



SHUTTERSTOCK

**STRENGTHENING UTILITIES AND
PROMOTING ENERGY REFORM
(USAID SUPER)
IRAQ ENERGY SECTOR ASSESSMENT**
March 28, 2022



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ACRONYMS

Acronym	Definition
ADFD	Abu Dhabi Fund for Development
COVID-19	Coronavirus Disease 2019
DDI	USAID Bureau for Development, and Innovation
DFC	Development Finance Corporation
DOE	United States Department of Energy
DOS	United States Department of State
DSM	Demand-side Management
EE	Energy Efficiency
ECA	Export Credit Agencies
EPC	Engineering, Procurement, and Construction
ESCO	Energy Services Company
GE	General Electric
GCCIA	Gulf Cooperation Council Interconnection Authority
GW	Gigawatt
HFO	Heavy Fuel Oil
HVDC	High-voltage Direct Current
IEA	International Energy Agency
IFC	International Finance Corporation
IKR	Iraqi Kurdistan Region
IPP	Independent Power Producers
ISIS	Islamic State of Iraq
KM	Kilometer
kWh	Kilowatt Hour
KRG	Kurdish Regional Government
LCOE	Levelized Cost of Energy
MEL	Monitoring, Evaluation, and Learning
MEPS	Minimum Energy Performance Standards
MoE	Federal Iraq Ministry of
MoF	Federal Iraq Ministry of Finance
MoO	Federal Iraq Ministry of Oil
MoP	Federal Iraq Ministry of Planning
MoU	Memorandum of Understanding



MW	Megawatt
NIC	National Investment Commission
NREL	United States National Renewable Energy Laboratory
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
OTI	USAID's Office of Transition Initiatives
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PV	Photovoltaic
RE	Renewable Energy
SCADA	Supervisory Control and Data Acquisition
Scf/d	Standard Cubic Feet per Day
SME	Small and medium enterprise
SOW	Scope of Work
SUPER	Strengthening Utilities and Promoting Energy Reform
T&D	Transmission and Distribution
TBI	Trade Bank of Iraq
TO	Task Order
UAE	United Arab Emirates
UKEF	United Kingdom's Export Finance
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USG	United States Government
WA	Work Assignment

I. EXECUTIVE SUMMARY

I.1 Introduction and Scope of Work

The Strengthening Utilities and Promoting Energy Reform (SUPER) Task Order is a U.S.-based program funded by the United States Agency for International Development (USAID). The SUPER Task Order aims to promote utility commercialization and equitable, effective reforms that will enhance the financial viability and long-term sustainability of developing countries' electricity systems, and thereby enable their expansion and growth and establish the necessary preconditions for clean energy investments. This Assessment examines the current state of the energy sector of Federal Iraq and the Iraqi Kurdistan Region (IKR) and identifies opportunities and obstacles for potential USAID programming support. The Assessment includes:

- An overview of Federal Iraq's and the IKR's generation, transmission, and distribution systems; electricity access and quality of service; electricity demand projections; and fuel and electricity imports
- Analysis of the energy sector policy and regulatory environment
- Discussion of energy sector priorities for Federal Iraq and the IKR
- A high level summary of the relevant energy stakeholder landscape
- Potential recommendations for future USAID programming for the energy sector

Iraq's energy sector, specifically the electricity generation, transmission, and distribution system, has faced numerous, complex challenges across the entire energy value chain given the country's history, its political landscape, and its energy needs. USAID Iraq has set an objective to examine the current state of the energy sectors of Federal Iraq and IKR to better understand the context and identify areas for opportunities for potential USAID programming support to advance Federal Iraq and IKR's respective economic development and growth goals.

I.2 Key Findings

The assessment of the Iraqi power sector identified the following key findings:

- i. Federal Iraq and IKR have sufficient installed base to meet their power generation needs; however, chronic and significant underinvestment in the transmission and distribution (T&D) system has reduced the capacity to transmit power to a combined 25GW across the country leading to load shedding and the use of diesel generators to attempt to plug the gap to reach the 35.5GW peak demand in summer.
- ii. High government subsidies reduce the amount customers pay for electricity disincentivizing energy efficient behaviors by consumers and greatly reducing the revenues the governments of Federal Iraq and IKR can collect to invest in system upgrades. These subsidies are politically and socially challenging to remove due to recent political instability and the socialist history of Iraq that legally codifies that energy resources are owned collectively by the Iraqi people.

- iii. Power piracy and weak bill collection processes significantly impact the solvency of the Ministry of Electricity as it is estimated that 46% of power is either stolen and/or billed but not paid.¹
- iv. The combination of high subsidies, weak bill collection, budget deficits, and significant investment needs to rebuild following ISIS make financing a key priority for both Federal Iraq and IKR to advance power infrastructure projects.
- v. A complex stakeholder landscape, lack of strong regulatory framework to promote private sector investment, including a failure to fully implement key legislation, and transparency issues hamper progress and impact private sector trust.
- vi. Failure to implement standard operations and maintenance (O&M) procedures for key power assets and the use of harsh, low-quality liquid fuels reduces the efficiency and availability of the generating assets, further compounding the power shortages.
- vii. Iraq has developed a series of roadmaps and white papers in conjunction with commercial and non-profit entities over the past 5 years but has struggled with the implementation and execution of these plans due to capacity, transparency, and political continuity issues. The current roadmaps for utility-scale solar projects appear to also be facing similar challenges.
- viii. Distrust of the government among the Iraqi citizens in addition to a lack of awareness of the benefits of both renewable energy and energy efficiency measures creates a roadblock to generate public support for important energy diversification measures.

I.3 Key Recommendations

Importance of trust as an overarching principle: The Iraqi government is facing a trust deficit among its citizens, private sector entities, ministries, and political parties. Building that trust will require a clear strategy with broad support, active transparency and accountability measures, strong communication of priorities, activities, and timelines, and a dedication to achieving key milestones in line with outlined plans. This will require open consultations with relevant stakeholders, leveraging global and regional leading practices, and creating a mechanism to enable multi-year capital investment while reducing bureaucratic processes and inefficiencies.

Key recommendations for USAID’s potential programmatic interventions in the Iraqi power sector include:

- i. *Renewable Energy Integration:* Both Federal Iraq and IKR see renewable energy playing a significant role in the future power generation mix. Creating the right ecosystem to accelerate the development of renewable energy sources will require a strong regulatory framework supported by an empowered stakeholder working group comprised of representatives from the relevant ministries to facilitate the implementation of policies that promote investment, including auctions and net metering regulations. This can be bolstered by implementing a capacity building action plan to focus on building the technical, commercial, project management, and financial skillsets to develop and deploy renewable energy projects. In addition, to support the sustainability of the sector, it will be key to develop the capacity of local industry groups, suppliers, and service providers to support sourcing local content and increasing knowledge

¹ <https://iraqenergy.org/guest-author/harry-istepanian/>

transfer. Partnering with the International Finance Corporation could also help unlock the necessary funds while building the investor confidence required to realize the 12+GW of utility-scale solar Federal Iraq and IKR are planning for. This will all need to be carefully coordinated with strong messaging and public awareness campaigns to highlight the value of renewable energy, specifically solar, in reducing the use of non-renewable oil and gas resources for power generation, reducing environmental impacts of diesel generators, and ultimately increasing the sustainability of Iraq's power sector.

- ii. *Energy Efficiency and Demand-Side Management:* Develop a national energy efficiency action plan to improve energy efficiency standards, reduce the system load, generate cost savings, and change mindsets towards a more sustainable future. This will require developing the capacity within the Ministry of Electricity to perform energy efficiency resource planning and audits. This can be bolstered by establishing an Energy Efficiency Center with a University and performing an energy efficiency retrofit pilot.
- iii. *Private Sector Engagement:* Develop and implement a robust IPP framework with competitive and transparent bidding processes to develop investor trust in the commercial viability of the Iraqi power sector. Engage private sector stakeholders in the working group discussions to strengthen relationships. Support and expand civil society by developing an energy services association and work together to outline a market strategy to launch energy service companies (ESCOs) to accelerate energy efficiency programs.
- iv. *Reduction of Technical and Commercial Losses:* Reduction of technical losses will require updating the T&D Master Plan to account for the new renewable energy plan in conjunction with improved planning for power system components and spare parts to improve O&M capabilities. Reducing commercial losses will rely on awareness campaigns to promote bill payment, facilitating electricity tariff reform dialogues at the ministerial level, and improving collection processes through online platforms, pre-paid and smart meter programs, and bill collection incentives.
- v. *Environmental Risk Mitigation:* Build awareness around the role of renewable energy, energy efficiency, and reduction of technical losses in improving Iraq's environmental risk by ultimately reducing diesel and HFO fired power generation and reducing GHG emissions. This can be done through a study modeling the potential positive impacts of these initiatives, which can be done in conjunction with developing a national GHG emissions inventory and partnering with the U.S. Department of Energy to perform a climate risk assessment on energy infrastructure to ensure the right investments are being made. It will also be key to reduce methane emissions in the oil and gas sector. Iraq can also play a role in promoting climate action among its suppliers and partners by giving preferential scoring for climate-forward suppliers and by promoting green solutions such as a Waste-to-Energy pilot to reduce landfill waste while innovatively meeting generation needs.



2. USAID'S COMPETITIVE ADVANTAGE FOR PROGRAMMATIC CONTRIBUTIONS

METHODS AND OBJECTIVES

The findings in this Assessment were triangulated from data obtained primarily from stakeholder interviews, with other data from a supplemental media analysis and desktop research. The Assessment's purpose is to identify Federal Iraq and IKR's primary challenges across the energy value chain and recommend areas of intervention for USAID Iraq.

RECOMMENDATION CATEGORIES

The recommendation categories reflect USAID's competitive advantages, highlighting where USAID Iraq can add the most value in comparison with other bilateral and multilateral institutions active in the country. These advantages are organized into **four recommendation categories**:

1. Supporting Government Reform
2. Capacity Development
3. Pilot Programs and Partnerships
4. Raising Awareness

Each recommendation category is explained, and potential technical activities that USAID can implement to help the sector attain more reliable power, increase the penetration of renewable energy, and improve its financial and operational sustainability to support the country's economic growth are outlined under these four recommendation categories. Each recommendation category also includes an analysis on the area's ability to sustain impact in the longer-term.²

These four recommendation areas are aligned to the **five technical areas** outlined in Section 2 of this report, with the goal of providing integrated and complementary activities that USAID can implement to support the following outcomes:

1. **Renewable Energy Integration:** Support Federal Iraq and IKR to successfully deploy utility-scale and distributed renewable energy, most immediately solar PV;
2. **Energy Efficiency and Demand-Side Management:** Leverage the opportunity to reduce system costs, level loads, and improve sustainability through energy efficient standards and programs;
3. **Private Sector Engagement:** Develop and implement an enabling environment to attract and retain private sector entities to strengthen the sustainability of the power sector;
4. **Reduction of Technical and Commercial Losses:** Improve the technical and commercial management of the grid and power sector to increase the revenue needed for sustained sector investment;

² Sustainability in this context is part of USAID's definition of the Journey to Self-Reliance, is working with host country governments and partners to achieve locally sustained results, helping countries mobilize public and private revenues, strengthening local capacities, and accelerating enterprise-driven development



5. Environmental Risk Mitigation: Steer Iraq toward a path of sustainable development and reduce vulnerabilities.

N.B. the recommendations presented throughout are in order of implementation, from first to last under each of the four recommendation areas: Supporting Government Reform, Capacity Development, Pilots and Partnerships, and Raising Awareness. These recommendations are not intended to be completely comprehensive or exhaustive but represent areas where USAID Iraq can help Federal Iraq and IKR move forward with initial priorities in ways that USAID is well-positioned to support.

1. Supporting Government Reform

USAID programming is well-equipped to support government reform with activities that: i) improve the legal and financial operating environment by working with stakeholders in the Ministry of Electricity, and ii) strengthen administrative and public planning through USAID programs that provide relevant Iraqi and IKR ministries with trainings and tools that enhance their capacity to execute energy sector planning. Most prominent among potential programming challenges are transparency issues and complexity, which often interfere with the execution of energy-related legislation and the implementation of policies and standards.

Sustainability: Activities under this recommendation category will focus on improving the investment environment and improving the public planning process, thereby prioritizing technical assistance for activities that depoliticize the process and reduce the bureaucratic challenges as much as possible in the current environment. Additionally, USAID can provide relevant Iraqi and IKR ministries with trainings and tools to strengthen their managerial and administrative capacity to execute energy sector planning in a way that incentivizes those counterparts to maintain that growth for the sector.

2. Capacity Development

USAID is well-positioned to improve the capacity of Iraq’s institutions with programming that focuses on training and support to relevant ministries, supporting the development of local industry groups, and strengthening the role of civil society groups.

In particular, the MoEs need significant technical and operational capacity support. This includes technical advisory support and other technical activities such as grid impact studies, forecast reports, and staff technical skill assessments and interventions. In terms of managerial support, this can include strengthening the tender process, assessing supplier performance and developing performance improvement plans, and developing an indicator tracking system to assess progress.

Support to local industry and civil society groups requires a deeper assessment on stakeholder needs to develop a more nuanced understanding of the civic fabric related to the energy sector and more targeted objectives for each type of group. After an initial needs assessment, an intervention plan should be developed to strengthen their ability to advocate, interact with federal institutions, and track accountability and progress.

Sustainability: This is likely the area where USAID can most leverage with near-term tailored trainings that generate long-term sustainability for the counterparts to allow them to drive these priorities and manage the activities themselves. USAID can help play a crucial role in scaling up activities quickly and efficiently by strengthening the institutional capacity and the social and civic fabric.



3. Pilot Programs and Partnerships

Pilot projects add a tangible physical component to technical assistance that can provide a direct impact, experience to counterparts with the process, and demonstrate the scalability. Pilot projects must be accompanied by the appropriate enabling environment (to incentivize private sector engagement) and follow-on capacity building (to train regulators and power sector operators and other key counterparts) to achieve replication at scale. In addition, Iraqi government stakeholders have previously a low risk tolerance, so implementing successful pilots can help achieve buy-in and promote positive awareness of new technologies, processes, and approaches.

USAID can help Iraq to find adaptive solutions to its energy challenges by i) partnering with other donors, USG agencies, and development finance on existing initiatives to demonstrate impact and ii) launching and managing targeted pilot projects. Given the complex stakeholder landscape, there are multiple private, non-profit, and international entities undertaking energy-related pilots. USAID can partner with these entities and provide either additional expertise or increased scale to further these initiatives.

Sustainability: USAID can make the most direct, immediate impact on beneficiaries by promoting pilots, either independently or in collaboration with active entities and other implementers. Assessing the stakeholder landscape and not duplicating existing efforts will be important, however, to facilitate programming that uniquely advances USAID's priorities.

4. Raising Awareness

Given the distinct need for citizen buy-in and awareness in Iraq, USAID can leverage its expertise in communications to influence behavioral change and empower citizens to be active participants in the energy reform process. This applies to individuals working in the sector as well as residential and commercial energy consumers. USAID, an independent, third party entity, can fill an important role by educating the public on renewable energy and energy efficiency behaviors and the associated benefits for the country and its citizens. An effective communications plan could engage important segments of the Iraqi population and help steer Iraq towards a more energy secure future.

Sustainability: There is a general distrust of government-affiliated media and Iraqi government messaging among Iraqi citizens. USAID will have to account for this when creating a communications campaign and ensure that messaging is seen as independent from the government to secure citizen buy-in. Empowering and educating citizens to be a meaningful part of the reform process can help facilitate a long-term, lasting impact from USAID technical assistance after program delivery. These types of activities will help enable Iraqi citizens to advocate for improved sector outcomes, understand how to hold politicians and policymakers to sector commitments and how to engage with the utility more effectively for either more reliable power or alternate energy sources of on-site power.

3. RENEWABLE ENERGY INTEGRATION

3.1. Renewable Energy Challenges

In addition to the information outlined in Section 2, the sections below provide more context about the renewable energy sector in IKR and Federal Iraq. Specifically, solar energy, which has the most commercial potential in both Federal Iraq and IKR (compared to wind or biomass). Utility-scale solar can help reduce the need for natural gas imports and reduce the impact of fossil fuel generation, and rooftop solar can help households reduce dependence on diesel generation.³ However, addressing certain regulatory, financial, and geopolitical challenges would help Federal Iraq and IKR develop solar energy more quickly.

BARRIERS TO SOLAR UPTAKE

Iraq is endowed with abundant renewable energy resources, particularly wind and solar. Federal Iraq has just 216 MW of installed solar capacity despite its high solar irradiation levels, and IKR has only three operational private solar sites with a capacity of 500 kW.^{4 5} These resources are underdeveloped, especially in a country where electricity demand exceeds supply and natural gas imports cost the government of Federal Iraq more than \$2 billion annually.⁶ The Federal Government Program (2018 – 2022) set a goal of creating 1 GW of solar electricity by 2020,⁷ which shows that this is a focus for the top levels of government. This goal remains largely unmet, however, due to a combination of a poor regulatory framework and a poor enabling environment for finance, exacerbated by unclear investment laws.

A key factor hindering the development of solar energy, both grid-scale and rooftop, is the lack of supporting technical power system infrastructure. The unstable nature of the electricity grid in Iraq will present a major challenge to the operator when trying to integrate intermittent solar power, as the power system is currently designed to support the needs of a centralized power system run on baseload power, not a distributed system with intermittent power generation.⁸ Given chronic power shortages, difficulties with large-scale natural gas development, and the increasingly competitive cost of distributed and large-scale solar, solar energy could technically become an economic and practical part of Iraq's generation mix.⁹ However, integrating renewable energy within the existing national grid will pose a significant technical challenge. The lack of available high-quality transmission infrastructure means that remote areas, which are often good sites for solar PV plants, will either require extended transmission connections to the grid or accompanying battery storage solutions.¹⁰

Another major challenge is the highly subsidized cost of electricity for consumers, making it difficult for distributed solar energy to compete on a cost basis without the government also subsidizing this solar

³ <http://library.fes.de/pdf-files/bueros/amman/16324-20200722.pdf>

⁴ <https://www.pv-magazine.com/2021/09/06/totalenergies-to-build-1-gw-solar-park-in-iraq/>

⁵ <https://www.wri.org/insights/iraqi-kurdistan-solar-offers-hope-powerless>

⁶ <https://iraqenergy.org/2020/02/20/overview-of-iraqs-renewable-energy-progress-in-2019/>

⁷ Idem

⁸ <https://www.al-monitor.com/originals/2021/07/iraq-invests-clean-energy>

⁹ https://iea.blob.core.windows.net/assets/fb1f67b9-3515-4b5a-bb40-06ca0b83ef70/Iraq_Energy_Outlook.pdf

¹⁰ <https://www.al-monitor.com/originals/2021/10/iraq-opts-clean-energy-ambitious-energy-reform-program>

power as well. Domestic consumers in IKR currently pay about \$0.02/kWh for power from the national grid, although they do pay more than 10 times that (\$0.25/kWh) for diesel power.¹¹ From a grid-connected, utility perspective, customers must begin to pay a cost-reflective tariff to prevent the existing financial energy sector deficit from growing and leveling the playing field for new renewable energy generation, particularly distributed solar energy.¹² It is important to highlight, however, that adding utility-scale solar, which would be cheaper than HFO or diesel fired generation, could reduce the subsidy burden, especially for Federal Iraq that has a larger proportion of liquid fuel power plants. In IKR, according to a conversation with the MoE, the levelized cost of energy (LCOE) for solar is approximately \$0.06-0.07/kWh, which is only slightly cheaper than gas. As Federal Iraq and IKR develop more utility-scale PV projects, however, it is expected that the costs would decrease, which could provide an opportunity for further cost savings for the governments. Globally, the LCOE for solar PV is approximately \$0.03-0.04/kWh and continuing to fall, while for gas it is \$0.045-0.075/kWh when in combined cycle.¹³

FINANCING AND REGULATING SOLAR ENERGY

The Federal Iraqi government has had preliminary successes partnering with regional and foreign private sector energy companies to facilitate solar energy project development, although these are still in the early stages. Neighboring countries, such as the United Arab Emirates (UAE) and Saudi Arabia, have potential sources of financing that can help bring stability to the region. The Islamic Development Bank is another viable financing source that could potentially invest in new renewable energy capacity in Iraq as it has invested in other sectors in the country.

