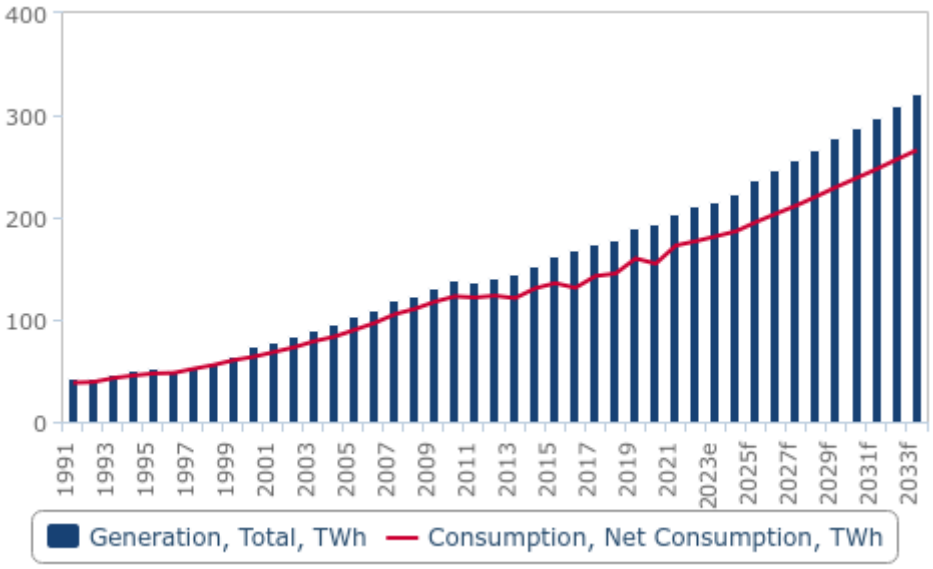
In July 2024, Prime Minister Mostafa Madbouly announced that load shedding and scheduled power outages to reduce grid load will cease from July 21 2024 until mid-September 2024. The government highlighted its aims to resolve the electricity crisis fully by the end of the year, and laid out plans to prevent future outages. In response to a severe heatwave, power cuts in June lasted three hours per day, followed by a load shedding programme with rolling two-hour cuts in July 2023. An emergency plan to import mazut and natural gas has been initiated to manage the increased demand.

We believe that the increase in electricity consumption will be driven by an increase in cooling system installations as Egypt experiences increasingly warmer weather in the summer seasons as well as increasing urbanisations rate in the market. Additionally, Egypt is making strides in renewable energy, particularly green hydrogen, which is expected to show a 46% growth in capacity between 2024 and 2033. This surge is linked to significant investments, including USD40.0bn in green hydrogen and renewable technology projects in the Suez Canal Economic Zone. These developments will contribute to an anticipated 28% growth in electricity consumption over the forecast period. We estimate that electricity consumption year-on-year growth will rise by 3.6%, rising from 192.3TWh in 2024 to 267.6 TWh by 2033. Generation outpaces consumption and we expect that the country will maintain an excess in electricity generation through the continuous expansion of its power capacity, exporting power through its expanding cross-border transmission interconnection network over the coming decade.

We highlight that technological developments in energy-efficient electrical appliances (such as air conditioning) could dampen growth in the demand for power. However, strong demand from the energy-intensive desalination plants will remain, maintaining a positive growth trend for electricity consumption.

Electricity Consumption To Expand Strongly Although Still Below Generation Output

Egypt - Electricity Generation & Consumption, TWh & % y-o-y (1991-2033)



e/f = BMI estimate/forecast. Source: National sources, BMI

Transmission And Distribution, Imports And Exports

Latest Updates

- As of July 2024, the Egypt-Saudi interconnection project is 60% complete. The first phase of the project is set to start operating in July 2025, with the interconnection allowing the exchange of up to 3,000MW of power by early 2026.
- The European Bank for Reconstruction and Development is considering a sovereign loan of up to EUR165.0mn to help Egypt to enhance its electricity grid and accommodate new renewable energy sources. This loan will be directed to the Egyptian Electricity Transmission Company for infrastructure development. About 60% of the funds are earmarked for constructing a 200km high-voltage transmission line in the Gulf of Suez to connect approximately 2.1GW from new wind energy projects. The remaining portion will finance upgrades to a major substation in Cairo, ensuring network stability, as part of Egypt's Nexus Water, Food & Energy initiative.

Structural Trends

We expect that Egypt's power supply surplus will remain high over our 10-year forecast period, attributable to rapid increases in net generation, which significantly outperforms the underlying demand trend. In December 2018, the Egyptian Electricity Transmission Company temporarily ceased operations at power plants, totalling 18GW of its operational capacity due to an oversupply of electricity and a lack of infrastructure to export the surplus. While we note that this fell within Egypt's low-demand winter season (December to March), we expect that the country will prioritise the development of new power interconnection projects to boost its export capacity and maintain demand for growth in the sector.

Egypt has high- and extra high-voltage (132kV to 500kV) transmission lines stretched 27,266km, with 118,850MVA total transformer capacity in place. Its electricity grid is currently interconnected with those of Jordan, Syria, Iraq, Turkiye, Libya and Sudan. Egypt is cooperating with other African countries to build connections under the Nile Basin Initiative, whose membership includes Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. With the completion of the interconnection network, Egypt will significantly broaden its electricity export potential through access to the East African Power Pool.

The Egypt-Saudi and EuroAfrica transmission interconnector projects, both rated at 500kV, are among the largest in the region. The Egypt-Saudi interconnection project, involving the EEEHC and Saudi Electricity Company (SEC), aims to link the two markets with a 3,000MW interconnection cable. The SEC and EEHC will share the cost of the 500kV cable, including a 20km undersea section. Initially delayed multiple times between 2016 and 2019, and further paused in early 2020 due to Covid-19, the project saw renewed progress in late 2021, with contracts awarded by May 2022. As of July 2024, the project is 60% complete, with the first phase set to start operating in July 2025 and full capacity by early 2026.

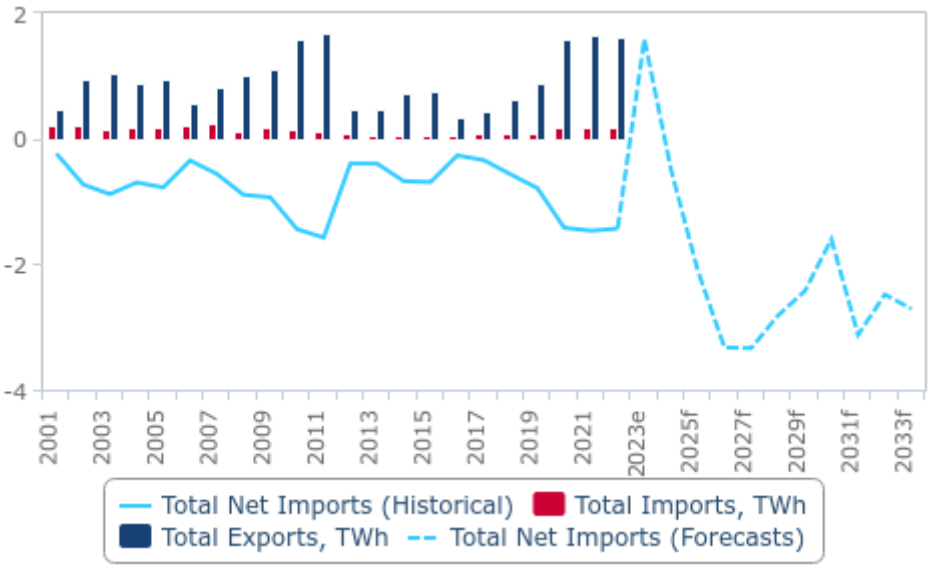
The interconnection will alleviate the need for load shedding during peak demand periods in both countries. Saudi Arabia's peak consumption occurs between noon and midnight, while Egypt's is after sunset, making them ideally suited for on-demand electricity trading. This project will also facilitate electricity trading between Egypt and the Gulf Cooperation Council upon completion of new Middle Eastern interconnections. It is expected to expand Egypt's export capacity and drive further investment in new power infrastructure, creating opportunities for infrastructure and power companies in two major electricity markets.

