

Iraq grid-scale energy storage

Two decades on from the 2003 U.S. invasion of Iraq, efforts to improve the country's electricity infrastructure have lagged. Despite massive hydrocarbon reserves, including the world's fifth-largest proved crude oil and 12th-largest proved natural gas reserves, Iraq struggles with chronic electricity shortages. Citizens do not have access to reliable electricity service and have to rely on expensive neighborhood diesel generators to cover some of the gap. There is a clear need to explore cleaner alternatives, such as renewable energy systems, yet the deployment and integration of these systems would be hindered by the same structural woes that have crippled the electricity sector, and which go far beyond generation issues.

Overview of the power sector

Iraq is one of OPEC's largest crude oil producers, second only to Saudi Arabia, with 17% of Middle Eastern oil proven reserves and 8% of global reserves. As a major producer, Iraq's electricity sector is almost entirely dependent on fossil fuels, which account for more than 80% of power generation. Despite its vast energy resources, the performance of the country's power sector is sub-optimal.

Iraq's power sector suffers from a double whammy: unsustainable growth in power demand, coupled with under-investment and a lack of reforms in generation, transmission, and distribution. The result is a growing mismatch between power supply and demand.

Although there has been significant progress in the expansion of installed power generation capacity, the additions have not matched the announced plans and the growing demand and losses. Installed power generation capacity is approximately 30 GW, while the available capacity is only 23.4 GW. The peak demand, however, is estimated to have reached 34.18 GW in summer 2022. This figure may be an underestimate considering that a significant share of the supply gap is covered by neighborhood diesel generators, an informal economy which goes largely unaccounted for. These generators are prevalent across Iraq -- so much so that the country ranks fifth highest globally in terms of the number of diesel generators per capita.

On average, 1 to 2 GW of power generation has been added per year, amounting to an annual growth rate of 5%; 1.4 GW was added between 2021 and 2022. A massive 13 GW was added between 2012 and 2018. But growth in power demand has outstripped the 5% annual growth in installed capacity, averaging 8% compared to a global average of 5%. The unsustainable growth in power demand is largely linked to wasteful consumption driven by high subsidies. The residential and commercial sectors are the largest power consumers, in line with regional trends, with low implementation of power conservation or efficiency measures.

Renewable energy integration



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Considering the need to diversify the energy sector, and the growing shortages in power supply and reliance on generators, the need to explore alternative resources, particularly renewable energy, may seem evident. In practice, however, the issues that cripple the overall power sector would hinder the integration of renewable energy into the system. Large-scale projects would be hampered by the high transmission and distribution losses, weak business investment climate, and vested interests, whereas distributed renewable energy would have to overcome the absence of regulation, customer protection, and incentives.

Iraq boasts a strong potential renewable energy base: It has significant solar irradiance levels, economically-viable wind speeds in some areas, and hot springs that could present an opportunity for the geothermal development (pending technical assessments). Power generation from renewable energy sources would increase Iraq's energy security and reduce the power sector's greenhouse gas emissions, which account for almost half of Iraq's total emissions, due to its high dependence on fossil-fuel-fired power plants and the heavy deployment of polluting diesel generators.

However, integrating variable renewable energy systems such as solar photovoltaics and wind turbines creates a set of challenges to grid stability. Solar and wind energy sources are intermittent and do not generate fully-dispatchable electricity as power generation is available when weather conditions allow -- when the sun is shining and wind is blowing -- and not necessarily when demand requires. Mitigating this involves flexible power systems, expanded and modernized grid capacity, and energy storage systems, among other measures. Significant transmission capacity is also required to carry the generated electricity over large distances from the renewable energy farms to the load centers.

The need for grid reinforcements, flexible power systems, and storage will grow in direct proportion to the share of renewable energy in the power mix. But these require hefty capital investments, and therefore, a favorable business investment climate to attract developers and optimal financing costs. In its current state, the Iraqi business climate is only attractive for companies with a high risk appetite, due to the weak political system, heightened concerns over security and corruption, and the slow pace of economic reforms. The subsidies and wide gap between tariffs and recovery costs further hinder investments, as these investments would not be recovered but would add to the existing strains on the state budget in the single-buyer market.

The renewable energy industry's great capital investment requirements entail heightened risks of corruption and lower value for money. This is especially true where institutions are weak and accountability mechanisms are lagging, such as in Iraq. Similarly to the oil industry, the long tenure and complexity of contracts in the renewable energy industry can lead to rent-seeking behavior and can yield quasi-monopolies where contracts are awarded to one dominant developer for political and vested interests.

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