The National Investment Council will be a central stakeholder in the renewable energy sector in Federal Iraq. It has demonstrated successful partnerships with MoE and private developers, such as with Masdar to develop 1 GW of solar PV projects,¹⁴ and with French company TotalEnergies intended to supply Basra's regional grid with another 1 GW of solar,¹⁵ and with a consortium led by Norwegian company Scatec, a 525 MW project in Karbala and Babylon.¹⁶ Stakeholder consultations also indicated that AMEA Power (a USAID Power Africa partner)¹⁷ is another important private sector partner. Federal Iraq and PowerChina also have an initial agreement to develop up to 2 GW of solar plants.¹⁸ These projects are all in line with the Federal Iraq's goal of 12 GW of generation from clean energy sources by 2030, and

¹¹ https://www.globalpetrolprices.com/Iraq/electricity_prices/; Iraq Residential Tariff Reform Publication; [In Iraqi Kurdistan, Solar Offers Hope to the Powerless | World Resources Institute \(wri.org\)](#)

¹² <https://www.wri.org/insights/iraqi-kurdistan-solar-offers-hope-powerless>

¹³ [Solar retains its LCOE edge in latest Lazard analysis – pv magazine USA \(pv-magazine-usa.com\)](#)

¹⁴ <https://www.energyglobal.com/solar/12102021/masdar-to-develop-solar-projects-in-republic-of-iraq/>

¹⁵ <https://www.pv-magazine.com/2021/09/06/totalenergies-to-build-1-gw-solar-park-in-iraq/>

¹⁶ <https://www.al-monitor.com/originals/2021/10/iraq-opts-clean-energy-ambitious-energy-reform-program>

¹⁷ <https://www.ameapower.com/partners/>

¹⁸ <https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/100721-iraq-seeks-75-gw-of-renewable-power-as-it-inks-2-gw-deal-with-uaes-masdar#:~:text=Iraq%20has%20been%20striking%20a,1%20GW%20solar%20power%20plant.>



the key milestone of 7.5 GW of renewable energy generation by 2023.¹⁹ However, the interview with Federal Iraq MoE representatives revealed that though memorandums of understanding (MOUs) have been signed, financial discussions have not yet taken place. IKR has less solar potential than Federal Iraq, but still has tremendous potential that has not begun to be explored in earnest, and the IKR MoE reported some successes with small solar tenders.²⁰

Structural changes to regulatory frameworks in both Federal Iraq and IKR could facilitate the uptake and operationalization of utility-scale solar PV generation.²¹ Though Federal Iraq put forth a tender for 755MW of solar energy in 2019 and the media periodically reports on it, stakeholder consultations revealed that no progress has been made on the construction of these solar generation units.²² As such, in Federal Iraq, investors are skittish due to previously stalled projects, weak off-taker credit, bankability, and safety and security concerns despite winning bid companies being treated favorably under the 2006 investment law, with reduced customs fees, access to government-owned land, and favorable tax benefits.²³ To try to accelerate distributed rooftop solar, the MoF developed a mechanism of providing low-interest loans for the installation of solar home from select manufacturers.²⁴ Similar investment promotion and favorable import and fiscal policies could help facilitate investor confidence for utility-scale PV as well. In IKR, the government has not fully implemented the IPP structure because costs are not fully transferred to consumers and the true cost of energy is not reflected in the electricity prices for consumers.

Overall, solar PV is already at the same LCOE or cheaper than oil and gas-fired generation, but the extremely challenging investment climate, the low understanding of the project development process, high subsidies, and uncertain project management costs have stifled solar energy's share of the portfolio in Iraq.²⁵ In order to accelerate renewable energy deployment and address the key issue of financing, the Federal Iraqi government has discussed creating a sovereign wealth fund to finance renewable energy projects. The government has proposed depositing one percent of oil export revenues each month to fund solar projects, either through direct loans or partnerships with investors.²⁶ While sovereign wealth funds have been a successful platform for economic diversification for other commodity-based economies, such as Norway and Abu Dhabi, they require strict corporate governance structures and could open Iraq up to additional transparency issues. In addition, Iraq would need to develop the capacity and talent to manage a successful fund while ensuring the fund cannot become politicized.

¹⁹ <https://solarquarter.com/2021/10/27/iraq-plans-for-33-clean-energy-by-2030/#:~:text=Oil%20Minister%20of%20Iraq%2C%20Ihsan.sources%20to%2033%25%20by%202030;https://m.energytrend.com/news/2021/11/22-24355.html#:~:text=According%20to%20the%20recent%20statements,renewable%20generation%20capacity%20by%202023>.

²⁰ <https://www.wri.org/insights/iraqi-kurdistan-solar-offers-hope-powerless>

²¹ <https://www.wri.org/insights/iraqi-kurdistan-solar-offers-hope-powerless>

²² <https://iraqenergy.org/2020/02/20/overview-of-iraqs-renewable-energy-progress-in-2019/>, stakeholder interviews

²³ <https://iraqenergy.org/2020/02/20/overview-of-iraqs-renewable-energy-progress-in-2019/>, <https://investpromo.gov.iq/wp-content/uploads/2013/06/Amn-Invest-Law-En.pdf>

²⁴ <https://iraqenergy.org/2020/02/20/overview-of-iraqs-renewable-energy-progress-in-2019/>

²⁵ https://iea.blob.core.windows.net/assets/fb1f67b9-3515-4b5a-bb40-06ca0b83ef70/Iraq_Energy_Outlook.pdf; <http://library.fes.de/pdf-files/bueros/amman/16324-20200722.pdf>

²⁶ [Iraq sets out blueprint for sovereign wealth fund for clean energy - Iraq Oil Report](#)

The lack of a comprehensive IPP framework in Federal Iraq (more detail on IPPs in Section 6) and the failure to fully implement recommendations from the National Energy Strategy and other documents, especially during a time of low oil prices and the global pandemic, pose additional barriers to the government's goal of procuring 12 GW of renewable energy by 2030.²⁷ With proper implementation and assuming technology costs continue to decrease, solar and battery technologies could compete against residential and neighborhood diesel generation. Currently, Electricity Law (53) of 2017 regulates the adoption of renewable energy, its activities, and new key roles for the MoE.²⁸ A subsequent draft Renewable Energy Law was passed through the MoE to the Iraqi Ministerial Energy Council, the highest executive energy body in the country. The Law was prepared with the help of the United Nations Development Programme (UNDP) Regional Renewable Energy Centre, but is yet to be finalized, leaving the MoE as the executive authority controlling the development and financing of renewable energy projects in the country.²⁹

A clear strategy and effective legislation pertaining to renewable energy would better facilitate interest from frontier private investors. Lack of a conducive regulatory and business environment for decades has severely inhibited Iraq's ability to attract foreign direct investment into the electricity sector in general and renewable energy in particular.³⁰ For example, the \$0.035/kWh feed-in-tariff (FIT) originally proposed for grid-connected solar PV was too low for a new market that had not developed projects and thus had no cost reference points; investors were not comfortable with that risk and, eventually, the FIT scheme was abandoned.³¹ According to the MoE in IKR, the solar LCOE is approximately \$0.05-0.06/kWh, which could be a good benchmark for Federal Iraq as well; however, this could be confirmed with price discovery programs through auctions. (Please see **Section 3.2**, Pilots and Partnerships, for more on price discovery through auctions)

DOMESTIC ENERGY SECURITY

Incorporating more domestically produced renewable energy into Iraq's energy portfolio will also contribute to domestic energy security and reduce Iraq's dependence on Iranian gas. As of early 2021, Iraq owed Iran \$6 billion in arrears (overdue payments) for imported natural gas³² and imported 17.5 billion cubic meters of Iranian gas between March 2019 and March 2020.³³ After 2003, Iraq has not enjoyed a cooperative relationship with its neighbors in the Gulf, but has established ties with Iran.³⁴ Though the interconnection with Kuwait is a step towards cooperation and is reducing Iraq's dependence on Iranian gas and power imports, Iraq is still several years away from developing domestic sources of natural gas sufficient to meet its power generation needs. Solutions to reduce reliance on Iranian energy imports must be explored and implemented at scale. Building and incorporating more

²⁷

²⁸ <https://documents1.worldbank.org/curated/en/504001557108087756/pdf/Iraq-Electricity-Services-Reconstruction-and-Enhancement-Project.pdf>

²⁹ <https://iraqenergy.org/2020/02/20/overview-of-iraqs-renewable-energy-progress-in-2019/>

³⁰ <https://alkhatteeb.org/on-iraq-power-and-power-politics-meets-interview-with-luay-al-khatteeb/?lang=en>

³¹ [On Iraq Power, And Power Politics: MEES Interview with Luay al-Khatteeb | Luay al-Khatteeb | Former Minister of Electricity – Republic of Iraq \(alkhatteeb.org\)](#)

³² <https://www.reuters.com/article/iraq-gas-iran-int/iran-gas-company-says-slashed-flow-to-iraq-over-6-billion-debt-idUSKBN29219N>

³³ <https://en.radiofarda.com/a/iraq-has-to-import-gas-and-electricity-from-iran-for-years-says-minister/30576394.html>

³⁴ https://www.atlanticcouncil.org/wp-content/uploads/2020/12/Iraqs_Energy_Security_Strategy.pdf

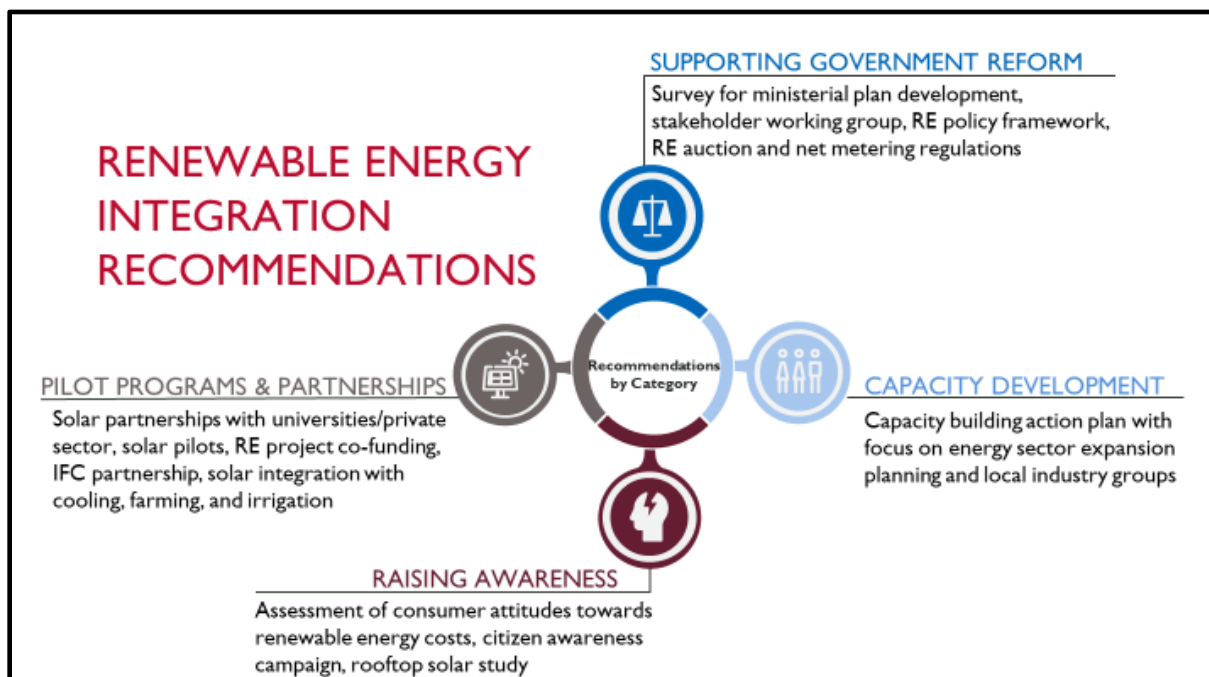
solar-generated power into the Iraqi grid would additionally help mitigate planned retirements of aging thermal generation assets and start to bolster its domestic capacity at a smaller scale.

3.2. Recommendations for USAID Program Activities

USAID can make an impact on Federal Iraq and IKR’s abilities to incorporate renewable energy, most immediately solar power, into their portfolio by:

- Helping the respective governments codify and clarify laws to promote investment and uptake, including for renewable energy auctions
- Building the capacity of the MoE, the energy workforce, and suppliers to sustain renewable energy skillsets and processes
- Scaling existing solar solutions to permanently grow the market share of solar
- Educating consumers and equipping stakeholders to communicate solar power’s benefits to change attitudes and inspire a cultural shift

Figure 11: Renewable Energy Integration Recommendations



SUPPORTING GOVERNMENT REFORM

Federal Iraq is still at the outset of its efforts to meaningfully scale up and operationalize renewable energy, and while IKR has recently made strides in that area, the renewable energy sector is still relatively nascent. USAID can play a meaningful role supporting the government entities to establish the necessary policies and regulations to facilitate frontier investments in the sector. USAID has done this with partner countries across many similar geographies and can leverage tools developed and lessons learned in Iraq through appropriately tailored technical assistance. The following activities could help USAID support Iraq to meet its renewable energy goals through government reform.

- 1) **Strengthen laws and regulations to promote renewable energy uptake:** Developing a renewable energy sector requires an understanding of key factors that may accelerate or inhibit sector growth, such as institutional drivers, the current regulatory framework and the strength of its implementation, and current technical and commercial capacity to develop and execute renewable energy projects. USAID should begin by conducting an assessment across the relevant stakeholders (including MoE, MoO, MoP, and MoF) to outline these key factors and to help guide the development of individual ministerial plans, describing the major features and important considerations. Given a similar assessment conducted by the Department of Commerce in 2016,³⁵ the team recommends consulting and possibly coordinating with Commerce on the assessment and its focus on RE. The assessment itself can be conducted by a third-party implementer with a strong MEL focus. The survey should focus on:
 - a) Conducting an institutional baselining of what drivers exist in the ministries for and against renewable energy, including other initiatives that might facilitate or inhibit renewable energy programming. This could include an assessment of where the benefits accrue from any savings achieved (e.g., the activity, the ministry, or the general treasury), and the degree to which upper management is supportive of savings initiatives (for instance, are they emphasizing it in any correspondence to employees?)
 - b) Conducting an assessment with relevant ministries on what laws exist and are visibly implemented versus what laws are inhibiting renewable energy development, including investment and tax laws.
 - c) Assessing current knowledge and skills regarding renewable energy among the ministries' staff. It is key to assess if there are employees with the necessary technical and commercial skills to develop renewable energy projects to develop tailored training programs and address capacity gaps.
- 2) **Establish and support a governmental stakeholder working group:** The current stakeholder landscape involved in renewable energy development in Federal Iraq is complex, diverse, and potentially not aligned to achieve the outcomes necessary to reform the sector. Investors have been and will continue to be hesitant to invest if it is unclear who owns the projects, budgets, specifications, and decision-making. This lack of defined roles is further complicated by Federal Iraq's problematic history of corruption in tendering, project development and unreliable vendor payments. Therefore, it is important to create a working group that brings together Federal Iraq stakeholders to increase transparency and decrease the points across which a project can be stopped, increase investor confidence, align with the private sector, and increase the sustainability of the sector by studying tariff reform options. Alignment and buy-in of these stakeholders are key to achieving a robust and sustainable renewable energy program. USAID can begin to facilitate this through the following:
 - a) Support the creation of a renewable energy working group with representatives from MoE, MoO, MoP, Prime Minister's Office, NIC, and MoF. This group will focus on accelerating the development and implementation of regulations that will accelerate renewable energy update, establishing a separate, multi-year budget mechanism to support the full lifecycle of a renewable

³⁵ [https://cldp.doc.gov/sites/default/files/Legal Guide to Investing in Power Generation in Iraq.pdf](https://cldp.doc.gov/sites/default/files/Legal%20Guide%20to%20Investing%20in%20Power%20Generation%20in%20Iraq.pdf)

energy project to promote investor confidence in long-term investment, and connecting with local industry groups and private sector players to support the discussions and ensure recommendations are aligned with creating a strong investment climate, adopting new technology, increasing the role of the private sector, and leveraging international leading practices.

- b) Conduct a study through the working group on options for tariff reform to support competitive pricing for solar and facilitate renewable energy uptake. This study would consider the costs and benefits of cost-reflective tariffs for consumers and market-based pricing for electricity purchased from the grid and should explore subsidy alternatives. It is important to highlight that both Federal Iraq and IKR currently subsidize the tariffs paid by the customer, which is based on either gas or HFO fueled plants as there is currently no utility-scale renewable energy deployed in the country. Because the current consumer tariff is around \$2 cents/kWh, which is less than what the utility-scale solar could achieve in the short-term, the challenge is that both the IKR and Federal Iraqi ministries will need to also subsidize solar PV, thus continuing the same cycle.
- 3) **Facilitate the implementation of sector policies to encourage investment:** To develop a sustainable RE sector, Iraq will need to ensure key legislation is not just developed, but fully and transparently implemented to provide external signals that the sector is ready for investment and that those investments will be protected under sufficient rule of law and standard policies and regulations. Federal Iraq has already made progress by developing a renewable energy policy framework, an interest-free loan program for rooftop solar, and an investment law to support this priority economic sector; however, the awareness and implementation of these regulations is inconsistent.
 - a) It is important that USAID works through the stakeholder working group to identify next steps and implementation plan for key renewable energy-enabling legislation. This would include supporting the stakeholder working group to identify the specific pieces of legislation that need to be prioritized, in addition to the ones outlined below.
 - b) USAID should work to support completion of the draft renewable energy policy framework, its passage in Parliament, and its implementation, focusing on bringing in private sector actors to advocate for these reforms with key stakeholders. This should be followed by National Plan Roadmapping to help adapt policy prioritization into specific actions and timelines by designated government entities according to well-specified targets and with clear ownership among the stakeholders in the working group. Publicizing the goals of the working group or asking the working group to work with an association of private sector investors or industry leaders can help drive accountability and commitment to timelines and objectives.
 - c) USAID should provide training and capacity building to Iraq's Central Bank and/or the Trade Bank of Iraq to support the implementation of the interest-free loan program for rooftop solar. This would include providing advisory support to develop approved vendor lists, approved technical system specifications, and processes for assessing the risk profile of borrowers. This could also include a web-based fast track application process that clearly outlines the steps, required documents, and eliminates in-person office visits for loan approvals. In tandem, USAID should develop an awareness campaign for citizens around the economic benefits of solar home systems and reduced reliance on diesel generators and outline the loan application process to drive adoption.