Progress continues to be made on the 500kV EuroAfrica transmission interconnection, linking Egypt to mainland Greece. Stakeholders in the USD2.7bn Egypt Cyprus transmission interconnection project - which forms the first leg of the EuroAfrica Interconnector - invited bids for the tender on its EUR650.0mn EPC contract in early 2020. This first phase was scheduled to reach completion by December 2022, with stage two connecting Cyprus and Greece (via Crete and Attica) scheduled online one year later by December 2023. Projects such as these are exceptionally important to the Egyptian government, who recognise that the expansion of their electricity exports not only generates revenue for the country but will also drive future growth in the country's power sector. Damco Energy and Elica Mediterranean Interconnection signed a MoU with Infinity Power to develop a project to supply renewable power to Europe via a planned subsea transmission project between Egypt and Greece. The GREGY 3GW transmission project will include the installation of a 950km-long submarine cable to supply electricity, from 9.5GW of renewable projects to be deployed in Egypt to Greece.

Despite these advancements, Egypt faces ongoing challenges in its transmission and distribution network. Our current forecasts indicate that transmission and data losses will remain at an annual average level of 16.3% over the next decade. This underscores the need for continued investment in grid modernisation and efficiency improvements. The ambitious projects in the pipeline, including the Greece-Africa Power Interconnector and the GREGY Subsea Interconnector Project (both aiming to connect Greece and Egypt), are crucial steps toward mitigating these losses and enhancing the overall reliability of the grid. With these initiatives, Egypt is not only addressing its internal energy needs, but also positioning itself as a central hub for electricity trade and renewable energy in the region.

Net Electricity Exports To Increase As Generation Outpaces Consumption

Egypt - Total Electricity Imports & Exports, & Net Electricity Imports, TWh



e/f = BMI estimate/forecast. Source: EIA, local sources, BMI

Electric Power T&D Losses Data And Forecasts (Egypt 2022-2027)

Indicator	2022	2023e	2024f	2025f	2026f	2027f
Electric power distribution losses, TWh	35.9	36.3	37.3	39.1	40.6	42.0
Electric power distribution losses, % of output	17.0	16.8	16.7	16.5	16.4	16.3

e/f = BMI estimate/forecast. Source: EIA, BMI

Electric Power T&D Losses Data And Forecasts (Egypt 2028-2033)

Indicator	2028f	2029f	2030f	2031f	2032f	2033f
Electric power distribution losses, TWh	43.5	45.0	46.4	47.9	49.4	51.0
Electric power distribution losses, % of output	16.3	16.2	16.1	16.1	16.0	15.9

f = BMI forecast. Source: EIA, BMI

Industry Risk/Reward Index

Egypt Power & Renewables Risk/Reward Index

Please Note: *BMI is enhancing its risk analysis with a new scoring system following its acquisition of GeoQuant, a market-leading provider of political risk data. From March 27 2024, risk scores are inverted: zero now represents the lowest risk and 100 represents the highest risk. This allows for clearer, industry-standard assessments. For further details, please refer to our updated methodology document.*

Given the changing power & renewables sector landscape, we have revised our Power Risk/Reward Index (RRI) by replacing six indicators within the Rewards profile. In order to represent power & renewables sector growth more appropriately within the Industry Rewards profile, we have replaced Electricity Capacity and Electricity Generation with Electricity Capacity Additions and Electricity Generation Additions. We have also revamped the indicators in the Country Rewards profile to consider Electricity Consumption, Electricity Consumption Growth, Generation to Consumption Ratio and Access to Electricity.

Key View: *This quarter, Egypt's position on our Power Risk/Reward Index has shifted, dropping to seventh in the region and 45th globally. While the country's Industry Rewards profile remains robust, driven by ongoing investments in renewable energy and capacity expansions, significant challenges in economic stability, high inflation and geopolitical tensions have adversely affected its Country Rewards and Risks scores. The overall risk environment in Egypt has deteriorated due to increased external financing needs, high borrowing costs and substantial geopolitical risks stemming from regional conflicts, which have collectively impacted its attractiveness to investors.*

Risk/Reward Snapshot

Egypt & Middle East & North Africa Region - Power & Renewables Risk/Reward Index

Note: Scores out of 100; lower score = more attractive market. Source: BMI Power & Renewables Risk/Reward Index

Global And Regional Ranks

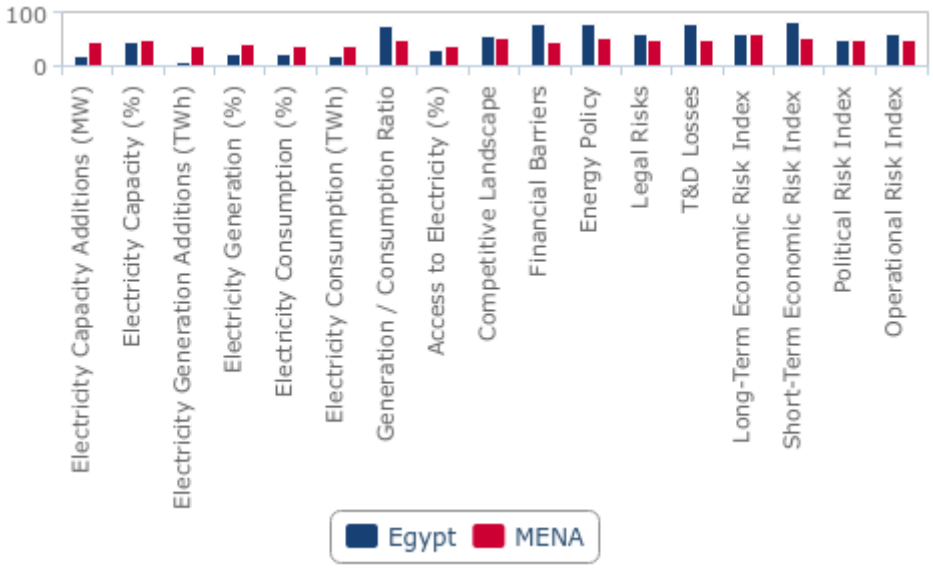
- Regional rank (out of 15): 7th
- Global rank (out of 117): 45th

Key Features And Latest Updates

- Egypt's Industry Rewards score remains largely unchanged from the previous quarter, continuing to rank below the regional average. However, it still stands out as one of the best-performing pillars in the Middle East & North Africa (MENA) region. The power & renewables sector is set to expand significantly over our medium-term forecast period to 2028, with Egypt expected to add about 6GW of electricity capacity and increase generation by a little over 37TWh. This growth is anticipated to be driven largely by natural gas, renewables and nuclear energy towards the end of the forecast period. These developments present substantial opportunities for investment, particularly in the non-hydro renewables sector, highlighting the market's potential for attracting new capital and technology.
- Egypt's Country Rewards profile ranks lower than both the regional and global averages. This is largely due to high power consumption growth in the market, with a projected 30TWh increase between 2024 and 2028. The country is projected to have an average annual net consumption growth rate of 5% between 2024-2028, driven by high consumption from the residential and industrial sectors. While Egypt's electricity consumption remains high, it is currently experiencing power cuts. Despite this, Egypt's overall electrification stood at 100% in 2022, according to the World Bank. This high generation-to-consumption ratio positions Egypt as a strong net exporter, with forecasts indicating that it will remain so through to 2028, presenting potential opportunities for rewards in the power market.
- The Industry Risks in Egypt have remained stable since the last quarter, indicating consistent market conditions. However, the market's transmission and distribution losses continue to weigh down the Industry Risks profile, with forecasted electric power transmission and data losses of 16.4% between 2024 and 2028. Financial barriers and a lack of clarity and continuity in Egypt's energy policy framework pose significant risks for investors. The recent monetary policy tightening and rising borrowing costs have also affected investment activity, slowing real terms growth over past quarters, as indicated by the insights from our Operational Risk team.
- As for Country Risk, Egypt's short-term economic risks remain high, driven by significant external financing needs amid limited capital inflows. High borrowing costs due to aggressive monetary policy tightening and reduced subsidised lending have slowed lending activity, impacting investment and domestic demand. Additionally, geopolitical risks, particularly from the Israel-Hamas conflict, pose significant threats. The potential for regional instability, combined with internal political challenges, heavily burden the market's operational risk. Businesses also face risks from congestion and supply chain disruptions due to ongoing transport infrastructure upgrades, exacerbating operational challenges, as indicated by our Country Risk team.

RRI Matrix Breakdown

Egypt & Middle East & North Africa Region - Power & Renewables Risk/Reward Index By Component



Note: Scores out of 100; lower score = more attractive market. Source: BMI Power & Renewables Risk/Reward Index

Market Overview

Key Policies And Market Structure

Latest Updates

- In April 2024, Egypt enacted new rules to bolster private investment in renewables, allowing direct agreements between private entities to enhance the energy market's efficiency and sustainability. The Electricity and Consumer Protection Regulatory Agency's endorsement of these 'Private to Private Projects' signifies a strategic shift, promoting competitive neutrality and reducing state involvement in line with the Supreme Investment Council's decisions.
- In 2023, Egypt updated its Electricity Law, mandating the Egyptian Electricity Transmission Company to manage the transmission system adhering to economic and environmental standards, ensuring fair access for producers and consumers. The law empowers the company to operate and maintain the network, manage energy procurement, and facilitate domestic and cross-border electricity trade, while also engaging in research and development to support network expansion and stability.

Regulation And Competition

Regulation

Two government ministries share responsibility for Egypt's energy sector: the Ministry of Petroleum, which is charged with upstream and downstream oil and gas activities; and the Ministry of Electricity and Renewable Energy (MOEE), which is responsible for electricity generation, transmission and distribution. After nationalising the sector in the 1960s, the state is still the main shareholder in the power industry and the MOEE acts as the owner of the state entities in the power sector. There have been efforts to make the sector more competitive by attracting greater private sector investment.

The industry was vertically integrated under the Egyptian Electricity Authority until 2000, and has been structurally unbundled, vertically (having been divided into generation, transmission and distribution/supply segments) and horizontally (with a number of companies now operating in the generation and distribution/supply segments). The Egyptian Electricity Holding Company (EEHC) is still fully owned by the state, and encompasses the different actors under its umbrella, including 16 subsidiaries:

- One hydropower and five thermal electricity generation companies;
- Nine electricity distribution companies; and
- A transmission-and-dispatch company, the Egyptian Electricity Transmission Company.

The EEHC coordinates the plans and investments in the power sector and manages the sector's overall finances. In addition to the EEHC's affiliates, there are six authorities operating in Egypt's electricity sector. These entities report directly to the MOEE and comprise the Rural Electrification Authority, Hydropower Projects Executive Authority, New and Renewable Energy Authority, Atomic Energy Authority, Nuclear Power Plants Authority and Nuclear Material Authority. Growing demand in the late 1990s spurred industry restructuring and allowed limited privatisation of the sector. As a result of these reforms, Egypt has a number of privately owned power plants that are either independent power projects or financed under build-own-operate-transfer schemes.

Competition

The power market is organised in a single-buyer form, with all generation companies selling to the transmission company. The transmission company sells electricity to customers and eight distribution companies. This single-buyer market does not allow free competition among existing generation companies. However, this is an intermediate step towards the establishment of a liberalised electricity market, as envisioned in the country's Electricity Law.

Power Generation Sector: Egypt's power generation is largely state-run, but reforms are inviting independent producers, particularly in renewables, diversifying the energy mix and signalling a gradual shift towards a more pluralistic market.

Transmission Sector: The Egyptian Electricity Transmission Company monopolizes power transmission, yet the growing renewable sector and infrastructure needs suggest potential openings for future private investment.

Distribution Sector: State-controlled regional companies handle distribution, facing efficiency challenges; however, ongoing reforms hint at possible privatisation to boost performance and reduce state financial burdens.

Reforming The Power & Renewables Sector

Egypt is transitioning to a privatised power industry from its current state-controlled system. A law privatising energy production, distribution and transmission was approved by the government in February 2015. The new law seeks to shift the state's role from one of direct management of the power sector to one of regulation. In order to separate transportation, production and distribution activities, the new law includes regulations that will allow for free competition in the production, transfer, distribution and sale of energy.

In theory, these legal amendments permit private businesses to transfer and sell electricity directly to customers. The opening of transmission and sales to the private sector is the most important modification to the law. The EEHC now has a dominant purchasing position in the energy industry and currently has a wide scope to set conditions, including energy prices. It will lose this when it opens up the market for competitors to transmit and sell power.

Egypt cannot afford to improve its electricity infrastructure on its own, so the government is appealing to the private sector. These changes should allow for the steady improvement of processes and functions, fostering competition within the electricity market in a way that makes it more appealing for entrants to invest in the generation and trading of electricity.

A new investment law has also been passed with the goal of regaining investor trust, luring in new investments, and protecting both domestic and foreign investors by providing more incentives and guarantees, reducing barriers, and expediting the process. Such incentives include payment facilities in relation to the price of the power required to operate a project or allocating government land at reduced prices. Under the new legislation, customs duties on imported equipment and machinery required for the establishment of a project have been reduced to 5%. Mechanisms of land allocation to investors have been made flexible, allowing the sale of land to investors, while payment by the investor may be postponed until operation of the project takes effect.

In July 2018, Egypt's parliament passed a law to establish a sovereign wealth fund to manage state assets, which it plans to list on the stock exchange. The 'Egypt Fund' was granted EGP5.0bn (USD280.0mn) as start-up capital to be paid over three years, with a capital target of EGP200.0bn (USD11.0bn) in future. The IMF has reportedly encouraged Egypt to increase privatisation in order to increase the state's liquidity and encourage economic growth through private sector investment. The country's power sector is among the targeted industries for increased private sector participation. This has been done in recent years through regulatory reform, which has opened up the market for private investment in power generation and transmission. However, reports highlight the possibility that the state may look to privatise assets in the power sector, either through transfer of ownership to the Egypt Fund,

or through partial listing of operations companies on the open market stock exchange. We note that this would present a significant opportunity for investors and we will continue to monitor developments in this regard.

Energy And Emissions Policies

According to data from the Energy Information Agency, Egypt is among the top five contributors of carbon emissions from energy consumption in the Middle East and North Africa region. According to a report by the African Development Bank, Egypt has one of the fastest-growing greenhouse gas (GHG) emissions markets in the world, ranking in the top 11 globally. The country has seen a sustained increase in energy demand, which has been met by the growing use of fossil fuels.

The Egyptian government has attempted to promote some energy policy actions designed to curb the growth in GHG emissions. In particular, the government unveiled a series of feed-in tariffs in late 2014 to promote the use of renewable energy. Under the scheme, households and commercial producers are offered various rates of compensation per KW of solar or wind energy produced. The scheme has the potential to bolster investment in the sector, which, for the time being, remains relatively small in Egypt.

The country's long-term goals include:

- A 20% share of renewables in overall consumption by 2022.
- A 42% share of renewables in overall consumption by 2035.
- Developing a network of new cross-border transmission interconnections to make Egypt a regional energy exchange hub.
- Modernising and optimising the electricity grid.

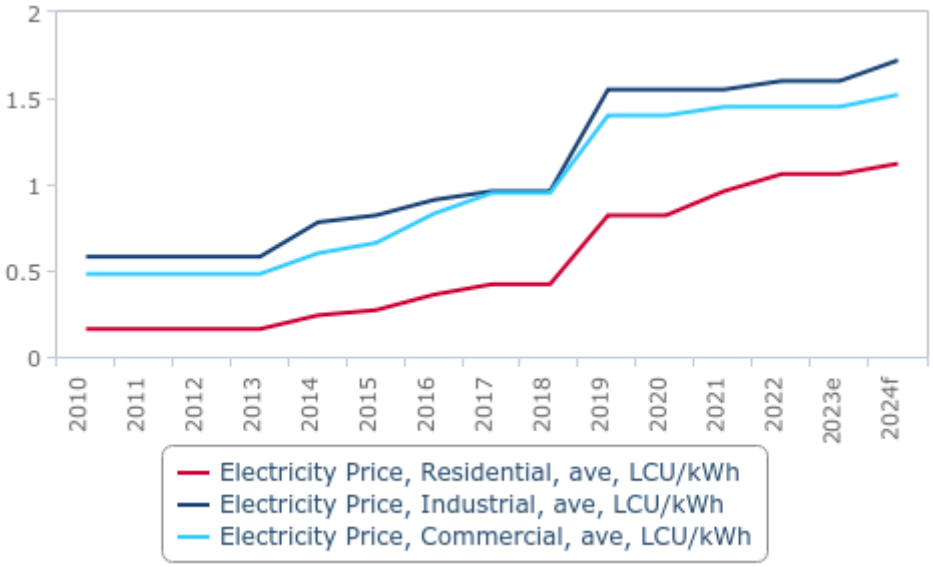
Electricity Prices Market Overview

Latest Updates

- We expect that electricity prices for all user types in Egypt will increase over 2024. The hike is due to the Egyptian Electricity Holding Company's recent announcement of revised tariffs, marking the first adjustment since 2021, effective in January 2024.
- We believe that electricity prices will remain on the elevated in the medium-to-long term (H1 2025). This sustained price level is due to the Egyptian government's decision to eliminate power subsidies, a move delayed since 2021 due to rising inflation amid the pandemic.
- We anticipate increased costs for businesses as Egypt transitions away from electricity subsidies. This change is likely to affect industrial production costs, leading to higher prices for goods and services. Notably, industrial electricity rates have already climbed from 1.6LCU/kWh to 1.7LCU/kWh in 2024.