- d) Federal Iraq already benefits from an investment law that should allow the import of energy infrastructure-related materials into the country tax and duty free. IKR does not currently have such a law. It is key that USAID supports the implementation of the investment law in Federal Iraq by working with the MoF to ensure import tax reimbursement claims are processed and paid. In addition, USAID should work with the IKR MoE to identify a list of products that should qualify for tax and duty waivers to support growing a renewable energy sector and support the development and implementation of an investment law for IKR.
- 4) **Support the groundwork for renewable energy auctions:** Iraq must reduce its energy costs, in part by encouraging new and rehabilitated generation capacity, to eventually improve its energy sector performance. The traditional negotiated tender model and even the feed-in-tariff model, which was implemented for price support in many countries when first establishing renewable energy sectors, do not provide the opportunity for price discovery. Renewable energy auctions would allow for more competitive pricing, greater transparency, and can be scaled up and replicated more easily across multiple rounds. Because auctions require strong institutional capacity to execute, it is key that Iraq focuses first on developing its institutional capacity to undertake, manage, and understand the downstream sector impacts of the auctions. From there, USAID can focus on helping Federal Iraq design a simple set of auctions focused on price discovery and successful implementation to develop capacity and increase investor confidence. USAID can begin to facilitate this through the following:
- a) Begin by conducting training on auction design, technical and commercial requirements, and project timelines.
 - b) Consider funding an initial set of technical feasibility studies to support solar project development in key geographic regions.
 - c) In line with the stakeholder working group recommendation above, support Federal Iraq and IKR to build the fiduciary capabilities to create a designated renewable energy fund for auctions and begin the process of budgeting for and setting aside funds in a separate mechanism housed within the MoF; in the working group, define clear, achievable RE targets publicly with a list of pre-developed projects.
 - d) In line with the strengthening laws and regulations to promote renewable energy uptake recommendations above, support Federal Iraq to streamline the permitting process and clarify roles within the Iraqi government in the auction process.
 - e) Coordinate and work with other international partners such as IFC to support the development of a bankable power purchase agreement (PPA) example to improve the projects' financial attractiveness and viability (more information on PPAs in Section 6).
- 5) **Support initial net metering regulation development and implementation:** Facilitating distributed solar will decrease the load on the system and incentivize reduced energy consumption if combined with net metering. Developing and implementing net metering regulations will drive greater adoption of solar home systems and other rooftop solar PV, particularly if there is a strong financial incentive through lower household energy costs (for power taken either from the grid or from diesel generators) and improved reliability.
- a) USAID should expand the smart meter pilots discussed in Section 5 of this Assessment to help the utility roll out digital meters across Iraq and utilize that touchpoint with the customer to promote better billing and payment behavior. USAID should leverage the experience in IKR of

allowing customers to sell excess electricity into the grid for a direct compensation on their electricity bills.³⁶

- b) USAID should leverage the stakeholder working group to develop and implement net metering regulations and begin with a pilot on government and/or public facility rooftops. This could also help with collections as government facilities are often in arrears; in addition, government facilities have more square footage and can contribute more solar than residential-scale systems.
- c) USAID should provide technical assistance to help IKR develop a net metering program that incentivizes prosumer engagement, with robust public outreach, public initiatives, and messaging that signals its importance alongside complementary grid codes, permitting processes, and tariff mechanisms (e.g., sell tariffs, net billing). IKR has been implementing a smart meter program and privatized its distribution network so USAID could play a key role in supporting the successful implementation of these changes and expansion of the solar program.

CAPACITY DEVELOPMENT

As Federal Iraq and IKR continue to transition and modernize their energy sectors, the country will need support developing its workforce, citizens, and industries to support and operationalize those renewable energy goals. USAID has a significant track record with capacity building across its partner countries and in Federal Iraq, specifically. The following activities explain how USAID can evolve and target its capacity development tools and efforts to specifically target workforce needs to scale up renewable energy.

- 1) ***Begin with a Capacity Building Action Plan:*** The capacity building Action Plan should address the immediate capacity building needs for the MoE of Iraq and IKR and prioritize areas critical for renewable energy development and deployment. The plan should target building the capacity of the electric utilities, system operators, and the respective government agencies to support renewable energy planning, integration, and procurement, beginning within the MoEs of Iraq and IKR. It is important that capacity-building efforts be targeted and sustained over time, with milestones and benchmarks to track organizational and workforce progress by department. The capacity building Action Plan should include the following components depending on the current levels of capacity within the MoEs:
 - a) ***Integrated energy sector expansion planning technical support:*** Support Federal Iraq MoE to integrate renewable power projects into the transmission grid and support an operational and tactical shift to approach the country's energy portfolio as an integrated energy networks instead of set of stand-alone assets. These capacity building exercises and trainings can focus on:
 - i) ***Renewable power project grid impact studies:*** Build the capability of distribution companies to perform grid impact studies for wind and PV projects connecting at low and medium voltages, and to review grid impacts studies submitted by project developers and third parties. USAID should utilize its partnership with the U.S. National Renewable Energy Laboratory (NREL) for these activities.

³⁶ [Iraq's Kurdistan awards 300 MW of solar projects - report \(renewablesnow.com\)](https://renewablesnow.com/news/iraq-kurdistan-awards-300-mw-of-solar-projects-report)

- ii) **Bottom-up energy demand forecasting:** Help develop comprehensive and detailed models of energy consumption by sector and end use, with projections of growth according to economic and technological trends, disaggregated by geographic region.
 - iii) **Grid code requirements and specifications to connect to the grid:** Diversifying the energy mix and adding more RE will require an updated grid code, increased enforcement of the grid code, and improved outreach to publicize the grid connection requirements. Stronger grid code enforcement can also lead to improved service quality and ultimately allow for tariff increases. (More on the Grid Code in Section 6.2 of this Assessment).
 - iv) **Testing and assessing grid compatibility:** Assess the capability and experience of the Federal Iraqi and IKR distribution companies to test projects for distribution grid code compliance and recommend improved protocols to fully assess renewable power projects for grid code alignment before they are energized.
 - v) **Net metering program development:** Training utility employees and building internal capacity on how to stand up and operationalize an initial net metering program, starting with how to establish the foundational protocols for meter deployment, technical specifications, viable sell-back rates, connections fees, and the other initial priorities, etc.
- b) **Promote technical skills development for staff:** A successful renewable energy program requires a variety of low-skill and high-skill technical competencies as well as non-technical expertise to streamline project management and execution. Key roles include logistics experts, engineers (electric, civil, and mechanical), safety experts, quality control experts, environmental impact analysts, legal and contract professionals, financial analysts, modelers, power line technicians, system designers and integrators, project managers, and others. While some of the technical capabilities already exist in Federal Iraq and IKR on the traditional thermal power plant project teams, there will need to be reskilling and upskilling of workers to help transition them into this new field. In addition, the renewable energy sector (specifically solar PV and wind) has project development requirements that differ from traditional thermal plant development (i.e. environmental impacts, financing structures, grid interconnections, system integration, etc.) that will require capacity development to support the successful development, execution, operation, and maintenance of renewable energy grid-connected and distributed projects. Promoting this technical development could involve the following activities:
- i) **Current capacity baseline:** Leveraging the survey described above in the Supporting Government Reform sub-Section of this Assessment, it will be necessary to develop a baseline understanding of the current capacity, both technical and commercial, that exists within the MoE, MoP, MoF, and the Ministry of Environment to develop, execute, operate, and maintain renewable energy projects. This baseline activity should lead to a capacity-building Action Plan to outline priority gaps, training programs, and a timeline for closing those gaps.
 - ii) **Capacity building trainings:** Support the delivery of capacity building trainings to increase skills, facilitate knowledge transfer, share tools, and support program sustainability with both a technical and non-technical focus. From a *technical perspective*, it will be important to include:
 - Training of planning staff on the incorporation of bottom-up modeling and integration of renewable energy policy planning into national planning strategies

- Programs to reskill service technicians currently under-utilized in the thermal sector to learn renewable energy services, maintenance, and operations
- Renewable energy technology procurement training and supply chain management
- Advisory support on tendering for renewable energy projects and executing energy auctions
- Environmental impact assessments for renewable energy

From a *non-technical perspective*, it will be important to include elements of:

- Monitoring and evaluation and target setting
- Project management
- Change management
- Regulatory framework strengthening
- PR and awareness
- Financial management

- 2) **Develop capacity of local industry groups:** Developing a successful renewable energy sector can be accelerated by bringing together local private sector entities through a formal industry association that can more effectively communicate with government energy entities. The role of this association would be to facilitate information sharing, providing feedback to the industry and stakeholders on the cost of doing business and pricing recommendations, make recommendations on legislation to accelerate the sector's development, setting key standards for the sector, and promoting favorable trade policies.
- a) **Establishing a solar association:** USAID should help develop local solar associations, bringing together technology providers, local manufacturing companies who could produce solar components (such as cables, panels, local contractors, and system integrators) and representatives from cities and governorates to share leading practices and provide support for developing and executing solar projects. These solar associations should feed into one national solar industry trade group that is connected to the stakeholder working group described above.
- b) **Host a suppliers' conference:** USAID should host a suppliers' conference in Federal Iraq and IKR and invite local and regional technology providers, Engineering, Procurement, and Construction (EPC) contractors, system integrators, component manufacturers, and government representatives. The forum could achieve the following:
- i) Allowing government officials to clarify legislation and incentives for renewable energy and provide guidance on applying for project permits and how to be considered for the approved vendor lists.
 - ii) Developing local manufacturing and supply capability for Iraq's solar market by enabling introductions between regional and local players to facilitate knowledge sharing. Preparation for the suppliers' conference should also include an assessment of solar components that could be produced in Iraq (by benchmarking components, such as panels and switchgears, that are made in neighboring countries, such as Turkey and Saudi Arabia) as well as outlining components that are currently produced in Iraq that can be leveraged for solar, such as cables and iron/steel works. The assessment could include a ranking of the technological complexity and capital investment costs associated with these components to develop a roadmap for in-country manufacturing. Certain advanced components, like inverters, would likely be de-prioritized for initial investment in favor of more commoditized components.

- iii) Building awareness for the nascent solar sector in Iraq through an active social media campaign around the event.

PILOTS AND PARTNERSHIPS

While there has been some small-scale development of renewable energy recently in Federal Iraq and even more so in IKR, supporting tangible examples of an even smaller solar project development from start to finish can provide external investors with confidence in the process and the outcomes. It can also build citizen support for these investments and help the government build momentum toward the larger deals and opportunities it will need to transform the sector. Recommendations for developing key pilot projects and establishing partnerships that build momentum follow.

- 1) **Partner with the International Finance Corporation (IFC) for renewable energy auctions:** In order to leverage ongoing donor expertise and build initial momentum, USAID should partner with the IFC to support key components of developing an initial renewable energy auction, utilizing their expertise and potentially crowding in initial financing. The IFC runs a Scaling Solar program that implements a standardized process to facilitate a competitive bidding and award process for auctions. The program focuses on an open, competitive, and transparent approach that provides a “one-stop shop” for governments to attract private funding to develop and execute grid-connected solar projects at competitive tariffs. This process has been successfully deployed for RE across the region and in countries with similar contexts, including 100 MW PV in Uzbekistan,³⁷ which achieved a winning bid of just under \$0.027/kWh by Masdar, a price that is on par with other PV projects in the Middle East region.³⁸ The IFC can help arrange a financing package and provide oversight that the deal is bankable, and the appropriate deal structure is used. The Scaling Solar³⁹ program can help with the following areas from basic to more advanced: capacity building, price discovery process, provision of loan financing, advertisement to private sector investors, and, eventually, technical uptake and acceleration of grid-connected solar PV.
- 2) **Integrate distributed solar with farming and irrigation:** Iraq has historically been known as the “breadbasket of the Middle East” for its fertile soil and water supplied by the Tigris and Euphrates rivers. Poor regulations, internal violence, and a decrease in water levels because of policies of neighboring countries have created poor soil conditions and reduced the commercial viability of farming.⁴⁰ Reducing the cost of this irrigation to farmers from displacing the current use of diesel generators would be a boon to local farmers and could potentially increase local food production. Distributed solar generation is effective for powering irrigation infrastructure and it is a potentially cheaper option on an ongoing basis due to high diesel fuel costs.
 - a) USAID should continue the Office of Transition Initiatives (OTI) program, which has found that farmers accept the concept of solar for irrigation once they understand the reduced maintenance cost and elimination of fuel costs while maintaining efficiency. OTI found that these programs did not require any coordination with the government.

³⁷ [Sunny-Side Up: Adding Solar Power to Uzbekistan’s Future \(ifc.org\)](#)

³⁸ [Scatec Solar submits \\$24/MWh bid for Tunisia solar project, a record low in Africa - Institute for Energy Economics & Financial Analysis \(ieefa.org\)](#)

³⁹ [Scaling Solar | Accelerating Investments in Solar Power](#)

⁴⁰ [Can Iraq beat the drought and become the breadbasket of the Middle East again? | Middle East Eye](#)

- b) USAID should support the Federal Iraqi MoE to expand the current program to supply farmers with 150 kW solar power stations to operate water pumps for agriculture. It will be important to conduct a study to understand the extent to which these solar systems have been deployed, the cost, and the additional need. USAID could then consider providing a grant directly to a local distributor to fund additional deployment of these systems. In addition, it is recommended that these farmers be included in the solar industry association above.
- 3) **Start with public sector partnerships on solar:** A new law has been passed in Federal Iraq requiring that government facilities consider rooftop solar for powering their facilities. USAID could support developing assessment criteria, including capital cost and payback period, rooftop PV system sizing recommendations based on facility size and power needs, training on maintenance, and providing lessons learned for other government facilities. Once an assessment methodology has been created, USAID can expand to universities, mosques, schools, and other public and non-profit buildings.
- 4) **Provide grant funding to demonstrate solar pilots (rooftop with batteries, street lighting retrofits, cooling):** Developing the technical and commercial viability of new technology requires pilots to test at a small scale. USAID can provide the grant funding to support pilots in basic areas that have the potential to be scaled up and commercialized for the Iraqi market.
 - a) **Rooftop solar and batteries:** Demonstrating to residential and commercial customers that distributed rooftop solar and battery system can provide reliable power efficiently and effectively would be advantageous to the Federal Iraqi and IKR governments. IKR has already had some success with a combined solar/battery storage project. USAID could help to develop one or two pathways to implement priority, small-scale pilot projects in specific sectors (i.e. health clinics, markets, etc.) or key geographic regions where they can serve as an example to facilitate uptake. USAID should focus on a robust technical and financial evaluation of the grantees, and prioritize proven past performance in similar conditions, to make sure the enterprise is capable of meeting the requirements and set a proper example for the sector.
 - b) **Street lighting solar retrofits:** The Shlama Foundation has had success in retrofitting street lighting with solar powered lights. The low cost, high impact, and execution speed of these projects make them attractive for USAID to consider funding across Federal Iraq and IKR. OTI is also looking into projects for solar street lighting in coordination with the MoE, which should be continued.
 - c) **Linking solar home systems with cooling:** Summer demand for cooling overwhelms the electricity network and causes rolling blackouts. Reducing the demand on the system by integrating small-scale solar with air conditioning would reduce electricity consumption, promote small-scale solar, and improve cooling system efficiency. USAID could fund pilots for PV+cooling systems for both homes and larger government buildings to assess the technical requirements and costs and then facilitate the large-scale deployment of optimized systems.

RAISING AWARENESS

Across both Federal Iraq and IKR, the public and citizens need to be bought into the renewable energy value proposition to facilitate residential and commercial customers as potential end-users of distributed solar and to discourage citizen unrest or vested interests from unnecessarily stalling development. Activities to raise awareness and engage citizens, associations, and the media intersect well with USAID



Iraq's capabilities in its economic growth and governance units. Potential activities USAID could explore related to how to raise awareness of the potential of solar power include:

- 1) **Conduct a study to assess consumer attitudes and perceptions on the role of renewable energy in reducing energy costs at commercial facilities and in residences:** Accelerating the support for and adoption of grid-connected and distributed solar PV will require an active outreach campaign targeted at public, private, and non-profit audiences. This study should provide a current state overview of the positive and negative views towards solar PV (both grid-connected and distributed), the level of confidence of consumers to adopt this and potential timeline, the level of technological understanding, and an overview of the barriers to adoption and potential mitigation strategies. This mitigation strategy should also include a plan to address the vested interests supporting the diesel generator market, which is economically and politically challenging. Understanding the consumer perception in contrast to its current alternative, unreliable grid-provided electricity or expensive back-up diesel generators, could help inform future marketing and engagement plans.
- 2) **Develop a citizen awareness campaign and communication plan:** USAID should help raise awareness of renewables and solar power technologies through promotional campaign design, campaign monitoring, and evaluation. Soliciting buy-in from the public on the benefits of renewable energy will be key to increasing the share of renewable energy into the generation stock and the public's perception of renewable energy as a viable option. Sources estimate that in Federal Iraq 4.5 GW of additional capacity can come through small and distributed systems and the government has announced 12 GW of solar plans while IKR has announced plans to develop 9 GW of solar energy. The complexity of meeting these goals will require active public support to accelerate development and adoption. It is important to consider that:
 - a) Choosing the right communication channels is key to having the public believe and endorse the messages. Social media, particularly Facebook and YouTube, are more trusted and more frequented platforms. Initial messaging should not come from the government because of a significant trust deficit.
 - b) Focusing on a message that shows clear value (power reliability and availability, economic advantages, and environmental improvements) to the Iraqi people will gain the most traction. The key message is how to have cheaper, 24/7 reliable power. Solar home systems with battery storage can power cooling, heating, fridge/freezers, and other major energy consumers within the home. Grid-connected solar will provide power more cheaply and cleanly than diesel generators, thus reducing dependence on the costly diesel generators. The messaging can come from independent experts, partners from solar pilot programs, key influencers, the private sector, civil society, and academia.
 - c) Messaging effectively will require targeting the right audience. The information campaign should start by targeting main cities where there may be more awareness and discussion of renewable energy.
 - d) Monitoring the media outreach campaign performance will provide important feedback for refining messages, pivoting on chosen communication channels, and improving audience segmentation for more targeted messaging campaigns.
- 3) **Conduct a study on how decentralized, rooftop solar will reduce the dependency on neighborhood generators and be more cost effective:** To message effectively to consumers and



key stakeholders, it will be key to be able to show the economic, environmental, and power availability benefits from rooftop solar PV. This would include a cost analysis to show how rooftop solar installations, services, and usage costs compare to diesel generators and diesel fuel costs. In addition, the study should assess the commercial viability of adding battery storage into the rooftop solar installations to provide 24/7 power to homes compared to the current costs of diesel generators plus power procured from the national grid.

Create a public awareness campaign about the value of rooftop solar: Following the study on the cost benefits of rooftop solar, USAID should launch a public awareness campaign on the economic, environmental, and power availability benefits of rooftop solar PV, especially solar home systems. This campaign should show people where they can procure solar home systems, how to finance through the Central Bank loan program, and how to install the systems. The campaign should feature success stories from citizens and non-profit entities (like universities) that have installed solar PV and utilize local associations and community and neighborhood champions to promote uptake.

4. ENERGY EFFICIENCY AND DEMAND-SIDE MANAGEMENT

4.1. Barriers and Challenges

In addition to the information outlined in Section 2, the sections below provide more context about energy efficiency and demand-side management (DSM) in IKR and Federal Iraq.