Subsidy Cuts Set To Drive Up Electricity Prices

Egypt - Electricity Prices By Consumer Type, LCU/kWh (2010-2024)



e/f = BMI estimate/forecast. Source: Egyptian Electricity Holding Company, local sources, BMI

Structural Trends

Similar to other markets in the Middle East, subsidies and capped prices have undermined profitability and weighed on private sector investment over past years. In 2014, energy subsidies made up about one-third of the government's budget, with 75% of this spent on the energy sector. Since 2016, Egypt's government has made adjustments to reduce energy subsidies, successfully attracting robust investment over recent years.

The Minister of Planning and International Cooperation Ashraf al-Arabi reaffirmed his position that Egypt had 'no time to waste' in tackling the country's growing electricity subsidy bill. The minister promised the international community that energy subsidies would be reduced by 43% over a three-year period. The government sought to reduce subsidies in the electricity sector, raising the electricity prices for households with mid-to-high usage by an average of 19% for FY2016. This was part of a five-year plan to reduce subsidies. The government unveiled increases in electricity prices in August 2016 of between 25% and 40%, with the proposed price hike variations linked to consumption. The move came as the government was locked in negotiations with the IMF over a USD12.0bn bailout package. Price hikes graded between 15% and 42% eventually took effect in July 2017.

In June 2018, the government announced that they would raise electricity prices as part of austerity measures designed to aid in economic recovery and secure a three-year USD12.0bn loan from the IMF, which was initiated in 2016. As of July 2018, industrial consumers paid 42% more for electricity prices, while household tariffs were raised by 21%. In July 2019, the Egyptian government eliminated nearly all electricity subsidies and increased electricity tariffs by a further 15%. One year later on July 1 2020, Egypt's Ministry of Electricity and Renewable Energy announced electricity price hikes between 17% and 30%, beginning in August that year.

In response to the economic challenges posed by the Covid-19 pandemic, Egypt's Minister of Electricity Mohamed Shaker announced in 2021 a decision to extend the deadline to phase out electricity subsidies for consumers from 2022 to 2025. This extension was a part of a larger plan to manage the economic impact on citizens, while also adjusting the subsidy threshold down from 1,000kW to 650kW, making prices subsidy-free beyond this new limit. Consequently, electricity tariffs saw an increase of 18.6%, from EGP 1.18/kWh for the consumption bracket of 351kWh to 650kWh, to EGP 1.40/kWh for consumption above 650kWh. Although the original plan aimed to eliminate subsidies by July 2022, the government opted for a cautious approach to reform, which resulted in tripling the extension of the timeline, with the final adjustments coming into effect at the start of 2024.

Egypt Power & Renewables Projects Database

Egypt's power project pipeline is extensive, with over 84GW of nuclear, thermal, hydropower and renewables projects captured in our Key Projects Data. The largest projects in terms of capacity are primarily nuclear and gas-fired power projects, with several new power plants at various stages of development. While the largest projects are either thermal or nuclear power projects, Egypt is also developing its hydropower and non-hydropower renewables sectors. In terms of Egypt's non-hydropower renewables project pipeline, there are almost 38GW of projects at various stages of development, comprising a mix of solar, and offshore and onshore wind. While the project pipeline is expansive, a significant number of projects remain at the planning stage, and there is some risk that projects under development will be further delayed.

Egypt - Top 10 Power Projects By Capacity

Project Name	Campanies	Status	Value (USDmn)	Capacity (MW)
Sohag Wind Farm Project, Sohag	Egypt New & Renewable Energy Authority (NREA)[Sponsor]{Egypt},Abu Dhabi Future Energy (MASDAR)[Sponsor]{United Arab Emirates},Hassan Allam Holding[Sponsor]{Egypt},ACWA Power International[Sponsor]{Saudi Arabia},Infinity Power Holding B.V[Sponsor]{Egypt}	At planning stage	10,000	10,000
Masdar Wind Project, Suez Canal Economic Zone, Suez	Abu Dhabi Future Energy (MASDAR)[Sponsor]{United Arab Emirates},Hassan Allam Holding[Sponsor]{Egypt},Infinity Power Holding B.V[Sponsor]{Egypt}	At planning stage	10,000	10,000
FourWinds Coal Fired Power Plant, Sharm El Sheikh, South Sinai	FourWinds Group[Sponsor]{Switzerland},Government of Egypt[Sponsor]{Egypt},Egyptian Electricity Holding Company[Sponsor]{Egypt}	Under construction	11,000	6,000
Sohag Wind Project, Sohag	Egypt New & Renewable Energy Authority (NREA)[Sponsor]{Egypt},Scatec Solar[Sponsor]{Norway}	At planning stage	5,000	5,000
New El-Dabaa Nuclear Power Plant, Matrouh	UJV Rez, a. s.[Consultant/Project Management]{Czech Republic},Arab Contractors[Construction]{Egypt},Hassan Allam[Construction]{Egypt},Petrojet[Construction]{Egypt},Government of Egypt[Sponsor]{Egypt},Nuclear Power Plant Authority (NPPA)[Operator]{Egypt},Rosatom[Construction]{Russia},Government of Russia[Sponsor]{Russia},Ministry of Electricity and Renewable Energy of Russia[Sponsor]{Russia}	Under construction	30,000	4,800
Sidi Shabib Coal-fired Power Plant, West Matrouh	Egyptian Electricity Holding Company[Sponsor]{Egypt},Elsewedy Electric[Construction]{Egypt},Marubeni Corporation[Sponsor]{Japan}	At planning stage	na	4,000
Egypt - Saudi Arabia Interconnection Link, Interconnection	Tractebel Engineering[Consultant/Project Management]{Belgium},SNC-Lavalin[Consultant/Project Management]{Canada},Hitachi ABB Power Grids Ltd[Construction]{Switzerland},China National Electric Engineering (CNEEC)[Construction]{China (Mainland)},Xian Electric Engineering Co. Ltd[Construction]{China (Mainland)},Orascom[Construction]{Egypt},Egyptian Electricity Transmission Company (EETC)[Sponsor]{Egypt},Giza Systems[Construction]{Egypt},Standard Chartered[Financier]{United Kingdom},Prysmian Group[Equipment]{Italy},Japan International Cooperation Agency (JICA)[Financier]{Japan},Sumitomo Mitsui Banking Corporation[Financier]{Japan},MUFG Bank Ltd[Financier]{Japan},Kuwait Fund for Arab Economic Development (KFAED)[Financier]{Kuwait},Arab Fund for Economic and Social	Under construction	na	3,000

Project Name	Campanies	Status	Value (USDmn)	Capacity (MW)
	Development (AFESD)[Financier]{Kuwait},Saudi Electricity Company[Sponsor]{Saudi Arabia},Islamic Development Bank (IDB)[Financier]{Saudi Arabia},Al Yamamah Company for Reinforcing Steel Bars[Equipment]{Saudi Arabia},General Electric[Construction]{United States},Bank of Yokohama[Financier]{Japan}			
GREGY Subsea Interconnector Project, Interconnection, Greece - Egypt	Abu Dhabi Future Energy (MASDAR)[Sponsor]{United Arab Emirates},Infinity Power Holding B.V[Sponsor]{Egypt},Copelouzos Group[Sponsor]{Greece}	At planning stage	na	3,000
Engie Wind Power Project, Sohag	Orascom Construction Industries[Sponsor]{Egypt},Egyptian Electricity Transmission Company (EETC)[Sponsor]{Egypt},Engie[Sponsor]{France},Toyota Tsusho[Sponsor]{Japan},Egypt New & Renewable Energy Authority (NREA)[Sponsor]{Egypt}	At planning stage	na	3,000
Ataka Mount Hydropower Plant, Pumped Hydro, Suez	AF Consult[Consultant/Project Management]{Sweden},Artelia Group[Consultant/Project Management]{France},Exim Bank of China[Financier]{China},Egypt Ministry of Electricity[Sponsor]{Egypt},Sinohydro Corporation[Construction]{China}	At planning stage	2,600	2,400

na = not available. Source: BMI Key Projects Data

Competitive Landscape

The Egyptian power & renewables market is primarily state-controlled. The Egyptian Electric Holding Company (EEHC) is the primary power company in Egypt. It is affiliated with 16 companies: six for electricity generation, nine for distribution and one for transmission. Late 1990s demand challenges prompted industry restructuring, prompting a limited level of sector privatisation and the development of a handful of privately owned power plants functioning in the nation.

Egyptian Electric Holding Company (EEHC)

The EEHC manages the power portfolio on behalf of the government and comprises 16 affiliated companies. Power generation, transmission and distribution activities have been separated; the EEHC includes six generating companies, nine distribution companies and the Egyptian Electricity Transmission Company. Generation units include Cairo Electricity Production Company, East Delta Electricity Production Company, West Delta Electricity Production Company, Upper Egypt Generation Company, Middle Delta Electricity Production Company and Hydro-Power Plants Electricity Production Company. The EEHC controlled a peak load capacity of 58.8GW over 2020-2021 and was able to generate 204.79TWh of electricity, compared with a contribution of 0.0024TWh by independent power projects (IPPs) and 11.18TWh by build-own-operate-transfer (BOOT) projects in the same year. Cairo Electricity Production Company was the largest contributor to total generation, followed by the East Delta Electricity Production Company and the Middle Delta Electricity Production Company.

In 2018, EEHC introduced three new electricity companies, which would be located in Beni Suef, New Administrative Capital and Brulus. The three firms operate a corresponding 4,800MW Siemens CCGT thermal power plant. Furthermore, in 2018 Egypt's parliament passed a law to establish a sovereign wealth fund to manage state assets, which it plans to list on the stock exchange. The 'Egypt Fund' was granted EGP5.0bn (USD280.0mn) as startup capital to be paid over three years, with a capital target of EGP200.0bn (USD11.0bn) in future. The IMF has reportedly encouraged Egypt to increase privatisation in order to increase the state's liquidity and encourage economic growth through private sector investment. The country's power sector is among the targeted industries for increased private sector participation. This has been done in recent years through regulatory reform, which has opened up the market for private investment in power generation and transmission. However, reports highlight the possibility that the state may look to privatise assets in the power sector, either through transfer of ownership to the Egypt Fund or through partial listing of operations companies on the open market stock exchange. We note that this would present a significant opportunity for investors and will continue to monitor developments in this regard.

Privately Owned And Financed Power Plants

Demand pressures in the late 1990s spurred industry restructuring and some limited privatisation efforts in the sector, resulting in several privately owned power plants set up either as IPPs or financed under BOOT schemes.

The construction of the country's first three privately developed power plants was completed at the beginning of the new century, adding a combined capacity of 2,048MW to the grid. The facilities, operated under a BOOT scheme and supported by 20-year power purchase agreements, are the 650MW gas-fired plant located at Sidi Kerir, which began commercial operations in 2001; and two gas-fired plants operated by EDF, near the cities of Suez and Port Said. The two plants, which came online in 2003, have a combined capacity of 1.4GW. These units now belong to Tanjong's Powertek, which formally took control of them in 2006.

Since the successful implementation of these groundbreaking projects, the Egyptian government has repeatedly reiterated its commitment to privately financed power schemes. In March 2013, the ministry announced its intention to tender three local power generation projects with a total capacity of 5,500MW and a combined cost of nearly EGP50bn (USD7bn). Besides the Dairut city project, the capacity would comprise 1,300MW from a steam power project in Qena and 1,950MW from a gas project in Beni Suef, with the latter eventually upscaled to 4,800MW. Germany-based Siemens was the key counterpart for the Beni Suef project and for two other 4,800MW gas plants. Phase-by-phase start-ups began in 2017, with the final inauguration occurring in mid-2018.

Besides the companies engaged in BOOT schemes, the Egyptian Electric Utility and Consumer Protection Regulatory Agency lists several private distributors and generators operating in the country. Private players focusing exclusively on distribution include:

- The Egyptian Chinese Joint Venture Company for Investment: This company is a joint venture between Egyptian and Chinese investors, focusing on various sectors including energy.
- Delta Company for Constructions and Reconstruction: A private company involved in construction and reconstruction projects, including infrastructure for energy distribution.
- Engineering Group For Electric Energy: This company specialises in engineering solutions for electric energy distribution.
- Madinety Electrochemical Energy: A company focusing on electrochemical energy solutions.
- New Giza Eternal Luxury and City Services: This company is involved in various sectors including energy distribution.
- Global Energy Company: A private company engaged in power generation and distribution.
- Om El Goreifat: A company involved in the energy sector.
- National Electricity Technology Company (Kahraba): This company is involved in power generation and distribution.
- Mirage: A company involved in various sectors including energy.
- Consukorra Company for Commercial Proxies and Technical Consultations: This company provides commercial proxies and technical consultations, including in the energy sector.
- Power House Company: A company involved in power generation and distribution.
- ElGouna Electric: This company is involved in power generation and distribution.
- Generget Company For Renewable Energy: This company focuses on renewable energy solutions.
- Emak for Utilities and Services: This company provides utilities and services, including in the energy sector.

Regional Overview

Middle East And North Africa Power & Renewables Regional Overview: Gas Remains Entrenched As Sector Faces Hurdles

Key View

- We expect economic challenges and political instability to continue posing significant risks to the development of the MENA's power sector over the next decade.
- Renewable energy expansion and policy reforms will drive MENA's power sector growth over the coming 10 years, with solar power to be the fastest-growing power type.
- We expect investment in transmission and distribution infrastructure to be crucial for supporting the MENA region's growing power demand.

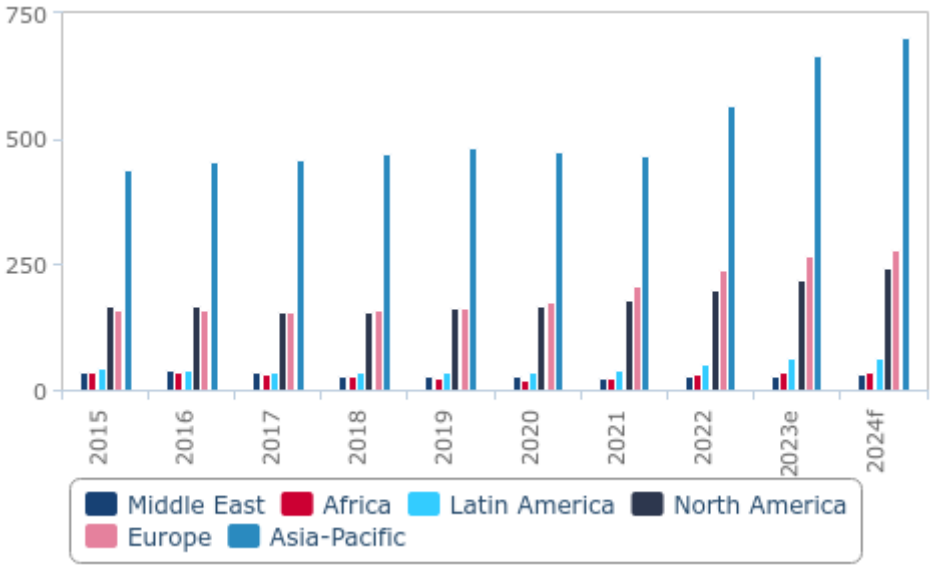
We expect economic challenges and political instability to continue posing significant risks to the development of the MENA's power sector over the next decade. MENA's power sector is heavily influenced by economic and political conditions, which vary across different markets. Economic challenges in markets like Jordan, Tunisia and Lebanon have led to financial constraints that impede power sector reforms and investments. For example, Lebanon's ongoing economic crisis has led to frequent blackouts and a reliance on expensive private generators. Similarly, Tunisia's economic instability has hindered the implementation of critical power infrastructure projects. Political instability and conflicts in markets like Syria, Libya and Yemen exacerbate these challenges, deterring foreign investments and disrupting power sector operations.

Despite these challenges, we highlight markets in the region that are implementing strategies to mitigate these risks. Saudi Arabia's Vision 2030 includes reforms aimed at diversifying the economy and reducing reliance on oil revenues, providing more stable funding for power sector projects. The UAE's stable political environment and proactive economic policies position it to attract investments in its power sector. However, ongoing tensions between Iran and other regional powers continue to create a volatile environment for MENA as a whole.

Finding a resolution to these economic and political risks requires a multifaceted approach, including regional cooperation, international partnerships and comprehensive policy frameworks that promote economic stability and political security. We believe that until a more predictable and stable environment takes shape, MENA markets will continue to face challenges in attracting investment to develop their power sectors, improve infrastructure and ensure reliable electricity supply for their populations.