Efforts to address Iraq's energy gap have typically focused on supply despite a significant proportion of losses occurring at the residential consumption level.⁴¹ The lack of administrative ability to collect payment and electricity theft contribute to high technical and commercial losses.⁴² Due to various economic, technical, and institutional barriers, the general level of awareness of energy efficiency is low, resulting in low overall adoption of energy efficiency technologies and laws in Iraq. To improve sector outcomes, the governments in Federal Iraq and IKR should focus on creating an enabling energy efficiency framework and action plan to accelerate the adoption of energy efficiency standards and technology. Furthermore, supporting activities to increase technical capacity and general awareness of the importance of energy efficiency in Iraq's energy sustainability will also be key.

INSTITUTIONAL BARRIERS

Tariff Structure

Electricity demand in Iraq is increasing by 7%-9% per year and the government does not have the capacity to bridge the gap between electricity supply and demand. The Iraqi government is further constrained by the financial burden of heavily subsidized residential electricity tariffs.⁴³ Tariff collection currently covers only about 10% of the electricity production and delivery cost. Additionally, due to inefficient meters and an ineffective billing system, only 33% of total electricity produced is paid for by citizens.⁴⁴ Iraqi citizens are generally not receptive to removing subsidies which would raise their electricity prices; however, cost-efficient demand-side management (DSM) programs can reduce the subsidization of the energy sector achieving a kWh saved at less than one produced. Any discussions about modifying the tariff structure are difficult for the government to have with the public and politically unpopular. Another externality of the current tariff structure is the propensity for Iraqis to use more electricity than they need to, because electricity is artificially inexpensive. The subsidized tariffs do not provide citizens an incentive to reduce energy use and be more energy efficient and does not provide a signal to the market to reduce energy costs.

Energy Efficiency Laws and Standards

There is no national law in Iraq that addresses energy efficiency specifically. There are also no minimum energy performance standards (MEPS) for public and residential buildings nor are there minimum energy efficiency standards for domestic appliances.⁴⁵ Given air conditioning equipment is the key driver of

⁴¹ <http://library.fes.de/pdf-files/bueros/amman/16449.pdf>

⁴² <https://www.mees.com/index.php/2020/5/15/geopolitical-risk/on-iraq-power-and-power-politics-mees-interview-with-luay-al-khatteeb/cf6ba480-96bc-11ea-9104-f105774a5b6c>

⁴³ Idem

⁴⁴ <https://library.fes.de/pdf-files/bueros/amman/16324-20200722.pdf>

⁴⁵ <http://library.fes.de/pdf-files/bueros/amman/16449.pdf>

projected demand, investing specifically in high-efficiency conditioning units could mitigate peak demand challenges providing reliable, cost-effective energy.⁴⁶ There is no specific energy efficiency policy focused on driving improved energy efficiency measures or adoption of energy-efficient equipment and appliances and no nationally coordinated policy or strategy or action plan. Investing in these regulatory measures could create commercial and consumer incentives, help proliferate greater access to energy saving appliances, and encourage more efficiently constructed, better planned buildings.

CONSUMER CHALLENGES

Lack of Institutional Trust and Public Awareness

Citizens view public utilities as unable to provide adequate customer service.⁴⁷ The MoE will need to reform its billing statement to build trust and consumer buy-in. Additionally, there is a lack of general knowledge among citizens regarding energy efficiency measures. For instance, many Iraqis do not know how to interpret their electricity bill to conserve costs and are unaware of the tangible benefits of electricity conservation.⁴⁸ Promoting greater energy efficiency literacy among citizens could help produce long-term shifts in demand. Additionally, despite a large population of architects, greenhouse architecture techniques are not mandated in university curriculum, and thus many Iraqi architects are often untrained in energy efficiency techniques that could benefit the construction of new buildings.⁴⁹

Financial Barriers

Energy efficiency programs require tailored financial support to increase uptake and make the mandates financially viable for consumers. Financial barriers to adoption of energy efficiency technologies and practices in Iraq can include high investment cost and long payback period of an energy efficiency program and lack of access to capital for investing in energy efficiency technologies. In addition, for the residential sector, there can be different priorities for capital investment (households often have limited capital available for investment, so they usually prioritize other family expenses), which can complicate energy efficient uptake and frustrate consumers as energy efficient electric appliances can have a higher cost when compared with conventional electric appliances. It is therefore key that an energy efficiency program consider how to mitigate this lack of short-term financial incentives.

TECHNICAL BARRIERS

Smart Meters

Outdated metering systems consume greater energy and contribute to significant losses. About 80% of the meters in Federal Iraq are more than 30 years old, and it is unclear how many have been restored or calibrated.⁵⁰ Updating meters, especially with smart and pre-paid meters, could help customers to better monitor their usage. Smart meters and pre-paid meters, in particular, are now widespread at

⁴⁶ <https://1001iraqthoughts.com/2020/07/29/powering-iraq-why-electricity-is-key-to-peace-stability-and-prosperity/>

⁴⁷ <https://documents1.worldbank.org/curated/en/504001557108087756/pdf/Iraq-Electricity-Services-Reconstruction-and-Enhancement-Project.pdf>

⁴⁸ <http://library.fes.de/pdf-files/bueros/amman/16449.pdf>

⁴⁹ Idem

⁵⁰ <https://library.fes.de/pdf-files/bueros/amman/16923.pdf>



viable cost points, which provide financial benefits to the sector by mitigating electricity theft and non-payments. IKR has implemented a smart meter pilot program to begin addressing this issue.

Energy Efficient Appliances

Despite continued and growing demand for air conditioners in Federal Iraq, no energy efficiency standards currently exist for imported AC systems or electric fans. Peak power demand can reach 30GW in the summer months in Federal Iraq due to extreme temperatures, with much of this additional demand driven by air conditioners and electric fans.⁵¹ There are no standards for televisions and water heaters either. Because of the significant gap between power production and summer demand, private diesel generators are used to address this power gap, but they are expensive and damaging to the environment. Research indicated that \$4 billion is spent annually on diesel generators, partially due to the shared reluctance amongst Iraqi citizens to pay the government for electricity as it is seen as the government's responsibility to provide. This lack of financial incentives is in part responsible for the prevention of widely available energy efficient appliances.

4.2. Recommendations for USAID Program Activities

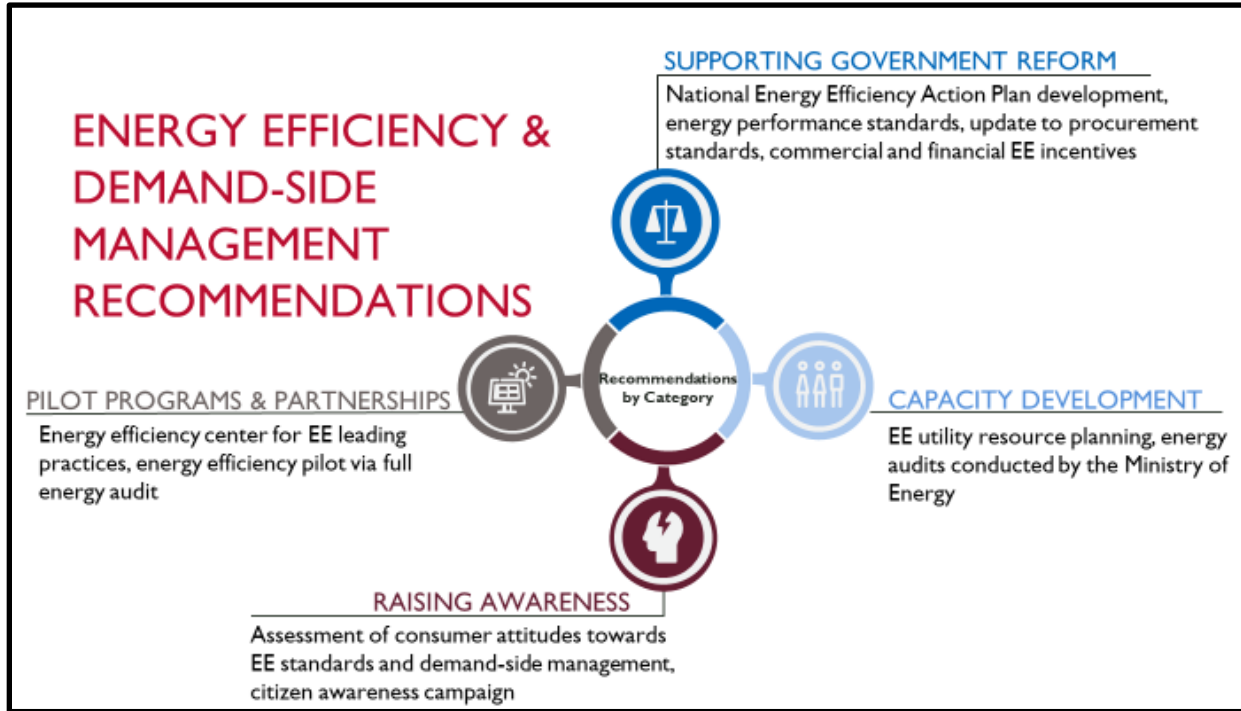
Energy efficiency represents an untapped opportunity for the utilities in Federal Iraq and IKR. Implementing energy efficiency programs would benefit these utilities by: 1) reducing energy input costs, 2) leveling loads to better match demand with supply, and 3) meeting requirements of energy savings targets and reduce the need for new power supply. USAID can help Federal Iraq and IKR capitalize on this opportunity by improving energy efficiency performance standards, conducting energy efficiency pilots, establishing partnerships, and raising stakeholder awareness of the benefits of energy efficiency.

USAID can make an impact on Federal Iraq and IKR's demand-side management and adoption of energy efficiency standards for residential, public, and private entities by:

- Helping the respective governments develop National Energy Efficiency Action Plans (NEEAP) including performance standards and financial incentives
- Building the capacity of the MoE for energy efficiency planning including implementing a plan for energy audits
- Partnering with local universities to develop an Energy Efficiency Center and pilot an energy efficient retrofit on that building
- Educate citizens on the cost savings of energy efficiency and long-term benefit to the country

⁵¹ [Iraq and Iran suffer conjoined electricity crisis amid summer heat \(thenationalnews.com\)](http://thenationalnews.com)

Figure 12: Energy Efficiency & Demand-Side Management Recommendations



SUPPORTING GOVERNMENT REFORM

Reducing the strain on the energy sector is going to require both demand side and supply side action and policies. From a demand side, reducing energy consumption through energy efficiency regulations and demand-side management initiatives is key. Because of the cost and cultural mindset shift required to implement energy efficiency programs, governments have a leading role to play by developing and implementing energy efficiency standards, providing financial incentives to increase uptake, streamlining procurement, and measuring impact. USAID can play a meaningful role supporting the government entities to put in place the necessary policies and regulations to drive the growth of this sector. The following activities could help USAID support Federal Iraq and IKR to develop and implement a sustainable energy efficiency sector through a strong regulatory framework.

- 1) **Develop a national energy efficiency action plan to improve energy efficiency standards:** Implement a strong regulatory framework to achieve energy efficiency targets and drive a cultural mindset change. USAID can support the government of Federal Iraq and IKR to develop a National Energy Efficiency Action Plan (NEEAP) that clearly outlines the steps to roll out energy efficiency development, leverages global leading practices, provides frameworks on impact evaluation, and mitigates potential barriers. This support should help to prepare a new law on energy efficiency that the Iraqi Government can adopt. The NEEAP should include the following components:
 - a) **Institute energy performance standards and labeling standards:** Develop a program for standards and labeling including minimum energy performance standards related to buildings, appliances, and lighting. Uninsulated buildings lead to significant heating and cooling costs, so developing basic minimum energy efficiency standards could lead to important financial gains and

reduce electricity demand. This can be done by requiring updated codes for new buildings and promoting energy efficient building retrofits that focus on basic appliances upgrades at the outset, such as LED lighting and reflective roof coatings and moving to more sophisticated systems, like variable frequency drives (VFD), insulated pipes, heat recovery systems, and programmable thermostats. Policies should mandate minimum standards and establish a clear timeframe for implementation with fines for non-compliance. In addition, policies should outline a clear timeline for when appliances must switch to higher-efficiency standards and when products that do not meet minimum energy performance standards will no longer be allowed to be imported or sold locally. Developing minimum energy performance standards should also include a requirement to conduct energy audits on government facilities, universities, mosques, schools, and other buildings.

- b) **Revise procurement standards for energy efficiency technology:** Support the Iraqi Government and IKR to revise procurement standards for energy efficiency technology to increase flexibility and incentivize procurement of the latest technology. Energy technologies are constantly advancing which requires that procurement strategies prioritize newer technology by reducing traditional performance-related criteria (such as reference hours⁵²) or international product certifications⁵³. USAID could mitigate the challenge of Iraq's low-risk appetite for new technology by encouraging the Iraqi government to accept international certifications later in the procurement bidding cycle and by working with major technology providers to provide additional performance guarantees for new equipment. As part of a national plan to retrofit government buildings, USAID can support Federal Iraq and IKR to implement bulk procurement policies to leverage economies of scale and provide momentum for adoption of efficient technologies.
- i) **Technical assistance for bulk procurement:** Bulk procurement refers to programs or policies to purchase large volumes of high-efficient equipment by a single buyer. The most common example of this is the purchase of high-efficiency equipment by government agencies through creating a list of eligible products from which procurement officers can choose. This includes:
- (1) **Technical specifications for qualified products:** Develop metrics and testing procedures for equipment as the technical basis for assuring the energy performance of products eligible for purchase within the program.
 - (2) **Product registry and procurement handbook:** Develop a product registry list of qualifying product models available on the market and define a process for keeping them

⁵² Standard policy in the Middle East is to require a certain number of reference hours in order for a technology provider to be able to bid a new technology platform. For example, a new gas turbine platform requires ~2,000 hours of proven, successful operation globally before many utilities will allow companies to bid the new technology (e.g. moving from F class to H class). This is due to a risk-averse culture of utilities towards new technology.

⁵³ For wind turbines, many Middle Eastern countries require international technology certification, called the Design Evaluation Conformity Statement (DECS), at the bidding stage. The process for DECS for new turbine platforms can take more than a year. By requiring DECS at bidding (instead of at financial close, which can be 1.5 years to 2 years after bidding), the utility is preventing companies from bidding their latest, most efficient technology. By relaxing these types of requirements, the MoE can allow for newer, more efficient technology to be used.

up to date. Procurement handbooks cover multiple programs and describe leading practices for acquiring high-efficiency equipment.

- c) **Explore commercial and financial incentives to reduce the cost of energy efficiency projects:** Support the MoE in developing commercial and financial incentives to reduce the cost of energy efficiency projects, drive commercial investments and encourage facility owners to purchase energy efficiency equipment. Examples of incentives include lower cost loans (loans with no interest or below-market interest rates, known as “concessional funding”), investment grants, financial subsidies and rebates, and tax exemptions or reductions. In Iraq, the best way to kickstart this program is through grants to enterprises. Iraq is still developing a banking culture and taking loans or operating on credit has not been common historically, especially at the residential level. Tax exemptions or reductions would be challenging to claim and process. A targeted grant program would likely have the easiest implementation with the fastest results.

CAPACITY DEVELOPMENT

Implementing energy efficiency measures necessarily includes developing the energy efficiency skillset within both the public and private sector. USAID has a significant track record with capacity building across its partner countries and in Iraq specifically. The following activities are recommendations for USAID to target implementation of energy efficiency measures within Federal Iraq and IKR.

- l) **Institutionalize energy efficiency resource planning within the utility:** In order to institutionalize the national energy efficiency action plan, it will be important to train MoE leadership and staff on how to develop, implement, and institutionalize the core components of the plan, including identifying the necessary institutional capacity, designating departments and owners, and providing the human and capital resources to sustain those investments. The dual impact of significantly increased power demand from air conditioners in the summer season with energy buildings (most without insulation) would be an important first focus area for both Federal Iraq and IKR. As highlighted above in Supporting Government Reform, developing and instituting minimum performance standards and updated building codes can also be a first step in the energy efficiency journey. Energy efficiency utility resource planning should include:
 - a) **Begin with a fundamentals of energy efficiency program design training:** Conduct training on concepts of energy efficiency programs and share program design leading practices. USAID could leverage the U.S. Department of Energy to conduct these trainings. It would also be important to highlight successful energy efficiency programs in neighboring countries (UAE, Saudi Arabia, Jordan) that could provide a model for Iraq.
 - b) **Undertake an energy efficiency cost-benefit analysis from the utility and government’s perspective:** Perform an analysis to understand expected costs of launching an energy efficiency program and expected cost savings, including mapping additional resources needed (human, technical, and capital) to design, develop, implement, and monitor a broader energy efficiency program. This analysis should then help direct the pilot energy efficiency projects, structure a potential energy efficiency fund, and develop awareness campaigns where the utilities can drive the most savings for the sector by highlighting the most cost-effective investments. It should also identify target economic sectors (e.g. tourism, agriculture) and customer classes (e.g. industrial, large and small commercial) with an associated timetable for engagement.

- c) **Design and prioritize initial energy efficiency projects:** Based on the cost analysis and aligned to the energy efficiency action plan, identify and rank highest impact and lowest cost energy efficiency programs from the utility financial perspective. Engage the U.S. Lawrence National Laboratory (LBNL)⁵⁴ to provide technical assistance through its energy efficiency modeling and analysis tools that can target the sectors with the largest payback and the largest savings. Once that standard analysis been conducted, work with MoE to understand which sectors, products, and customers might be the most effective to target initially, given cultural factors, the power of vested interests, and historical precedents, all of which are important for energy efficiency as realizing savings typically demand on the end-user changing behavior or making investments.
- d) **Lay the groundwork for an energy efficiency fund:** Support effective program design and build capacity within the MoE to manage and execute a fund that could help co-finance the aforementioned energy efficiency projects, tailored to typical lenders in the priority sectors identified. Utilize previous examples of when USAID has supported and operationalized these types of funds in countries with similar institutional maturity such as Jordan. The fund design should ideally have a separate budget with a multi-year spend approval. It will also be critical to focus on the technical capacity building of the fund administrators and to start with a smaller capitalization. It will also be critical to examine initial projects for viable pay back periods and structure lending to recapitalize the fund quickly, which is typically with energy efficiency loans, in order to demonstrate viability.
- e) **Drive nuanced awareness campaigns and stakeholder outreach:** Undertake a stakeholder analysis of the priority industries with the most energy efficiency savings potential to identify associations, ambassadors, and representatives for those specific industries. Conduct targeted outreach via community and association meetings, workshops, and publications to communicate energy efficiency program opportunities and program criteria. The conduits to drive energy efficiency awareness will vary depending on the end-user and the messaging should be nuanced to that sector or industry's cultural preferences and ways of doing business. The stakeholder outreach should focus on promoting the energy efficiency goals as well as encouraging first movers to apply to the fund.
- f) **Develop an energy service companies (ESCO) model:** This will be covered in Section 5.2 of this Assessment.
- g) **Establish the foundation for energy audits:** Support MOE to stand up an energy efficiency unit in the MoE to perform energy audits and develop energy savings action plans for government facilities, universities, mosques, schools, and other buildings. The energy audits should recommend energy conservation measures across all the government buildings audited. USAID could consider partnering with the U.S. DOE to leverage pre-developed energy audit tools and provide training on other leading practices to support the development of capacity in this sector in Iraq. It is important to consider in the implementation of energy audits and enforcement of codes and standards that there may be increased opportunities for corrupt practices. It is key to put into place measures that increase the transparency of these programs and their implementation.

⁵⁴ <https://international.lbl.gov/appliance-efficiency>; <https://ee4d.org/>

PILOTS AND PARTNERSHIPS

Energy efficiency is not a priority for many Iraqi households and businesses which are struggling with unreliable power. As a new focus for the sector, it will take time and resources to explain the benefits of conserving power, particularly with energy efficiency priorities that involve changing the status quo. In some instances, that type of messaging could be met with pushback and hostility, particularly coming from government entities that are unable to supply reliable power. Given that, USAID can play a key role by identifying and implementing turnkey pilots in priority sectors that highlight the cost savings and reduced system demand achievable through energy efficiency investments and practices. USAID can act as a link between government regulatory framework development and successful pilot implementation to begin to change mindsets to increase support for energy efficiency programs, particularly amongst industry groups and associations that have the most to gain initially.

- 1) ***Establish an Energy Efficiency Center to aggregate leading energy efficient practices and create an energy efficiency community of practice:*** Support the development of an energy efficiency center, ideally aligned to a university or the MoE, that will outline all the leading practices in energy efficiency practices. This center can be a resource for convening ambassadors and stakeholders in the energy efficiency community and can be used to host the ESCO association and private sector stakeholder association outlined in Section 6.2 of this Assessment. This Center could also potentially include the establishment and certification of a national testing laboratory, potentially matched with or under the apprenticeship of an existing testing technical laboratory in another country in the region, that is equipped with testing facilities to certify energy efficiency equipment and appliances. This Center could also house the ESCO accreditation agency. Establishing this center could be an opportunity for USAID to expand its partnerships with Iraqi universities. USAID could consider partnering with a in Federal Iraq, such as Basra University, which has a strong engineering program, and a university in IKR, such as of Sulaymaniyah, which is known for strong science programs.
- 2) ***Utilize the buildings and entities associated with the Center for an energy efficiency pilot:*** Proving the benefits of energy efficiency will be key to accelerating the deployment of energy efficiency standards and creating a market for energy efficiency retrofits. Funding grants for a full energy audit of the building used for the energy efficiency center and documenting the retrofits conducted, measuring improvements, and messaging around the pilot's success will be a helpful proof point for the market, the citizens, and can create momentum for additional energy efficiency adoption.

RAISING AWARENESS

Stakeholders, citizens, and commercial enterprise should be made aware of energy efficiency's role as a "fifth fuel,"⁵⁵ the lowest carbon and most efficient of energy sources (compared to the other four fuels: coal, oil, natural gas, and nuclear power), and the role of energy efficiency in reducing electricity demand and fossil fuel consumption, which is particularly relevant for Iraq given its largely oil-based generation

⁵⁵ [Invisible fuel | The Economist](#)



portfolio. USAID can play a vital role as a third-party broker in this sector, raising awareness with stakeholders to increase energy efficiency adoption and mitigate potential citizen and industry pushback to a government sponsored effort. Potential activities USAID could explore related to how to raise awareness of energy efficiency's critical role include:

- 1) **Conduct a study to assess consumer attitudes and perceptions of the role of energy efficient standards for appliances and residential products:** The government's goals should be to promulgate an understanding of first, the cost savings associated with energy efficiency, and second, how reducing energy consumption through energy efficiency measures has the potential to eventually increase power availability through reduced system demand. Accelerating the understanding and adoption of energy efficiency regulations, energy audits, and energy efficiency investments will require an active outreach campaign targeted at public, private, and non-profit audiences. This study should provide a baseline of the awareness of energy efficiency, a current state overview of the positive and negative views towards energy efficiency by different sector groups, the level of consumer confidence and understanding of energy efficiency impacts, the industry's level of technological understanding, and an overview of the barriers to adoption and potential mitigation strategies. The study could focus particularly on the public's understanding of energy efficient building retrofits, updated building codes, energy efficiency lighting technologies, and more efficient air conditioners, since those sectors and appliances that can dramatically reduce demand on the power system and increase the sustainability of the energy sector. This should include an opportunity cost assessment of reducing generation from a primarily oil & gas generation base, analyze the non-renewable nature of hydrocarbon reserves, and demonstrate how those can be through increased energy efficiency adoption.
- 2) **Raise citizen awareness of energy efficiency standards and technology through promotional campaign design, campaign monitoring, and evaluation:** Developing a mindset of energy efficiency and justifying the costs of energy efficiency upgrades and retrofits will require support and advocacy from the public. Leveraging the study on energy efficiency, USAID could implement a tailored awareness campaign to promote energy efficiency measures in target sectors through citizen and industry outreach. Similar to efforts related to renewable energy, it is important to consider that:
 - a) Choosing the right communication channels is key to having the public believe and endorse the messages. Social media, particularly Facebook and YouTube, are generally more trusted and more frequented platforms. Engaging active civic groups and associations will be critical as direct messaging from the government may not be impactful due to the significant trust deficit.
 - b) The key message relates to having constant, reliable power at a reduced price. Energy efficiency reduces system load and decreases the need for costly diesel generators. The messaging can come from independent experts, partners from energy efficiency pilots, key influencers, the private sector, civil society, and academia.
 - c) The information campaign should start by targeting main cities where there may be more awareness and discussion of energy efficiency and where there is a concentration of larger industrial and smaller commercial customers that would benefit more substantially from energy efficiency upgrades, equipment, and appliances.



- d) Monitoring the media outreach campaign performance will provide important feedback for refining messages, refining chosen communication channels, and improving audience segmentation for more targeted messaging campaigns.

5. PRIVATE SECTOR ENGAGEMENT

In addition to the information outlined in Section 2, the sections below provide more context about private sector engagement in IKR and Federal Iraq.

5.1. Context in Federal Iraq and IKR

REGULATORY AND FINANCIAL ENVIRONMENT

The investment landscape in Federal Iraq and IKR is complex with some commercial, frontier financial institutions and multiple international development finance entities active at some level in the energy sector. The country's outdated laws and regulations, complex bureaucracy, and transparency issues make it an extremely challenging, but not insurmountable, environment for new types of private sector investment. Many investors in the past have expressed their concern that economic, political, transparency, and security uncertainties inhibited their interest unless the government is willing to pay above-market prices. Many developers have raised concerns in the past of slow and bureaucratic processes in obtaining land permission, financing, and access to transmission infrastructure. Currently, Federal Iraq does not have a comprehensive regulatory and legal framework that would allow the private sector to export and sell electricity generated from renewable or other sources to the national grid. IKR has had a more robust history of private sector engagement in power generation, with Mass Global having built the first private power project in 2010.⁵⁶

Independent Power Producers (IPPs)

The most prominent challenge for private sector actors, according to stakeholder consultations, is forming IPPs. Given the lack of government capacity to address energy supply, private IPPs are pivotal to renewable energy project development and meeting the future of Iraq's fast-growing demand. Similarly, in Lebanon, the formation of IPPs proved to be an instrumental step that paved the way for much needed investment in renewable energy projects and bringing in new private sector investors comfortable with the risk climate.

Numerous unsuccessful attempts have been made to form IPPs in Federal Iraq. IPPs will be challenging to configure given the multiple obstacles for investors. These include an unfavorable regulatory framework and tariff structure and, notably, a lack of sovereign guarantees. Guaranteeing payments on loans is crucial to attracting needed private investors and materializing IPPs. IPPs may also need to tackle the issue of collecting payments from end-users. This model has been discussed in Abu Dhabi when looking to develop Kizad Port to have the IPP be responsible for collecting payment from the end-users in the economic zone. It is unclear to what extent this model has been implemented.

According to the interview with Dr. Abdulbaqi from the MoO, the MoE and the NIC are currently developing a bankable PPA structure. The structure includes a connection agreement, technical requirements to connection to network, and voltage levels to support the growing solar market.

In contrast, IKR has adopted an IPP model, bolstered the corresponding regulatory and policy environment, and has begun to mobilize initial external investment in new generation projects. Mass

⁵⁶ [GE secures US \\$200 million power contracts in Iraq - Construction Week Online](#)



Global Investment Company, a Kurdish IPP, partnered with GE in 2011 to deliver 2.25 GW of power through 18 gas turbines in IKR. Mass Global has received several investments from the World Bank and the IFC to expand thermal power installations.⁵⁷ It is important to highlight, however, that IKR has not fully leveraged the IPP model as it does not pass all costs onto consumers through cost-reflective tariffs. Research indicated that IKR continues to bear the costs of the IPP and is not benefitting from the IPP structure that should pass the costs onto the customers.

Sovereign Guarantees

The lack of sovereign guarantees in Iraq poses the largest challenge to key investment. Sovereign guarantees are considered a standard global practice, and without them, lenders are not provided with the confidence to fund capital intensive projects, like large scale generation. In another interview with the MoE, the Ministry stated that accessing financing is their most prominent challenge and they were willing to explore new mechanisms to provide that support for private investors. In 2017, Federal Iraq issued a \$1B sovereign bond that was actually backed by the U.S. Government's guarantee.⁵⁸ The Minister of Oil, Ihsan Abdul-Jabbar Ismail, stated in 2021 that Iraq would be providing sovereign guarantees to investors in the solar sector but that has not been verified in practice.⁵⁹

Under the Kurdistan Debt Law of 2015, IKR is authorized to enter sovereign guarantees up to \$5 billion.⁶⁰ By contrast, the federal Iraqi government does not currently offer sovereign guarantees. Instead, the Iraqi government leverages standby letters of credit for six months to help with payments through leading private sector arrangers, such as JP Morgan. Given local banks do not have long-term dollars to fund projects, the MoE and MoF are at a critical stage where providing sovereign guarantees could open untapped investment opportunities.

Investment in IKR

IKR is keen to expand its production of renewable energy and has made more progress than Federal Iraq in establishing an investment-friendly regulatory framework. The power distribution sector is currently undergoing privatization to cut costs, create new revenues, and provide more consistent electricity access. In a recent example, IKR's MoE selected three local companies to build solar plants totaling 300 MW in Erbil, Dahuk, and Sulaymania with completion projected for mid-2022.⁶¹

Iraq Investment Law

Per Iraq's Investment Law of 2006 amended in 2015, Article 17, Fifth A, there is an exemption from taxes and duties on imported raw materials for the purpose of commercial operations provided they are environmentally friendly.⁶² Stakeholder consultations revealed that this is rarely realized in practice. Developers must factor in the cost of importing materials, ultimately mitigating the potential incentives the law could provide. The investment law requires proper implementation and strengthening the code

⁵⁷ <https://www.ge.com/news/press-releases/first-ge-day-erbil-highlights-region-focused-partnerships-drive-growth-kurdistan>

⁵⁸ [Government of Iraq Issues \\$1 Billion Sovereign Bond with U.S. Guarantee | Press Release | U.S. Agency for International Development \(usaid.gov\)](#)

⁵⁹ [Iraq invests in clean energy - Al-Monitor: The Pulse of the Middle East](#)

⁶⁰ <https://www.lexology.com/library/detail.aspx?g=96d1cbe8-4ee8-46cc-9376-9b690d74a7ca>

⁶¹ <https://renewablesnow.com/news/iraqs-kurdistan-awards-300-mw-of-solar-projects-report-767622/>

⁶² <https://cldp.doc.gov/sites/default/files/Legal%20Guide%20to%20Investing%20in%20Power%20Generation%20in%20Iraq.pdf>

of law to help Iraq to actually provide those incentives necessary to generate international interest in such a challenging market.

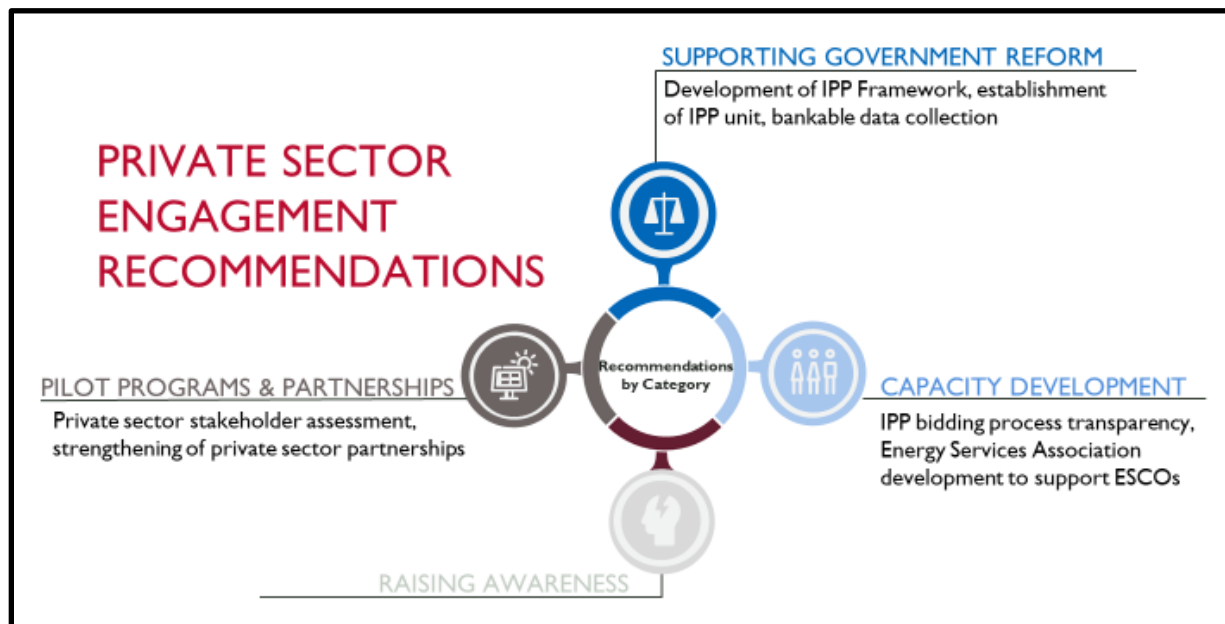
5.2. Recommendations for USAID Program Activities

USAID programming can play a crucial role in developing the enabling environment for enhanced private sector engagement, an essential component of a robust power system. USAID can make this impact through programming that supports the government’s ability to develop frameworks, improve in-country capabilities, and forge lasting partnerships.

USAID can make an impact on Federal Iraq and IKR’s energy sector growth, sustainability, and costs by increasing the role and scope of engagement of the private sector by:

- Supporting Federal Iraq to develop and fully implement a robust IPP framework and IKR to better implement their IPP framework, including developing strong project development and bidding capacity
- Developing an ESCO model through increased capacity, implementation of energy efficiency standards, and developing an ESCO association in Iraq to support the sector’s growth
- Assessing and benchmarking the current private sector landscape and facilitating increased partnership and dialogue between the private sector and key ministries in the energy sector

Figure 13: Private Sector Engagement Recommendations



SUPPORTING GOVERNMENT REFORM

While IKR has made strides in developing an IPP model, it could benefit from strengthening its implementation and ensuring the structure is aligned with accelerating renewable energy growth. Federal Iraq has faced challenges in developing an IPP structure for thermal projects but has an opportunity to implement IPPs for its renewable energy resources on a smaller scale. USAID can play a meaningful role



by supporting the government entities to review existing and planned IPP structures and help establish the necessary policies and regulations that would facilitate increased private investment in the energy sector. The following activities could help USAID support Federal Iraq and IKR to develop and implement IPP models.

- 1) **Develop a robust IPP framework which will encourage the private sector to engage and deliver services in partnership with the public sector:** A strong IPP model should provide reliable, long-term clarity on the roles, responsibilities, costs, revenue streams, and risks for the stakeholders. Developing a bankable PPA is compulsory for successful project development. The PPA design can change, but it must include the price, tenure, and supply commitment (contracted capacity) in order for the investors to begin to arrange financing. For renewable energy, the conditions are more complicated as accurate, high-quality data must be provided to indicate the expected resource variability, availability, efficiency, and the distance from load centers and grid connections. USAID can support both Federal Iraq and IKR to assess the current PPA frameworks, identify potential improvements based on regional and international leading practices, and develop a financial model to help the viability of initial transactions. It may be important to consider including provisions or clauses in the PPA to account for the higher risk profile of Iraq, including robust exit clauses, that may be necessary to attract private investors. Below are some additional steps USAID can support:
 - a) **Help the Government develop a PPP Unit:** Support the establishment of a public-private partnership (PPP) unit to own all IPP projects. This Unit will be part of the MoE but will be separate from the traditional EPC tendering division. The PPP Unit could develop, announce, and manage IPP projects. This Unit would provide training to enhance the capacity of PPP staff in areas such as project selection, prioritization, risk, procurement, and contract management. This unit can also collaborate with the stakeholder working group and should be given a mechanism to fast-track project development, approvals, and priority grid connections. This PPP Unit should also be given a separate investment budget that is allocated for the length of the proposed PPA (20-25 years) plus project development time (two to five years). Investors will be more attracted to projects that have guaranteed off-takers with allocated budgets for the lifecycle of the project. Given that, initially USAID should explore setting up IPPs directly to any large-scale industrial off-takers rather than government owned utility as private industry will have a better credit profile as well as a significant appetite for reliable power provision.
 - b) **Bankable data collection:** Financing renewable energy projects requires bankable data, or data that are considered worthy to make investment decisions on. Requirements for this data are generally that the data are collected over a pre-determined period of time (minimum 12 months), under specified conditions (100m+ hub height for wind), and at pre-determined time intervals (hourly) to show resource availability and strength (capacity factor) and allow financial return modeling. Entities that are new to developing renewable energy projects can delay project development by collecting data that are not bankable by not meeting investment criteria for collection. USAID can work with NREL and IRENA⁶³ to support both Federal Iraq and IKR to collect bankable data.

⁶³ [IRENA-Project-Navigator-2018.pdf](#)

CAPACITY DEVELOPMENT

Implementing a successful IPP model is key to reducing the financial burden on the Federal Iraq and IKR energy sectors and supporting both a sustainable renewable energy program as well as needed expansion in thermal generation. Transitioning from being a power producer to a power purchaser requires different capacities from a project finance, procurement, risk, and project development perspective. USAID is well-positioned to support this change management process and develop the necessary capabilities to implement an initial set of IPPs and open the market to future innovation and development. USAID can support that through the following activities:

- 1) ***Improve transparent IPP development and competitive bidding process through training:*** As mentioned above, it will be key to improve the capacity of a PPP unit to understand the mechanisms and fundamentals of launching a competitive bidding process, which can be done initially through auctions. This training should include design of financial models, competitive procurement processes, technical and financial evaluation of offers, standardization of terms and conditions for bankability, power project finance, and IPP financial analysis. There are a number of institutional changes and strengthening that needs to occur to signal to the market that the government is capable of overseeing these types of transactions. To that end, USAID could help the government look for a concessional financing partner or development finance institution, such as the IFC Scaling Solar program discussed in Section 4.2, to work closely with on the process in order to signal to the private sector that the appropriate checks and balances are in place and there is oversight within the Unit.
- 2) ***Develop an energy services association and market strategy for energy service companies (ESCOs):*** Energy Service Companies (ESCOs) take on the risk of implementing energy efficiency projects and get paid based on the amount of energy saved through the project. ESCOs have been operating successfully in North America and Western Europe for many years but require more support to be sustainable in countries. USAID is well positioned to leverage its experience in developing ESCOs in India and can leverage learning from the Dubai ESCO experience to provide the broad range of support that could establish an initial ESCO model for the extremely nascent and challenging environment in Federal Iraq and IKR:
 - a) ***Support establishing appropriate energy efficiency programs and regulatory framework:*** As outlined in Section 5.2 of this Assessment, USAID can play a key role in the development and implementation of an energy efficiency framework that can begin to create a market space for ESCOs. This includes creating energy efficiency agencies, energy efficiency standards and incentives and, eventually, eliminating subsidies. ESCOs need a strong regulatory framework with relatively cost-reflective tariffs to find cost savings through energy efficient upgrades.
 - b) ***Create a pre-qualification or accreditation program for ESCOs and site certification programs:*** In order to reassure clients of the reliability of the ESCOs and to set a standard for ESCO performance, USAID could support the creation of a prequalification or accreditation

program for ESCOs and a certification process for sites that have completed an energy efficiency retrofitting (similar to the LEED certification program⁶⁴).