MENA And SSA Lagging In Power & Renewables Sector Investments

Global - IEA Annual Power Sector Investments By Region, USDbn

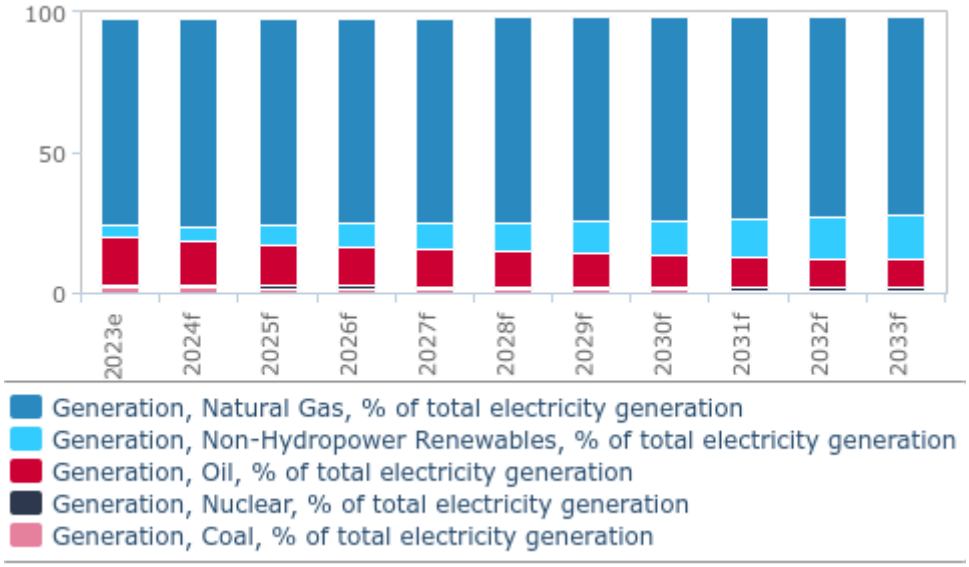


Note: May include territories, special administrative regions, provinces and autonomous regions. e/f = BMI estimate/forecast. Source: IEA, BMI

Due to the global shift towards cleaner energy, coal- and oil-fired power in MENA will decline. However, **we expect natural gas to remain entrenched** and dominate the region's power mix. We project natural gas accounting for 73% of the total generation in the region by 2033. The region's abundant natural gas reserves remain core to its dominance but similarly, we note that geopolitical tensions and market dynamics present stability and supply risks. For example, geopolitical conflicts have disrupted natural gas pipelines and supply routes, leading to potential shortages, international sanctions and increased volatility in energy prices. Market dynamics, such as fluctuating global natural gas prices, also pose downside risks to the financial viability of new natural gas power projects.

Natural Gas To Maintain Regional Dominance

MENA - Share Of Total Generation By Type, %



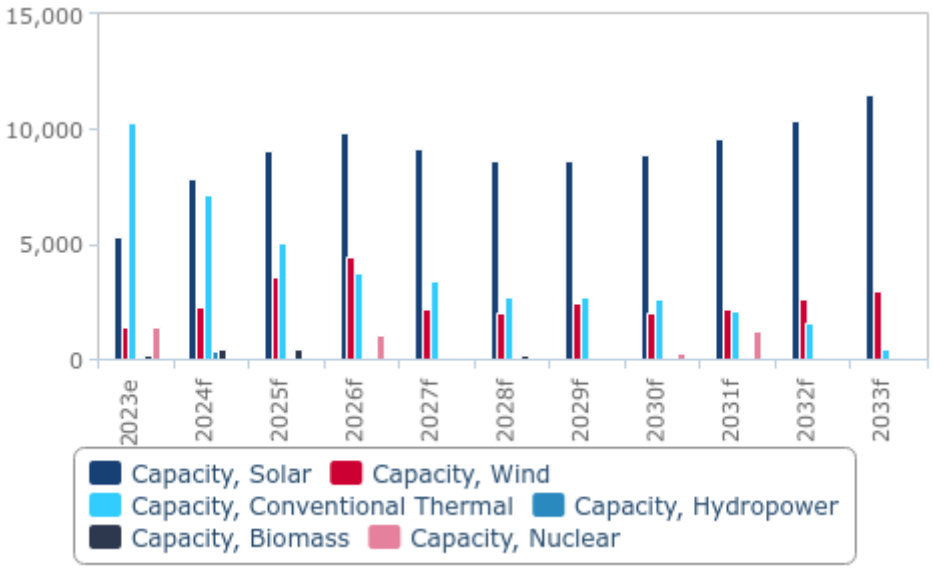
Note: Hydropwer excluded. e/f = BMI estimate/forecast. Source: EIA, BMI

Renewable energy expansion and policy reforms will drive MENA's power sector growth over the coming 10 years, with solar power to be the fastest-growing power type. MENA is experiencing a shift toward renewables as markets aim to diversify their power mix and meet climate action commitments. For instance, the UAE aims to achieve 50% clean energy by 2050, while Saudi Arabia's Vision 2030 targets 58.7GW of renewable power capacity by 2030. Morocco aims to generate 52% of its electricity from renewables by 2030. Egypt's implementation of feed-in tariffs and competitive bidding processes to attract investments in solar and wind projects also highlight its commitment to renewable power development. We note rapid expansion in solar power generation, driven by favourable policies, abundant solar resources and declining production costs. As outlined in the chart below, solar power capacity is projected to grow by 86.0GW between 2024 and 2033, making it the fastest-growing energy source in the region.

However, regulatory hurdles present significant challenges. Regulatory challenges include bureaucratic delays, lack of clear policy frameworks and limited private sector participation. For example, in Jordan, despite favourable policies, the slow pace of regulatory reforms and limited access to financing hinder the growth of the renewable energy sector. In Egypt, securing financing for large-scale projects remains a challenge due to economic instability and high-interest rates.

Solar Power To Lead Power & Renewables Sector Growth

MENA - Net Capacity Additions, MW



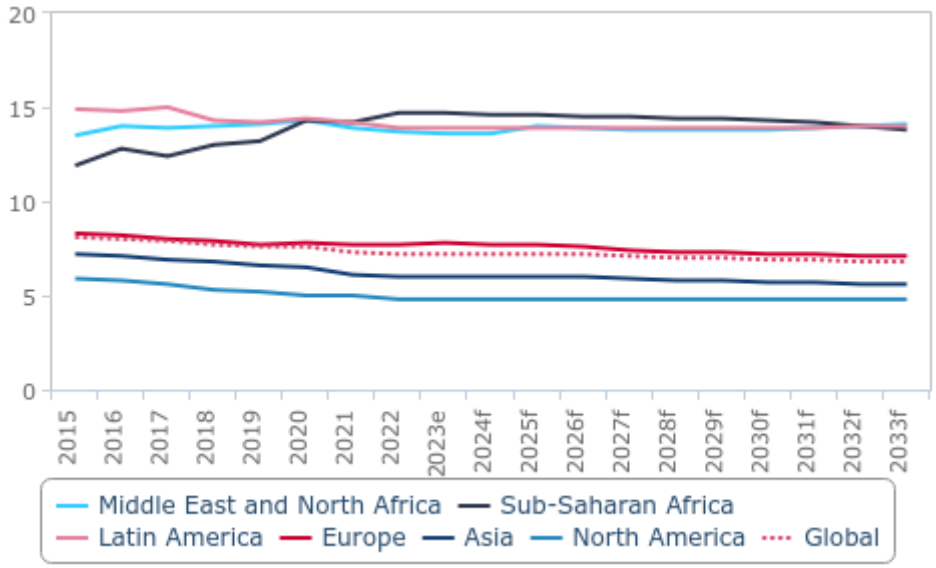
e/f = BMI estimate/forecast. Source: EIA, IRENA, local sources, BMI

We expect investment in transmission and distribution (T&D) infrastructure to be crucial for supporting the MENA region's growing power demand. Over the next 10 years, we forecast electricity generation to rise by over 541TWh, driven by a combination of market expansions, economic diversification strategies and population growth. However, MENA faces challenges related to grid inefficiencies, hampering power sector profitability. Markets like Iran experience T&D losses as high as 15%, which undermines power sector efficiency and reliability. Financial barriers, outdated infrastructure and a lack of modern grid management systems are primary contributors to these inefficiencies. MENA markets have acknowledged the need of grid improvements to support the increasing power demand and the integration of new renewable energy capacities. For instance, Saudi Arabia has announced plans to invest USD100.0bn in its electricity sector, with a significant portion allocated to modernising the grid and reducing T&D losses. Similarly, the UAE is focusing on smart-grid technologies and upgrading its T&D networks to ensure reliable power delivery.