- c) **Building awareness around ESCOs:** As part of the awareness program recommended in Section 5.2, USAID can support an ongoing information and awareness campaign to targeted potential clients (such as large industrial and commercial customers) to support building partnerships and providing a central source of information for the sector. This can also include demonstration programs and sharing of success stories.
- d) **Create an ESCO association in Iraq:** Bringing together energy service providers in Iraq into an association or trade group could accelerate the development of the ESCO market, provide a platform for sharing leading practices, highlight market challenges, and provide a connection between public and private sectors. USAID could facilitate the establishment of this association, implement awareness campaigns around ESCOs, and provide trainings to the association on potential pain points, including how to access financing, develop internal human resources, improve profit margins, lobby government for subsidy removal, and contract design.

PILOTS AND PARTNERSHIPS

The role of the private sector in energy service delivery has increased dramatically as utilities have privatized globally. Within the region and even in other post-conflict zones, utilities have begun to elevate the role of the private sector in energy service delivery through IPP models as a first step to utility privatization and reimagining the role of the utility from energy provider to a broader energy company. IPP models at their core require a partnership of the public and private sector to succeed. USAID can play a key role to assist both Federal Iraq and IKR to strengthen the role of the private sector and facilitate stronger connections between public and private actors.

- 1) **Undertake a private sector stakeholder assessment:** Understanding the landscape of domestic private sector stakeholders and segmenting them by their strengths, weaknesses, growth areas, and support needed will help to baseline the immediate opportunities to further private sector engagement and outline the development areas that USAID can support. It will be particularly important to identify the local players and small to medium enterprises (SMEs) to support the capacity development of the Iraqi energy service sector. This can be connected to the suppliers' conference recommended in Section 4.2 of this Assessment.
- 2) **Strengthen private sector partnerships:** USAID can leverage its strength in convening stakeholders to create an IPP sector working group including representatives from MoE, MoO, MoF, and MoP with key private sector representatives from power generation, transmission, and distribution to assess bottlenecks in private sector energy service delivery participation and mitigation measures. Leverage the stakeholder assessment information to ensure full sector participation in the stakeholder working group, which could include a sub-group of private sector players. This group can share leading practices from IPP projects regionally and globally and should have as an aim to strengthen partnerships with the private sector and to facilitate and accelerate the role of the private sector in energy service delivery. It can also start to undertake market activities like developing a pipeline of potential investment opportunities, organizing outreach to international

⁶⁴ [LEED rating system | U.S. Green Building Council \(usgbc.org\)](http://www.usgbc.org)



investors, preparing roadshow materials and background information on the viability of the specific projects, among other activities that help market the investment potential.

6. REDUCTION OF TECHNICAL AND COMMERCIAL LOSSES

In addition to the information outlined in Section 2, the sections below provide more context about reducing technical and commercial losses in IKR and Federal Iraq.

6.1. Structural Reasons for High Losses in Federal Iraq and IKR

STATUS OF TECHNICAL LOSSES

Aggregate T&C losses in the electricity transmission and distribution (T&D) network in Iraq are one of the biggest challenges for the MoE in both Federal Iraq and IKR, affecting the operational efficiency and financial viability of the entire energy sector. Technical losses are naturally occurring losses mainly in the transmission and distribution networks. Iraq's technical T&D losses were 20% in 2019.⁶⁵ Research indicated that Iraq's electricity distribution network is overloaded and in need of significant investment to be able to meet current and future demand. The infrastructure of medium voltage distribution networks is old, outdated, and needs rehabilitation, maintenance, and expansion. Inefficient management of the electrical grid operations and maintenance, due to outdated infrastructure for fuel supplies, affects the whole generation portfolio efficiency. Compounding this challenge, ISIS destroyed up to 20% of the transmission network during the recent conflict and attacks continue, especially to commemorate Saddam Hussein's birth.⁶⁶

Renewable energy alone will not be enough to close the gap between Federal Iraq and IKR energy supply and demand. Even if Iraq meets its very ambitious targets of 12 GW of renewable electricity by 2030, the gap will remain quite large.⁶⁷ Upgrades to the transmission and distribution systems are necessary. Reducing losses by half would improve the efficiency of grid supply, increasing available capacity by 33%,⁶⁸ and 2018 MoE data show that even reducing losses by 10% would yield a reduction of nearly \$100 million in subsidies to consumers.⁶⁹ The Federal Iraqi grid is operated under the recommended frequency level to supply power to a higher number of end-points (i.e. keep more lights on even at a lower quality of power), which is also bad for infrastructure.⁷⁰ When the electrical load on the gas and steam turbines increases, the turbines will operate at a lower speed. If the turbines are at generating capacity and their speed cannot be increased to meet additional demand, then the grid will operate at a lower frequency. This indicates that the grid is overloaded and generally the utility would reduce the demand on the turbines through load shedding or other demand-side adjustments. In order to avoid such load shedding, the Iraqi grid is run at lower frequency which over time can damage equipment connected to the system (motors, etc.). Furthermore, research indicated that generation is the priority at the expense of transmission and distributions sectors of the electricity system.

⁶⁵ <https://www.bayancenter.org/en/wp-content/uploads/2020/08/16449.pdf>

⁶⁶ <https://www.semanticscholar.org/paper/Development-of-a-reform-roadmap-for-the-electricity-Cpcs/107901c95385cf977a405f81c36709390b2605d8?p2df>; [On Iraq Power, And Power Politics: MEES Interview with Lu...](#)

⁶⁷ <https://agsiw.org/iraq-steps-up-solar-energy-plans-with-2-gw-award-to-the-uae/#:~:text=Iraq%20has%20signed%20a%20heads,in%20central%20and%20southern%20Iraq.&text=Iraq%20has%20set%20a%20target,from%20renewable%20energy%20by%202030>.

⁶⁸ https://iea.blob.core.windows.net/assets/fb1f67b9-3515-4b5a-bb40-06ca0b83ef70/Iraq_Energy_Outlook.pdf

⁶⁹ Iraq Residential Tariff Reform Publication

⁷⁰ <https://www.ijsce.org/wp-content/uploads/papers/v3i1/A1348033113.pdf>

Representatives from the IKR MoE stated that demand in IKR ranges from 5 GW to 5.5 GW and is expected to grow by more than 300-400 MW annually, leading to load shedding and a general shortage of power.⁷¹ This excess demand in IKR is exacerbated by similar O&M and infrastructure underinvestment issues prevalent in Iraq and continues to be challenged by the fallout and destruction from the war with ISIS. The former Energy Minister of Federal Iraq stated in a 2019 interview that ISIS destroyed 4.5 GW of electricity production and halted another 2.5 GW of construction.⁷² However, the IKR MoE stated that IKR is developing a T&D master plan to map infrastructure projects with targeted completion years and capital investment priorities for a 10-year period, and that IKR is predicted to have enough natural gas to meet supply needs with gas from their fields by March of 2023.

Currently, O&M is not a priority for either system. Planners' focus is driven by the high-power demand summer season, and Iraq is prioritizing increasing power generation as quickly as possible. O&M discipline is sub-standard. Stakeholder consultations confirmed that O&M is not a priority given the focus on developing additional electricity generation to meet the high electricity demand in the summer, making O&M discipline sub-standard. About 80% of Federal Iraq and IKR's electric meters are over 30 years old, with a significant portion never restored or calibrated.⁷³ This phenomenon, along with underinvestment in T&D, results in the high losses currently experienced in Federal Iraq and IKR.

SCADA Systems

A functioning SCADA system is critical for any utility to manage its grid and effectively integrate and distribute new sources of power. The Federal Iraq MoE began establishing a supervisory control and data acquisition (SCADA) system in 2012 through Distribution Control Centers (DCC) in seven target provinces. The MoE is planning to initiate phase 2 of the DCC plan by using loans through Swedish Export Credit Agencies to cover other provinces. Although this should provide greater demand side management of energy usage, integration among various SCADA systems and the National Distribution Center poses a serious challenge for Federal Iraq due to its complexity. Stakeholder consultations revealed that the existing SCADA architecture is non-functional, underused, and not interconnected. The MoE needs to ensure the system is updated and properly interconnected to provide the necessary data and system control.

STATUS OF COMMERCIAL LOSSES

Estimates vary, but sources consistently state that the range of total electricity lost in distribution from unmetered or stolen electricity can be up to 60%.⁷⁴ Commercial losses may account for over half of the losses in the system. The data indicate that 20% of electricity produced is stolen or unbilled and another 26% is billed but no payment is ever received. There are many structural challenges to payment collection, including in-person collection visits to homes so if no one is home then nothing is collected and a preference by consumers to avoid paying in a government office (also culturally challenging for

⁷¹ <https://www.rudaw.net/english/kurdistan/140720201>

⁷² <https://www.mees.com/2019/2/15/power-water/we-have-very-little-time-mees-sits-down-with-iraqs-electricity-minister/63226520-3147-11e9-88ab-b16d8ba91504>

⁷³ [16449.pdf \(fes.de\)](#)

⁷⁴ https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/Iraq_Energy_Outlook.pdf;
<https://www.bayancenter.org/en/wp-content/uploads/2020/08/16449.pdf>



women). Despite widespread citizen perceptions that electricity is a public good that should be free, customers would be willing to pay for reliable, 24/7 electricity access as evidenced by the high rates individuals and businesses pay for back-up diesel generation. Iraq needs to improve its ability to collect bills from customers and reform grid and tariff regulations for neighborhood generators.

Currently, the sector faces significant challenges; the sector is not solvent as insufficient bill collection lowers revenues and puts more downward pressure on investment in the sector, which reduces the available revenue for critical infrastructure improvements, further reducing consumer confidence, and leading to less likelihood of bill payment.⁷⁵ The system is also negatively impacted by the absence of effective metering, billing systems, and customer management systems. This leads to estimated non-technical losses of 20 TWh.⁷⁶

6.2. Recommendations for USAID Program Activities

Though electricity generation increased to 25 GW across Federal Iraq and IKR and grid upgrades are ongoing, the pace has not matched the need. Commercial losses from lack of payment and power piracy impacts supply and hinders investment. This leads to high losses leading to sustained power shortages in Iraq and no short-term way to bridge the gap between the peak demand and available supply.

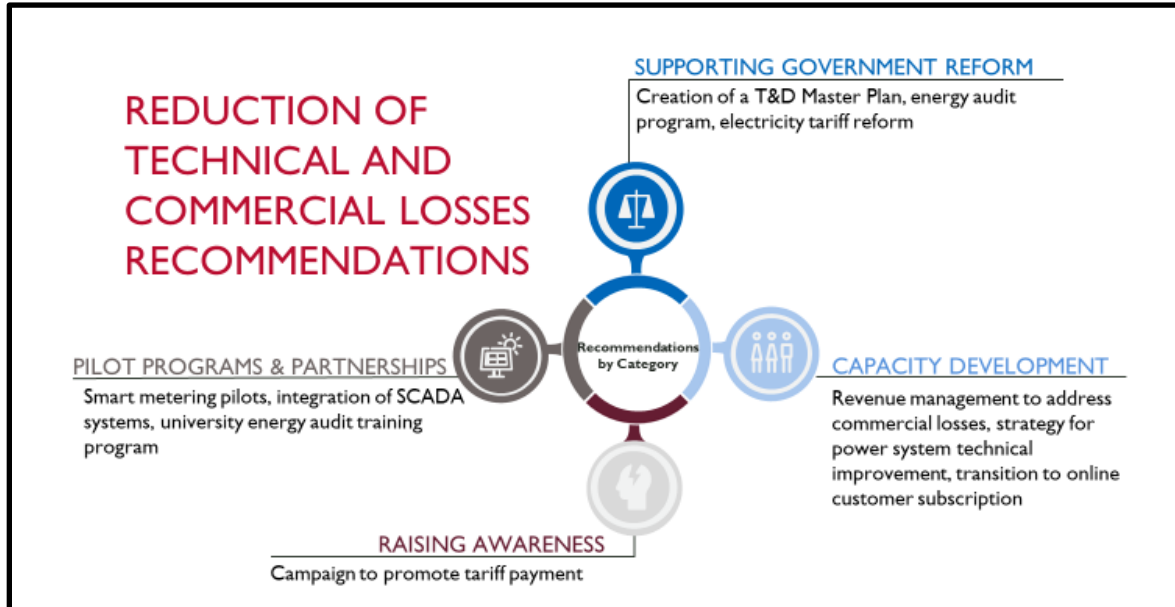
USAID can make an impact on Federal Iraq and IKR's technical capacity to manage their grids and commercial sector management by:

- Supporting the expansion and refinement of a T&D master plan, including improved technical management operating procedures
- Improving revenue management including transitioning to an online customer subscription and payment service
- Studying electricity tariff reform and messaging around securing Iraq's future by reducing the use of limited resources for inefficient power generation
- Partnering to implement key pilots and energy efficiency audit trainings

⁷⁵ <https://iraqenergy.org/product/residential-electricity-subsidies-in-iraq-exploring-options-for-reform-report/>;
<https://gjia.georgetown.edu/2020/01/13/iraqs-power-sector-problems-and-prospects/>

⁷⁶ Idem

Figure 14: Reduction of Technical and Commercial Losses Recommendations



SUPPORTING GOVERNMENT REFORM

Iraq suffers from some of the highest technical and commercial losses in the world, impacting the country’s energy service delivery and the utility’s financial solvency. Reducing both technical and commercial losses is crucial to improving power availability, reducing costs, and positioning Iraq for new investment in generation. USAID has done this with partner countries across many similar geographies, and it would make sense to leverage those tools and lessons learned in Iraq. The following activities could help USAID support Iraq to reduce technical and commercial losses through government reform.

- 1) **Modify and update a T&D Master Plan for Federal Iraq:** Both Federal Iraq and IKR have experience primarily in operating baseload power (thermal and hydro), which is much less complex than intermittent renewables to connect to the grid. With the ambitious renewable energy plans, both utility-scale and distributed, both Federal Iraq and IKR need to have a forward-looking T&D Master Plan that will facilitate the addition of solar PV now and also be flexible enough to incorporate other renewable energy technologies as they develop. Dr. Abdulbaqi, who is working on the solar plans of the MoO, highlighted that Federal Iraq needs more technical support on planning for the energy transition, particularly through a network analysis and how to technically connect new solar. Supporting the development of an updated T&D Master Plan with a focus on solar connectivity in partnership with NREL and the DOE is key to operationalizing growth in the renewable energy sector.
 - a) **Prioritize key components of grid code development:** Inculcate a sense that the energy system is a holistic system and develop regulations and standards that emphasize this systemic view. Maintaining grid reliability requires performance standards and technical requirements for the behavior of all participants in the power system, especially for distributed and renewable generation sources. A reliable grid has contributions from up and down its "value chain" and this necessitates visibility down to the distribution level. The grid code should be updated in a

manner that is conducive to the flexibility necessary for a 21st century grid (higher levels of variable renewable energy, rooftop solar and other distributed energy resources, etc.).

- b) **Reform grid operating procedures:** Proper grid operating procedures are key to protecting the equipment, increasing system efficiency, and optimizing performance. USAID can play a key role as a transparent broker to support reform on grid operating procedures by working to persuade MoE and other stakeholders of the importance of following leading practices for grid operating procedures, establishing training and exchange programs for current operational staff, and highlighting priority operational practices.
 - c) **Promote grid stability training:** Partner with NREL to train Iraqi government officials and employees on the need to reduce frequency oscillation, an imperative step for integrating renewable energy. The grid frequency is currently allowed to oscillate by 5-10 Hz, which impacts the long-term viability of the grid and would inhibit the connection of any renewable energy generation assets, as it would require that the renewable energy assets are run in island mode. USAID could also partner with DOE to bring in experts to address key topics of grid infrastructure security, stability monitoring, and other fundamental power systems engineering concepts.
- 2) **Assist MoE to introduce energy audits up to the distribution transformers:** As outlined in Section 4.2 of this Assessment, implementing a program to conduct energy audits can identify areas of key technical losses. This program should introduce utility-scale audits to the level of the distribution transformers to have a holistic view of energy losses from the HV, MV, and LV networks and support prioritizing upgrades at each level of the system.
- 3) **Begin to engage on electricity tariff reform:** Tariff reform is a challenging and politically charged process that needs to be based on leading practice structure and balanced with contextual realities. USAID can help design a program for a gradual increase of the electricity tariff, despite the political sensitivity of the issue, by between 5% and 15% per year. These increases should be nuanced enough to not impact low-income citizens and customers without an ability to pay (especially if done in conjunction with direct social security transfers to the most vulnerable groups) while still allowing for rates to approach cost-recovery levels over time. Working through the stakeholder group outlined in Section 3.2, USAID can help outline a plan and develop a timetable to increase tariffs by removing subsidies while shifting financial support to the poor and at-risk communities through direct social security transfers. This will be a large undertaking on behalf of the government and should be done carefully and based on leading practice structures for tariff reform, utilizing tariff specialists, and pairing them with designated points of contact in the relevant ministries. USAID should engage with the MoE on tariff reform once there is momentum on other underlying components of utility and sector reform. The overall goal is to help electricity rates slowly approach cost-recovery level. These efforts should be conducted in tandem with designing energy efficiency measures to support the adoption of energy efficiency mandates through clear electricity price signals to the market. Because of the sensitivity of this reform, it will be important to pair this with a tailored outreach campaign that can be tied to the energy efficiency awareness outlined in Section 4.2. The campaign should highlight the importance of reducing consumption to conserve Iraq's O&G resources and to improve the solvency of the utility to be able to deliver better services and invest in future energy infrastructure. This is addressed further in the Raising Awareness section below.



CAPACITY DEVELOPMENT

As Federal Iraq and IKR are beginning to implement their ambitious renewable energy targets, the country will need robust management of the grid, its operations, bill collection, technical challenges, and service pain points. USAID has significant experience with complex capacity development in transitioning energy sectors. Below are some areas USAID can provide particular impact in capacity development to support the reduction of technical and commercial losses:

- 1) **Revenue management:** Fund a study to help MOE to address the sector's high commercial losses, centered on revenue management operations including two main elements of billing and collections efficiency. USAID can focus its support on understanding the process for (a) procurement and installation of a new billing system and the businesses processes and human capacity building necessary to implement that system; and (b) outsourcing of revenue management services (also known as Collection and Service Contracts for meter reading and electricity sales revenue collection). Both of these elements need to be paired with improved, modern meter deployment, as outlined in Section 4.2 of this Assessment.
- 2) **Strategy for improving power system components, services, and spare parts:** As part of developing the mindset around proper system planning and operating procedures, USAID can assist MoE to ensure T&D equipment technical specifications are up to date and in line with leading environmental specifications. It is equally important to ensure that the necessary spare parts are budgeted for and stocked in-country to facilitate faster maintenance and continue developing a strong O&M culture.
- 3) **Distribution network capacity reinforcement:** Much of the AT&C losses happen through the distribution network. Identifying the technical losses through a study of reconductoring of existing lines with higher capacity conductors will result in a reduction in technical losses and provide greater power savings annually. Strengthening this network will improve supply reliability as well and contribute to decreasing the reliance on diesel generators.
- 4) **Transition to online customer subscription and service requests:** Improving energy service delivery and engaging end-users through online systems that customers can easily use and interact with is key to transitioning Federal Iraq to a more dynamic energy system and facilitating bill payment compliance. IKR has already transitioned to an online system for customer subscription requests, significantly reducing the number of steps and time needed to request a new power connection. The Federal Iraqi Government could benefit from implementing a similar system and expanding it to include service requests and outage reports. Improved service and customer experience through digitized systems could also support gaining acceptance of tariff reforms if the public feel their energy service delivery has improved. Eventually, this system can be used to offer online payments for both prepaid and postpaid energy services. Allowing online payments can also improve some of the structural challenges to payment collection outlined above.
- 5) **Strategy to improve and incentivize bill collection:** Improving bill collection rates is critical to reducing commercial losses. The MoE of Federal Iraq and IKR could benefit from an assessment of the performance and effectiveness of bill collection processes and agents currently, with a focus on how to incentivize improved collection performance. Such performance-based incentives would need to be studied to optimize the incentive strength and timing of the disbursement of financial rewards.

PILOTS AND PARTNERSHIPS

While there have been some initiatives to reduce technical and commercial losses through substation upgrades, limited pilot smart meter projects, and private bill collection, Iraq's challenges in this area are extensive. Pilots and partnerships can demonstrate technical and commercial viability and benefits to accelerate action. USAID has partnered with many countries to develop pilots that reduce AT&C losses and is well positioned to leverage those learnings to drive key new small pilots with community groups, local associations, and other civic focal points and to develop strong partnerships to help improve Iraq's power sector by making it more viable. Several ways in which USAID can begin to develop some key pilot projects and establish necessary partnerships are listed below.

- 1) ***Pre-paid and smart metering pilot projects:*** As outlined in Section 4 of this Assessment, pre-paid and smart metering is key to both increased energy efficiency and to reduction in commercial losses for different types of customers and tariff classes. In particular, pre-paid meters are a low-cost, very effective technical solution to help individuals manage their energy consumption and to help the manage its non-technical losses. As the utility swaps out and replaces meters part of its regular O&M, USAID should partner with the utility to support a pre-paid meter pilot on a particularly high-loss feeder. Accelerating a smart metering pilot project and scaling up the project across small commercial enterprises will support Federal Iraqi and IKR to improve their fee collection and facilitate improved collection of system data.
- 2) ***Integrate SCADA systems:*** MoE established SCADA in 2012 through control centers but only finished four out of seven targeted areas. DAI is leading a USAID-funded initiative to integrate SCADA systems with a national distribution center. Having a fully functioning and comprehensive SCADA system is critical for a functioning grid that is able to incorporate new generation and manage new customers. USAID should continue to support this system integration and build in any modalities necessary to incorporate new sources of renewable energy generation.
- 3) ***Start university training program to develop university-level energy audit teams:*** As outlined in Section 4.2 of this Assessment, developing the capacity to perform energy audits across public and non-profit buildings will be key to implementing a plan to improve energy efficiency through building retrofits. USAID could partner with the engineering department of a major university to develop a team of university students who can assist in conducting energy efficiency audits in that city. These students can then be recruited to staff the energy efficiency division of the MoE or even go on to develop ESCOs. Connecting the development of this capacity to conduct energy audits to undergraduate curriculum will help sustain the necessary talent development to support an impactful energy efficiency sector.
- 4) ***Identify a network of community and civic groups and business associations to work with on a non-technical loss reduction pilot:*** Reducing non-technical losses that result from non-payment, inability to collect, and customer theft are a delicate and nuanced area for a utility to address and it often takes working together with a strong community partner to identify the drivers for non-technical losses, development of nuanced and effective strategy to address those losses, and credibility of that community partner to help the utility overcome historical relationship issues. To improve the levels of non-payment in target customer segments and specific areas of the service territory, USAID can drive identification and outreach to the partner, help equip that partner with background and technical resources to work with the MoE on losses, and make sure both the utility and the community partner are working in sync to identify and drive down losses. Delivering and



crafting the message on why theft and non-payment are problematic for the sector, and thereby the country as a whole, needs to be a delicate exercise, driven by organizations that really understand customers', both residential and, motivations and challenges.

RAISING AWARENESS

Across both Federal Iraq and IKR, the public, citizens, and industry need to be into the value proposition of bill payment and respect for the electricity system as key to Iraq's energy future. Creating improvements in non-technical losses, specifically collections losses, requires both improved enforcement on collections and more disciplined accounts practices as well as an investment on the utility side to better engage customers, to explain customer rights and responsibilities, and to help end-users more effectively engage with the electricity company to demand and receive better service. This is most effectively done through civil society groups and associations that represent the better customer segments. Activities to raise awareness and engage citizens, associations, and the media intersect well with USAID Iraq's capabilities in its economic growth and governance mechanisms. Potential activities USAID could explore include:

- 1) ***Campaign to promote bill payment:*** Engaging customers to have a better payment culture is key to the long-term viability of both Federal Iraq and IKR's energy sectors, and more broadly, their economies. USAID should undertake an assessment of the existing associations and community organizations to identify those that would be the viable conduits to engage with on the utility – customer relationship and the associated responsibilities that are related to that relationship. This should include a deep dive analysis on what the most effective marketing and messaging strategies are to drive improved bill payment for each type of customer class – residential, commercial, and industrial. There are many different types of messaging that may compel billing and collections compliance, such as connecting with citizens on proper payment behavior to drive a better functioning electricity system which, in turn, drives more efficient utilization of Iraq's natural resources. Facilitating awareness of limited resources and the cost to the government and, ultimately, the Iraqi people, may be a viable message to promote a cultural shift towards improved electricity tariff payments. As outlined in Section 4.2 of this Assessment, this civic and stakeholder analysis can be paired with a study on the sustainability benefits of energy efficiency and the opportunity cost assessment of burning hydrocarbon resources for power generation. Uniting these message may help to change consumer mindsets on bill payment. There are several other activities that align this civic and stakeholder analysis and public relations campaign.
 - a) As with previous recommendations in Sections 3.2 and 4.2, choosing the right communication channels are key to having the public believe and endorse the messages. Social media, particularly Facebook and YouTube, are generally more trusted and more frequented platforms. Engaging active civic groups and associations will be critical as direct messaging from the government may not be impactful due to the significant trust deficit.
 - b) The key message is that the ability of both Federal Iraq and IKR to deliver reliable power, invest in future power infrastructure, and not waste the country's oil wealth is dependent on customers paying cost-reflective tariffs. The messaging can come from independent experts, partners from energy efficiency pilots, key influencers, the private sector, civil society, and academia.



- c) Monitoring the media outreach campaign performance will provide important feedback for refining messages, refining chosen communication channels, and improving audience segmentation for more targeted messaging campaigns.

2. Help the utilities partner with the community to provide other ancillary services and ameliorate its customer engagement: It is clear there is broken trust between the utility and the public, particularly in Federal Iraq, and that this contributes to a culture of non-payment and animosity. USAID can partner with the utility's customer service or distribution department to help design a limited number of outreach efforts to key customer segments to both engage on bill payment issues, while also offering other services that can improve customers' lives and livelihoods, such as fast tracking or streamlining applications for licenses and government identifications. In some instances, where there is limited actual ability to pay, the utility can partner with community associations or associations to provide job trainings, plan a job fair, or co-organize a registration event with other national and provincial government entities to help informal business register for official licenses or other official inputs that had been out of reach in the past. Engaging and targeting high-profile communities at the outset, to demonstrate the utility's impact, can help a broader set of citizens see the impact the utility is trying to make the community and improve its overall reputation, thereby eventually facilitating improved payment.

7. ENVIRONMENTAL RISK MITIGATION

In addition to the information outlined in Section 2, the sections below provide more context about mitigating environmental risk in IKR and Federal Iraq.

7.1. Environmental Considerations in Federal Iraq and IKR

WATER INSECURITY AND OTHER CLIMATE CHANGE-RELATED THREATS

The UN categorizes Iraq as one of the most “at-risk from climate change impacts” areas in the world and the fifth most vulnerable country to decreased water availability and rising temperatures.⁷⁷ Climate change related impacts, primarily decreasing water quality and availability, increasing temperatures, and intense droughts, lead to a decline in productivity in all sectors which ultimately impacts the energy sector. As each of these impacts grows in severity, internal migration increases, political stability decreases, the agriculture sector becomes less productive, and all of this impacts the ability of Federal Iraq and IKR to deliver high-quality electricity.⁷⁸

Federal Iraq operates several large dams, and IKR has historically relied on hydro power to meet a portion of its power needs.⁷⁹ Hydro is attractive in that it is both a baseload power and a type of clean energy. However, lack of water resources could impact the future hydro plants as Turkey, Syria, and Iran have restricted the amount of water flowing into Federal Iraq and IKR. Approximately 70% of Iraq’s water supply originates from neighboring countries.⁸⁰ Water flow in the Tigris and Euphrates rivers accounts for 98% of Iraq’s surface water supply.⁸¹ In the past 40 years, water flow in the Tigris has fallen by 29%, and water flow in the Euphrates has dropped by 73%.⁸² This flow level is expected to continue to decrease, posing a risk to hydropower as a cornerstone of Iraq’s renewable portfolio and eliminating farmers’ livelihoods.⁸³ Federal Iraq’s hydropower facility output has been on the decline for the past several decades, due to these lower water levels as well as poor construction and damage from the war with ISIS.⁸⁴ Poor water management practices have reduced the quality of the water available to citizens, with 100,000 Basra residents hospitalized in 2018 due to poor water quality issues.⁸⁵

Temperatures in Southern Iraq are starting to regularly exceed 125 degrees Fahrenheit in the summer.⁸⁶ Increasing temperatures can cause additional disruptions to an already inefficient grid. These high temperatures reduce the availability and efficiency of thermal plants, especially in the summer, and can also damage transmission lines, transformers, and other pieces of infrastructure.⁸⁷ Another impact of these high temperatures and low rainfall is the decline in agricultural productivity. This decline is forcing

⁷⁷ <https://www.iraq-businessnews.com/2021/11/01/a-climate-change-initiative-to-transform-iraq/>

⁷⁸ https://iea.blob.core.windows.net/assets/fb1f67b9-3515-4b5a-bb40-06ca0b83ef70/Iraq_Energy_Outlook.pdf

⁷⁹ https://www.researchgate.net/publication/315908006_Present_and_Future_for_Hydropower_Developments_in_Kurdistan

⁸⁰ https://iea.blob.core.windows.net/assets/fb1f67b9-3515-4b5a-bb40-06ca0b83ef70/Iraq_Energy_Outlook.pdf

⁸¹ https://www.researchgate.net/publication/236119760_Evaluation_Of_Quality_Of_Drinking_Water_From_Baghdad

⁸² <https://iraq.un.org/en/161240-iraq-joins-paris-agreement-un-calls-further-support-help-country-adapt>

⁸³ <https://www.washingtonpost.com/world/interactive/2021/iraq-climate-change-tigris-euphrates/>

⁸⁴ https://www.atlanticcouncil.org/wp-content/uploads/2020/12/Iraqs_Energy_Security_Strategy.pdf

⁸⁵ https://iea.blob.core.windows.net/assets/fb1f67b9-3515-4b5a-bb40-06ca0b83ef70/Iraq_Energy_Outlook.pdf

⁸⁶ <https://www.npr.org/2021/11/07/1051468823/iraq-marshes-climate-change-cop26>

⁸⁷ <https://www.eenews.net/articles/4-issues-to-watch-as-heat-disrupts-the-grid/#:~:text=Along%20with%20spiking%20electricity%20demand,less%20efficient%20in%20the%20summer.>



those who rely on agriculture to move to cities and putting additional strain on already stressed power infrastructure and low quality of services.⁸⁸

ENVIRONMENTAL IMPACTS OF OIL AND GAS ACTIVITIES

Federal Iraq's large portfolio of oil and natural gas-fired generation combined with significant levels of gas flaring has contributed significantly to poor air quality, water pollution, and CO₂ emissions and feeds the negative loop of climate change in the country. This has resulted in a wide range of damage both to the environment and public health, especially in the southern oil-rich provinces. Flaring operations emit carbon dioxide, methane, sulfur dioxide, and other toxic gases which are major contributors to global warming, have detrimental health impacts on Iraqi citizens, and cause negative impacts on the environment such as acid rain and ozone and smog formation.⁸⁹ Flaring alone contributes an estimated 30 million tons of CO₂⁹⁰ and Federal Iraq and IKR account for 8% of global methane emissions despite accounting for .5% of the global population.⁹¹

Serious and devastating health impacts are directly related to fossil fuel-fired generation. Cancer rates in Basra are growing at an alarming rate, with 800 new cases being recorded each month (though some of these can be attributed to depleted uranium dust from the Gulf War).⁹² Citizens continue to suffer from fallout from the war with ISIS, as ISIS militants set fire to oil wells and mineral stockpiles, and with limited resources for bioremediation.⁹³

PLANS AND COMMITMENTS

The Ministry of Environment spearheaded an initiative to increase the awareness of the Iraqi society towards the effects of climate change, which led to national action and resulted in the Iraqi parliament's ratification of joining the Paris agreement. The Iraqi Government announced its accession to the Paris agreement in accordance with law No.31 of 2020.⁹⁴

In September of 2020, Federal Iraq began work with the UN Environmental Program (UNEP) and the Green Climate Fund to develop the National Adaptation Plan (NAP) which the UN has helped many other countries develop and implement.⁹⁵ The NAP is intended to reduce Iraq's vulnerability to the negative impacts of climate change through identifying gaps in climate knowledge and build adaptive capacity by strengthening institutional, technical, and financial capabilities.⁹⁶ Federal Iraq also intends to

⁸⁸ <https://www.npr.org/2021/11/07/1051468823/iraq-marshes-climate-change-cop26>

⁸⁹ <https://today.tamu.edu/2020/08/03/the-problem-with-natural-gas-flaring/>; <https://www.trtworld.com/magazine/how-the-oil-industry-is-making-iraqis-sick-52514#:~:text=Iraq%20was%20the%20world's%206th,it%20comes%20to%20gas%20flaring.&text=Oil%20flaring%20operations%20emit%20CO2,global%20warming%20and%20climate%20change.>

⁹⁰ https://iea.blob.core.windows.net/assets/fb1f67b9-3515-4b5a-bb40-06ca0b83ef70/Iraq_Energy_Outlook.pdf

⁹¹ https://iraq.un.org/index.php?option=com_k2&view=item&id=12935:iraq-mulls-tackling-its-methane-problem-and-reaping-major-benefits-along-the-way&Itemid=605&lang=en; [https://www.worldometers.info/world-population/#:~:text=The%20current%20world%20population%20is,currently%20living\)%20of%20the%20world.](https://www.worldometers.info/world-population/#:~:text=The%20current%20world%20population%20is,currently%20living)%20of%20the%20world.)

⁹² <https://www.al-monitor.com/originals/2019/06/iraq-health-basra-cancer.html>

⁹³ <https://www.unep.org/news-and-stories/story/crude-impact-cleaning-ravages-war-iraq>

⁹⁴ <https://iraq.un.org/en/161240-iraq-joins-paris-agreement-un-calls-further-support-help-country-adapt>

⁹⁵ <https://www.iraq-businessnews.com/2020/09/18/iraq-launches-plan-for-climate-change-resilience/>

⁹⁶ https://www.unep.org/news-and-stories/press-release/iraq-launches-national-adaptation-plan-process-climate-change?_ga=2.266298767.1222031093.1643125978-838240530.1643125978



reduce methane emissions from multiple sectors by 15% by 2030, which will have a positive impact on air quality locally and an overall reduction in emissions that contribute to climate change.⁹⁷

Federal Iraq passed the Law of Protection and Improvement of the Environment in 2009, but it is not clear to what extent this law has improved environmental outcomes in the country.⁹⁸

7.2. Recommendations for USAID Program Activities

USAID can help steer Iraq, a country extremely vulnerable to climate change and whose citizens are vulnerable to the environmental impacts of the oil and gas sector, closer to a path of sustainable development. Supporting programming that enhances the government's ability to reckon with environmental issues, that provides the energy sector workforce with the tools and training necessary for a lasting transition, and that increases citizen awareness of their environment are all ways USAID's interventions can mitigate environmental risks. Many of the previous recommendations in earlier sections will help to mitigate and adapt to climate change. Implementing energy efficiency standards and retrofitting buildings will prevent energy waste and decrease overall system load, thus decreasing greenhouse gas (GHG) emissions. In addition, upgrading the T&D network to address technical losses will similarly reduce system load and thus GHG emissions. Finally, deploying both utility scale and distributed solar will reduce GHG emissions from thermal power plants and diesel generators.

USAID can make an impact on Federal Iraq and IKR's commitment to environmental risk mitigation and can build on the momentum of the Parliamentary ratification of the Paris climate accord⁹⁹ by:

- Taking actionable steps toward climate change mitigation and adaptation through developing a GHG emissions inventory and methane reduction strategy, partnering to perform a climate risk assessment on the energy sector, and working with citizen groups to advocate for climate-forward policies
- Building the capacity of female engineers in key skills of environmental risk mitigation that will impact Iraq in the future
- Promoting green supply chains through incentives to government suppliers who demonstrate climate-forward commitments

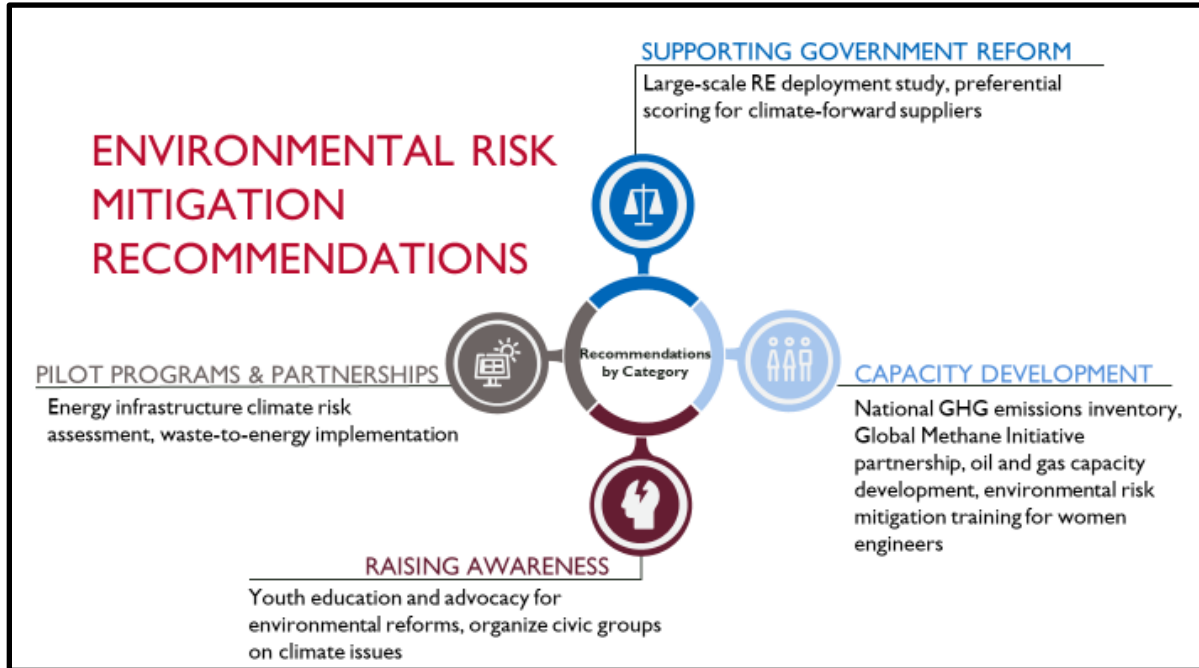
⁹⁷ <https://www.ccacoalition.org/en/news/iraq-includes-methane-its-nationally-determined-contributions-citing-health-and-development>

⁹⁸

https://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=89060#:~:text=This%20Law%20aims%20to%20improve,and%20cooperating%20with%20other%20Ministries.