Governments and utilities in the region are also implementing policies to attract private sector investments in T&D projects. For example, Egypt's Electricity Sector Reform Law aims to liberalise the electricity market and encourage private investments in grid infrastructure. However, the region must overcome regulatory hurdles, such as lengthy approval processes and inconsistent policy implementation, to effectively attract and utilise these investments. The successful improvements to T&D infrastructure in the region will be essential to ensure efficient power delivery and support the growing integration of renewable energy sources in the region.

Growing Need For Grid Infrastructure Investments And Enhancements In MENA

Global - Transmission & Distribution Losses, % of total electricity generation



Note: May include territories, special administrative regions, provinces and autonomous regions. e/f = BMI estimate/forecast. Source: EIA, IRENA, local sources, BMI

Power & Renewables Glossary

	Definition		Definition
bn	billion	IPO	initial public offering
capex	capital expenditure	IPP	independent power producer
CEE	Central and Eastern Europe	km	kilometres
CHP	combined heat and power plants	kW	kilowatt (103 watts)
DoE	US Department of Energy	kWh	kilowatt hour
e/f	estimate/forecast	LNG	liquefied natural gas
EBRD	European Bank for Reconstruction and Development	MEA	Middle East and Africa
EIA	US Energy Information Administration	mn	million
EM	emerging markets	MoU	memorandum of understanding
EU ETS	European Union Emissions Trading System	MW	megawatt (electric) (106 watts)
EU	European Union	MWh	megawatt hour
EWEA	European Wind Energy Association	na	not available/applicable
FDI	foreign direct investment	NGL	natural gas liquids
FiT	feed-in tariff	OECD	Organisation for Economic Co-operation and Development
FTA	free trade agreement	OPEC	Organization of the Petroleum Exporting Countries
GDP	gross domestic product	PV	solar photovoltaic
GHG	greenhouse gas	RES	renewable energy sources
GW	gigawatt (109 watts)	R&D	research and development
GWh	Gigawatt hour (1 GWh = 3.6 TJ)	t	metric ton = tonne (1 t = 1,000 kg)
GWEC	Global Wind Energy Council	TPES	total primary energy supply
IAEA	International Atomic Energy Agency	trn	trillion
IEA	International Energy Agency	TW	terawatt (1012 watts)
IMF	International Monetary Fund	TWh	terawatt hour (1 TWh = 3.6 PJ)

Power & Renewables Methodology

Connected Thinking

BMI employs a unique methodology known as 'Connected Thinking'. This means that our analysis captures the inter-relatedness of the global economy, and takes into account all of the relevant political, macroeconomic, financial market and industry factors that underpin a forecast and view. We then integrate them so as to explain how they interact and affect each other. Our Connected Thinking approach provides our customers with unique and valuable insight on all relevant macroeconomic, political and industry risk factors that will impact their operations and revenue-generating potential in the industry/industries within which they operate.

We use a transparent forecasting model as a base for our industry forecasts, but rely heavily on our analysts' expert judgement to

ensure our forecasts capture all of the insights we derive using our unique Connected Thinking approach. We believe analyst expertise and judgement are the best ways to provide the most accurate, up-to-date and comprehensive insight to our customers.

Power & Renewables Methodology

For the Power & Renewables industry we have historical data and 10-year forecasts for 19 core industry variables, including electricity generation, by fuel/technology, net electricity consumption, generation capacity by fuel/technology and transmission & distribution losses, and electricity trade.

Our forecasts are a combination of regression modelling and analyst expert judgement. Our Power & Renewables analysts interact with other analytical teams, including Country Risk, Autos (in the case of electricity vehicles), Mining and Oil & Gas. By considering related industries, the Power & Renewables team ensures that factors such as political trends, feedstock price outlooks and technology trends are considered in forecasts. In addition to this, the Power & Renewables team draws on qualitative assessments of political risk, regulatory outlook and specific projects to adjust model outputs as necessary.

There is a constant rolling cycle of data monitoring, with databases being updated at a quarterly interval. Analysts will use their expert judgement outside of these cycles to implement changes when necessary outside the regular update cycle.

Total Electricity Consumption (Net)

Total electricity consumption is expressed in terawatt hours (TWh).

Electricity consumption is defined as electricity available in a market or network through generation, net of trade, on grid. Therefore, it does not provide a picture of total demand, some of which is not met.

Historical figures for electricity consumption are based on data published by the US Energy Information Administration (EIA), national transmission system operators, national statistics, and other relevant and appropriate official sources.

Our electricity consumption forecasts are based on a regression model, using a market's own historical time series and key macroeconomic explanatory variables, such as real GDP growth, from our Country Risk service. Our consumption forecasts also consider end-use electrification in markets through factoring in future demand from energy transition technologies such as electric vehicles, green hydrogen electrolysers and heat pumps. In addition, we also apply analyst expert judgement to refine and finalise the electricity consumption forecast based on exogenous and endogenous variables or events not captured by our regression model.

Electricity Generation (Net)

Total generation is defined as the process of producing electric energy or the amount of electric energy produced by transforming other forms of energy, expressed in TWh. Our generation data, historical and forecasts, capture solely on-grid generation.

Our power generation statistics are displayed as net generation. Gross electricity production is measured at the terminals of all alternator sets in a station and thus includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station. Net electricity generation is defined as gross power generation less own use of power plants.

Historical figures for electricity generation are based on data published by the EIA, the International Renewable Energy Agency (IRENA), national transmission system operators, national statistics and other official sources.

Our electricity generation forecasts examine the industry with a bottom-up approach, forecasting electricity production for each fuel/technology in order to calculate the value of total generation in each market.

Fuels and technologies that make up total electricity generation are:

- Conventional Thermal
    - Coal
    - Natural gas
    - Oil
- Nuclear
- Hydropower
- Pumped hydropower storage
- Non-hydropower renewables
    - Wind (onshore and offshore)
    - Solar (CSP and PV)
    - Biomass & waste
    - Geothermal
    - Tidal & wave

The regression model used to calculate generation considers key macroeconomic variables, relying heavily on real GDP growth. In addition, for our electricity generation forecasts we rely extensively on analyst expert judgement. Things taken into consideration are:

- Technology and resource costs, and their expected evolution
- Monitoring of regulatory changes
- Hydrological and weather information for the short-term outlook

Transmission & Distribution Losses

Transmission & distribution (T&D) losses include electric energy lost due to the T&D of electricity. Much of the loss is thermal in nature.

Our historical figures for electricity T&D losses are estimated as:

T&D loss = (electricity generation + net imports) - electricity consumption

T&D losses are forecast using an auto-regression model taking into account historical trends.

Net Electricity Imports

Historical figures for net imports are based on data from the EIA and estimated as:

Net electricity imports = (total consumption - total generation) + T&D losses

Our net import data are a function of the data that we forecast for electricity generation minus electricity consumption and T&D losses, as shown in the formula above. The amount of electricity imported or exported will depend on electricity supply access abroad, with electricity pricing and interconnector access being key variables.

A positive value means a market is a net importer of electricity, whereas a negative value means it is a net exporter.

Electricity Generation Capacity

Electricity generation capacity is defined as the maximum output, commonly expressed in megawatts (MW), that grid-connected generating equipment can supply to system load, adjusted for ambient conditions.

For electricity generation capacity, we forecast:

- Conventional thermal
- Nuclear
- Hydropower
- Power storage
    - Pumped hydropower storage
    - Battery storage
    - Other storage
- Non-hydropower renewables
    - Wind (onshore and offshore)
    - Solar (CSP and PV)
    - Biomass & waste
    - Geothermal
    - Tidal & wave

Historical figures for electricity generation capacity are based on data published by the EIA and IRENA for non-hydropower renewables, as well as data published by government/ministry sources and official data from companies operating in each market.

Our electricity generation capacity forecasts examine the industry with a bottom-up approach, forecasting capacity for each fuel/technology to calculate the total value of capacity in each market. This process is overwhelmingly based on analyst expert judgement. Our analysts rely on BMI's Key Projects Data, a comprehensive catalogue of the largest transport and power & utilities projects around the world, to look at investment trends in power generation capacity in different markets, by technology/fuel, to assess the project pipeline and its viability. We also consider technology costs and regulatory frameworks that will influence the outcome of projects.

Electricity Prices

Electricity prices are expressed as a common unit LCU/KWh and USD/KWh for three benchmarks: residential, commercial and industrial users.

Forecasts examine price dynamics in the market using a bottom-up approach, based on analyst expert judgement of outside impacts on prices, current tariffs and historical trends.

Historical data for electricity prices are collected from primary government, grid operator and utility sources.

Power & Renewables Risk/Reward Index

Our Power & Renewables Risk/Reward Index (RRI) quantifies and ranks a market's attractiveness within the context of the power and renewables industry, based on the balance between the **Risks** and **Rewards** of entering and operating in different markets.

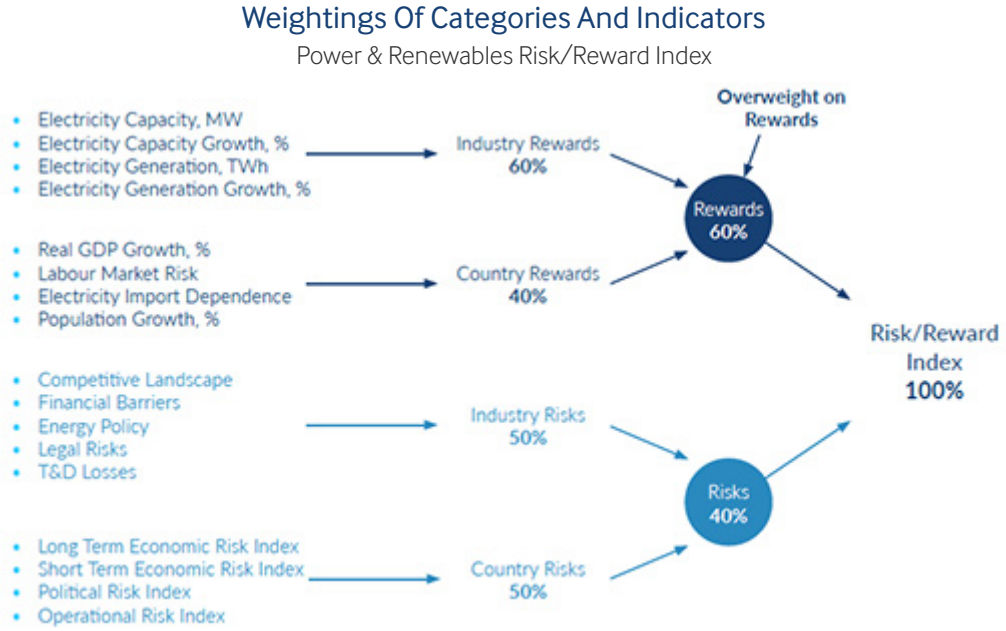
We combine industry-specific characteristics with broader economic, political and operational market characteristics. We weight these inputs in terms of their importance to investor decision-making in a given industry. The result is a nuanced and accurate reflection of the realities facing investors in terms of first the balance between opportunities and risk and second between industry-specific and broader market traits. This enables users of the index to assess a market's attractiveness in a regional and global context.

The index uses a combination of our proprietary forecasts and analyst assessment of the regulatory climate. As regulations evolve and forecasts change, so the index scores change, providing a highly dynamic and forward-looking result.

The Power & Renewables RRI universe comprises **117 markets**.

Benefits Of Using Our Power & Renewables RRI

- **Global Rankings:** One global table, ranking all the markets in our universe for Power & Renewables from most attractive (closest to zero) to most risk (closest to 100).
- **Accessibility:** Easily accessible, top-down view of the global, regional or sub-regional Risk/Reward profiles.
- **Comparability:** Identical methodology across 117 markets allows users to build lists of markets they wish to compare, beyond the confines of a global or regional grouping.
- **Scoring:** Scores out of 100 with a wide distribution provide nuanced investment comparisons. The higher the score, the less favourable the profile.
- **Quantifiable:** Quantifies the Rewards and Risks of doing business in the industry in different markets around the world and helps identify specific flashpoints in the overall business environment.
- **Comprehensive:** Comprehensive set of indicators, assessing industry-specific risks and rewards alongside political, economic and operating risks.
- **Entry Point:** A starting point to assess the outlook for the industry, from which users can dive into more granular forecasts and analysis to gain a deeper understanding of the market.
- **Balanced:** Multi-indicator structure prevents outliers and extremes from distorting final scores and rankings.
- **Methodology:** The index is a combination of proprietary BMI forecasts, analyst insights and globally acceptable benchmark indicators



Source: BMI

The RRI matrix divides into two distinct categories:

Rewards: Evaluation of an industry's size and growth potential (**Industry Rewards**), and macro industry and/or market characteristics that directly impact the size of business opportunities in a specific industry (**Country Rewards**).

Risks: Evaluation of micro, industry-specific characteristics, crucial for an industry to develop to its potential (Industry Risks) and a quantifiable assessment of the political, economic and operational profile (**Country Risks**).

Assessing Our Weightings

Our matrix is deliberately overweight on **Rewards** (60% of the final RRI score for a market) and within that, the **Industry Rewards** segment (60% of final Rewards score). This is to reflect the fact that when it comes to long-term investment potential, industry size and growth potential carry the most weight in indicating opportunities, with other structural factors (demographic, labour statistics and infrastructure quality) weighing in, but to a slightly lesser extent. In addition, our focus and expertise in emerging and frontier markets has dictated this bias towards industry size and growth to ensure we are able to identify opportunities in markets where regulatory frameworks are not as developed and industry sizes not as big as in developed markets, but where we know there is a strong desire to invest.

Power & Renewables RRI Indicators - Explanation And Sources

	Source	Rationale
Rewards		
Industry Rewards		
Electricity Capacity	BMI Forecast	Installed electricity capacity indicates market size and scale of operations. The larger the sector, the greater the opportunities available. MW, five-year average forecast.
Electricity Capacity Growth	BMI Forecast	Changes in installed electricity capacity indicate potential for business opportunities as a reflection of the market's pace of expansion. % change y-o-y, five-year average forecast.
Electricity Generation	BMI Forecast	Volume of electricity output indicates the size of the market and the level of supply volatility. TWh, five-year average forecast.
Electricity Generation Growth	BMI Forecast	Changes in electricity output indicate the market's pace of growth or exposure to sudden falls in power supply. % change y-o-y, five-year average forecast.
Country Rewards		
Real GDP Growth	BMI Forecast	The more substantial the growth rate, the greater the demand for additional electricity generation. % change y-o-y, five-year average forecast.
Labour Market Risk	BMI Operational Risk Indicator	Measures the risk to project development based on the labour market, assessing size, education levels and cost of employment.
Electricity Import Dependence	BMI Forecast	Higher exposure to electricity imports implies a lower level of energy security and provides more incentive to build domestic electricity capacity.
Population Growth	BMI Forecast	Proxy for extent to which demographic dynamics are favourable to the power & renewables industry. The more substantial the growth rate, the greater the demand for additional electricity generation. % change y-o-y, five-year average forecast.
Risks		
Industry Risks		
Competitive Landscape	BMI Subjective Indicator	Assesses the openness of the power and renewables competitive landscape. Considers saturation of the existing market, ability to compete in fair tenders and barriers to international companies entering the market.
Financial Barriers	BMI Subjective Indicator	Measures difficulties faced by businesses in accessing financing on both domestic and international markets.
Energy Policy	BMI Subjective Indicator	Assesses the market's position in relation to the competing goals of energy security, power sector decarbonisation and economic sustainability, as well as energy policy continuity.
Legal Risk	BMI Operational Risk Index	Risk to operations based on strength of the rule of law, the extent of corruption and investor protection.
Transmission And Distribution Losses	BMI Forecast	Provides an indication of the quality and efficiency of power & renewables infrastructure. The higher the losses, the lower the quality of power supply. % of total power output, five-year average forecast.
Country Risks		
Long-Term Economic Risk Index	BMI Country Risk Index	Takes into account the structural characteristics of economic growth, the labour market, price stability, exchange rate stability and the sustainability of the balance of payments, as well as fiscal and external debt outlooks for

	Source	Rationale
		the coming decade.
Short-Term Economic Risk Index	BMI Country Risk Index	Seeks to define current vulnerabilities and assess real GDP growth, inflation, unemployment, exchange rate fluctuation, balance of payments dynamics, as well as fiscal and external debt credentials over the coming two years.
Political Risk Index	BMI Country Risk Index	The Political Risk Index is a score made up of the mean average across three distinct pillars: Governance Risk, Society Risk and Security Risk. These are aggregated into an overall assessment of Political Risk.
Operational Risk Index	BMI Operational Risk Index	Focuses on existing conditions relating to four main risk areas: Labour Market, Trade & Investment, Logistics, and Crime & Security.

Source: BMI

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