⁹⁹ [Iraq approves Paris climate accord in step toward curtailing oil dependence - Al-Monitor: The Pulse of the Middle East](#)

Figure 15: Environmental Risk Mitigation Recommendations



SUPPORTING GOVERNMENT REFORM

Mitigating environmental risk will be achieved in large part through diversifying the energy mix to include a significant percentage of renewable energy, implementing strong energy efficiency standards, and reducing technical and commercial losses in the national T&D infrastructure, as outlined in Sections 2, 4, and 6 of this Assessment. USAID can play a meaningful role supporting government entities to put in place comprehensive policy reform to support achieving these goals. The following activities could help USAID support Federal Iraq and IKR to mitigate environmental risk.

- 1) **Conduct a study to show the potential for large-scale deployment of renewable energy to defray the environmental cost of burning diesel, HFO, and gas:** Given the high environmental and health impacts of burning diesel, HFO, and gas for power generation, conducting a study to demonstrate the potential to improve the environment and decrease disease can support increased public buy-in for renewable energy and energy efficiency initiatives. The study should focus particularly on how both distributed and grid-connected solar PV and energy efficient building retrofits and energy efficient appliances and air conditioners can dramatically reduce the need for diesel generators in the short-term and reduce overall system demand in the long-term, allowing Federal Iraq to retire liquid fuel power generation plants. This should include an opportunity cost assessment of not switching to environmentally-friendly power generation technologies, including economic and health costs. In addition, the study can offer a market analysis of the “price to beat” inflection point where customers would be incentivized to choose renewable energy resources instead of liquid fuels. This study could also build off of Iraq’s Nationally Determined Contributions (NDCs) outlined when Iraq joined the Paris Agreement in 2021. Specifically, Iraq committed to cut 1-2% of CO₂-equivalent emissions from industry, develop 12GW of renewable energy, increase



investment in natural gases, and assess the opportunity for \$100 billion investment in green economy from both the public and private sector over the next decade.¹⁰⁰

- 2) **Explore preferential scoring for climate-forward suppliers:** As the MoE in Federal Iraq and IKR continue to develop large-scale infrastructure projects, especially in renewable energy, T&D, and energy efficiency, the government should explore preferential scoring for bids by climate-forward suppliers. Policies that give a higher weight in scoring for projects to companies that can provide green technology and demonstrate climate-forward initiatives internally can promote increased environmentally friendly policies among key suppliers. Tendered projects have weighted scoring for the technical and commercial components of the bids. By adding a component to improve a supplier's bid by detailing company-wide climate initiatives, such as Siemens Gamesa's 2050 net zero goal¹⁰¹ and GE Renewable Energy's carbon neutral footprint pledge,¹⁰² the Iraqi government can promote green policies among major private sector players. This can be modeled on initiatives in neighboring countries to improve bidder scores by proving in-country content (e.g. IKTVA¹⁰³ in Saudi Arabia and ICV¹⁰⁴ in Oman). These measures can be included as part of the procurement policy development as outlined in Section 5.2 of this Assessment.

CAPACITY BUILDING

Iraq is facing significant climate and environmental issues from poor water quality, soil salinity, deterioration of key ecosystems, and the threat of water shortages. Population growth, war, poor land use planning, and global climate change impacts threaten the agricultural sector, water resources, human health, and energy infrastructure. USAID is well placed to support Iraq to begin developing the necessary capacity to address and mitigate environmental risks.

- 1) **Support for developing a national GHG emissions inventory:** Iraq is suffering from increased annual mean temperatures (an increase of 1-20 C between 1970-2004 according to the World Bank) with expectations that Iraq will continue to suffer higher temperatures and a decrease in annual rainfall.¹⁰⁵ Understanding current emissions, past trends, projecting future emissions, and identifying sectors for mitigation is key to managing national emissions. In addition, Iraq signed and ratified the Paris Agreement, which will require countries to begin reporting national GHG inventories starting in 2024.¹⁰⁶ Building a GHG inventory will require institutional and technical capacity building, including the establishment of a sustainable inventory management system and developing the technical capacity to ensure proper methodology, data collection, and documentation. The U.S. Environmental Protection Agency (EPA) offers bilateral capacity building to help developing countries build these capabilities through their Transparency Accelerator initiative. The Transparency Accelerator for Greenhouse Gas Inventories, developed with the U.S. DOS, includes toolkits to build GHG inventory management systems tailored to local conditions and

¹⁰⁰ [As Iraq joins Paris Agreement, UN calls for further support to help the country adapt | United Nations in Iraq](#)

¹⁰¹ [Siemens Gamesa's climate goals verified by Science Based Targets initiative - future Net Zero](#)

¹⁰² [CARBON NEUTRAL | GE Renewable Energy](#)

¹⁰³ <https://iktva.sa/>

¹⁰⁴ <http://incountryvalueoman.net/>

¹⁰⁵ [Environmental risks in Iraq.pdf \(publishing.service.gov.uk\)](#)

¹⁰⁶ [Capacity Building for National Greenhouse Gas Inventories | US EPA](#)

software to estimate emissions and removals from agricultural and forestry activities.¹⁰⁷ Leveraging USAID's deep experience in climate action and relationships with DOS, NOAA, and EPA will support both Federal Iraq and IKR to develop robust GHG emissions inventories to build the foundations for climate mitigation.

- 2) **Partner with the Global Methane Initiative (GMI) to reduce methane emissions from Iraq's O&G sector:** Methane pollution is responsible for more than 25% of global warming according to the UNEP's Energy and Climate Branch.¹⁰⁸ Iraq's O&G sector is responsible for approximately 8% of world methane emissions despite only producing 3% of global oil and gas.¹⁰⁹ While Iraq has indicated a desire to reduce methane emissions from O&G production, including signing the Global Methane Pledge¹¹⁰, it is imperative to build the domestic capacity in methane measurement to build a national methane baseline. In addition, Iraq needs to develop methane reduction targets while assessing opportunities to redeploy the methane into power generation. The UNEP is leading the Global Methane Alliance (GMA) under the GMI to bring together international organizations, non-governmental organizations, financing institutions, and O&G producers to develop methane reduction targets for the O&G industry.¹¹¹ Reducing methane emissions can be developed as part of the overall GHG reduction targets for Iraq.
- 3) **Develop environmental management capacity in the O&G sector:** USAID can partner with the MoE to develop the capacity of engineers to control oil spills and reduce pollution using new technologies. USAID could facilitate workshops or other training programs to targeted participants identified in partnership with the MoE to provide training that will lead to improved environmental outcomes through reduced spillage or leakage from oil extraction and exploration operations. This was previously identified as a priority area of intervention in Iraq's 2013 National Strategy and Action Plan.¹¹² Training on environmental monitoring and early warning systems for incident response could also be key components of this training.
- 4) **Promoting women's participation in STEM:** Developing innovation, science, and technology capabilities and programs are key to achieving sustainable development. Promoting full and equal access to, and participation in, STEM for women and girls is a fundamental component of both achieving development goals and increasing gender equality and empowerment. USAID could consider delivering a training for female engineers in the areas of environmental risk mitigation (infrastructure resiliency, water and waste management, drought mitigation, decarbonization, agricultural management and innovation, and carbon accounting) that will impact Iraq's future. Developing these important technical capabilities will support Iraq to better address current challenges and plan for future needs. This could be paired with a similar training for female university students in engineering and accounting along with career guidance on how to translate these skills into a professional career.

¹⁰⁷ [Transparency Accelerator Fact Sheet \(epa.gov\)](#)

¹⁰⁸ [Iraq mulls tackling its methane problem and reaping major benefits along the way | United Nations in Iraq](#)

¹⁰⁹ [Idem](#)

¹¹⁰ [In face of climate crisis, Iraq takes on methane pollution \(unep.org\)](#)

¹¹¹ <https://globalmethane.org/challenge/gma.html>

¹¹² [https://wedocs.unep.org/bitstream/handle/20.500.11822/8726/-The%20National%20Environmental%20Strategy%20and%20Action%20Plan%20\(2013%20E2%80%93%202017\)%20for%20Iraq-2013National_Environmental_Strategy.pdf?sequence=4&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/8726/-The%20National%20Environmental%20Strategy%20and%20Action%20Plan%20(2013%20E2%80%93%202017)%20for%20Iraq-2013National_Environmental_Strategy.pdf?sequence=4&isAllowed=y)



PILOTS AND PARTNERSHIPS

Environmental considerations are increasingly becoming top of mind for Iraqis. A water crisis in Basra in 2018 led to 118,000 hospitalizations and violent protests¹¹³ as people were sickened by polluted drinking water and increased salinity in the Shatt al-Arab, the key water source for Basra. Increasing impacts from climate change will only exacerbate these climate challenges. USAID's extensive experience in supporting climate action in developing countries, such as the USAID/Jordan Country Development Cooperation Strategy Annex on Climate Change Analysis, can be leveraged to bring in key partners and develop pilots to provide impactful environmental risk mitigation programs.

- 1) **Partner with the U.S. DOE to perform a climate risk assessment on energy infrastructure:** Climate change is already impacting Iraq with drought and water shortages, which have economic, political, and health impacts. Energy infrastructure planning needs to include an assessment of climate risk and adaptation of investment plans. A systems approach is necessary to assess risks across infrastructure and build a comprehensive national strategy to mitigate climate effects on current assets and adapt future infrastructure investments to the realities of climate change. Partnering with the U.S. DOE to perform a climate risk assessment will provide actionable outcomes and key sectors to provide impactful investment.
- 2) **Explore Waste-to-Energy (WTE) options to curtail emissions and innovatively meet generation needs:** Currently the potential to generate electric power from waste, which contributes to reducing and transforming accumulated waste into sustainable resources, is not utilized in Iraq. This requires sound environmental management of solid waste starting from separation and treatment of waste to final disposal and linkage to organic gas production utilities using plasma converters to produce clean fuel. Implementing WTE can decrease the rates of gaseous emissions (such as methane), improve the environment surrounding landfills, improve waste management, and provide an economic return. USAID can support an initial study to identify specific sites for this opportunity and its technical feasibility and guide the government through a pilot for an initial, small-scale WTE plant in Iraq.

RAISING AWARENESS

Across both Federal Iraq and IKR, the public and citizens need to be aware of their role in taking climate action and reducing environmental impacts from the energy sector. Activities to raise awareness and engage citizens, associations, and the media intersect well with USAID Iraq's capabilities in its economic growth and governance mechanisms. Potential activities USAID could explore related to how to promote awareness and motivate action include:

- 1) **Engage civic groups to campaign for the government to prioritize the environment:** Bringing together civic groups and non-profits active in environmental preservation and combatting climate change could help amplify their voice and drive meaningful change. USAID could outline key actors both domestically and internationally and organize them to lobby the government for of the environment. In addition, USAID could support a public-private dialogue between these groups and industry to make investments and projects more climate-resilient and efficient while also driving

¹¹³ <https://www.hrw.org/news/2019/07/22/iraq-water-crisis-basra>



better health outcomes. This type of public engagement with the private sector can help projects to get approved more quickly and harness civic momentum.

- 2) ***Engender a culture of climate action and improve environmental sustainability by educating youth to advocate for environmentally conscious reforms:*** The government needs to focus particularly on supporting talented youth who are promoting action on climate change and environmental and health priorities that impact the economic future of the country and its citizens. Within this, USAID can focus on supporting programs that educate students and youth on the mechanics of a sustainable energy transition and how they can influence that process. Conduct a baseline study on how to integrate the environmental dimension in the country’s educational framework, to promote environmental awareness at all social levels from primary school to university. It will be necessary to develop an integrated plan for environmental awareness and education programs, identify executing bodies and coordinate their tasks, roles, and fields of work. USAID can leverage the study to design and implement awareness campaigns targeted at schools and universities. From there, USAID can support Federal Iraq and IKR to create a curriculum on environmental topics, environmental pollution and protection, and climate change. This curriculum should be taught at the elementary, middle, and high school levels to instill a broader commitment to climate action. Prioritize apprenticeships, internships, “day in the life”, prize competitions judged by technical professionals and other ways to provide direct experience with individuals working on environmental priorities in the sector.



8. CONCLUSION

The Iraqi energy sector has faced numerous and complex challenges across the entire energy value network. Federal Iraq set a target of energy independence by 2030, including 30% power generation from renewable energy while IKR is looking to the pace of economic development, both of which will require diversifying the energy mix, decreasing demand through energy efficiency measures, increasing the role of the private sector, improved bill collection, and implementing climate-resilient policies. Achieving these goals will require a mix of policy development and implementation, increased capacity for public, private, and non-profit sectors, partnerships between public and private actors with pilots to prove concepts, and regular messaging to increase support for these programs.

Achieving sustainable and impactful results will require thoughtful, tailored, and measured solutions. The stakeholder landscape is complex, fluid, and lacks transparency. Changing entrenched mindsets and behaviors will be challenging. Instability and insecurity continue to undermine growth. Key gaps, including capacity, financial, and technical, impede successful reform. But with challenge and risk comes opportunity. USAID can play a meaningful part in reforming Federal Iraq and IKR's energy sectors to support overall growth. Leveraging USAID's strengths and experience in supporting policy reform, developing partnerships, providing capacity building trainings, convening stakeholders, and developing and implementing new programs, USAID can deliver meaningful results.

APPENDIX A: QUESTIONNAIRE

Iraq SUPER Interview Questions

- 1) Potential investment opportunities for increasing integration of renewables into the national energy mix
 - a. Iraq
 - i) Regulatory framework
 - ii. Grid connections
 - iii. Private sector participation
 - iv. Financing
 - v. Resource studies
 - vi. Mechanism (auctions)
 - vii. Local contractor capabilities, security
 - b. IKR
 - i) Regulatory framework
 - ii. Grid connections
 - iii. Private sector participation
 - iv. Financing
 - v. Resource studies
 - vi. Mechanism (auctions)
 - vii. Local contractor capabilities, security
 - 2) Opportunities for energy efficiency and demand-side management, such as improved solutions to respond to load-shedding and reliability issues associated with the grid
 - a. Energy efficiency current overview
 - b. Demand-side incentives – tariff structure
 - c. Citizen-level awareness-raising/BCC related to energy options, conservation, etc.
 - 3) Private sector engagement in energy service delivery
 - a. Challenges/opportunities related to distributed solar
 - i. Regulatory framework
 - ii. Financing – local banks
 - iii. Technical capacity
 - iv. Supply chain
 - v. Grid stability
 - vi. Government mandates / pilot programs
 - 4) Reduction of technical and commercial losses
 - a. Payment system – online possible?
 - b. Main areas of technical losses – plans to address?
 - 5) Environmental risks and impacts of the energy sector
 - a. Main challenges
 - b. Any current initiatives



APPENDIX B: STAKEHOLDER LANDSCAPE: ADDITIONAL PLAYERS

Additional players in Federal Iraq and KRG

Financing entities:

Development Finance Institutions (DFIs): the IFC, DFC, AIIB, IMF, JICA, and the Islamic Development Bank all have a presence in Iraq. USAID should be cognizant of not duplicating the efforts of these agencies when designing future programming and coordinating activities where possible.

- **The International Finance Corporation (IFC)**, the private sector investment arm of the World Bank, is the most prominent DFI and is working to open private capital in Iraq. Their role as a financing institution provides greater potential to leverage commercial banks and ensure a more streamlined tendering process that sidesteps corruption.
 - In 2016, the IFC financed the Iraqi power company Mass Global Energy Sulimaniya (MGES) with a \$375 million electricity project in Kurdistan and Baghdad. In 2021, the IFC invested \$360 million to support the Basrah Gas Company (BGC) in a five-year gas flaring reduction project, one of the largest in the world. Starting in 2011, the IFC began investing in Pakistan's nascent wind sector, unlocking that market and helping it grow to over 1 GW installed today with hundreds more MW under development.
- **The U.S. International Development Finance Corporation (DFC)**, previously OPIC, is co-financing a seven-year natural gas processing project in Kurdistan with Pearl Petroleum Company Limited, a UAE consortium. DFC is loaning \$250 million of the total \$630 million to support the infrastructure development and operation of the Khor Mor gas field.
- **Asian Infrastructure Investment Bank (AIIB): as of late 2021, Iraq is a prospective member of AIIB** and will receive full membership after completing requirements and depositing an initial capital installment.
- **The International Monetary Fund (IMF)** is another key stakeholder in the overall financing of Iraq. Iraq is in talks with the IMF for a \$4 billion loan that will target government reform assistance. The IMF is an ideal partner since it provides double checks on sovereign guarantees, and its loans provide financial discipline and ensure they are used for their intended purpose. In 2021, the IMF assessed Iraq's customs and regulatory framework and provided recommendations on how to bring laws up to international standard. The IMF stated that two of its key objectives in Iraq is reducing inefficient energy subsidies and mitigating losses in the electricity sector. To this end, the IMF is a prime stakeholder for future investment and collaboration.
- **Japanese International Cooperation Agency (JICA)** has been a key player in development financing for Iraq's infrastructure reconstruction. JICA has financed hundreds of millions of dollars in new and refurbished substations, thermal plant rehabilitation, hydropower plant construction, port modernization, refinery upgrades, and other projects. They are a key major lender to the Iraqi energy sector.



Islamic Development Bank: The Islamic Development Bank (IDB) has been active in Iraq, having funded \$551 million in infrastructure, services, and trade finance¹¹⁴; however, has not been a major player in financing Iraq's electricity sector.

Other Financing Entities:

- **Export Credit Agencies (ECAs):** ECAs offer trade finance, loan guarantees, and insurance to reduce export risks and facilitate exports of goods in their country.¹¹⁵ Because local banks do not have long-term dollars for investment, ECAs can provide intermediary solutions as they help with the transition of financing. This is especially critical given the lack of sovereign guarantees in addition to a cash culture that poses structural issues for investment. Two such ECAs active in Iraq are Germany's Euler Hermes and the United Kingdom's Export Finance (UKEF). Hermes approved the Trade Bank of Iraq (TBI) as a borrower in 2018 which facilitated a \$100 million loan framework between TBI and private bank Commerzbank.¹¹⁶ In 2019, UKEF increased its market risk appetite limit for Iraq by more than \$1 billion¹¹⁷ with much of this financing supporting contracts between General Electric (GE) and the MoE for power station construction and GE's Grid Solutions project to restore substations.¹¹⁸
- **Commercial Banks:** Local commercial banks have not been large players in the energy sector due to lack of capacity to fund projects, perform risk assessments, and perform due diligence on borrowers.

Technical Advisors:

- **Technical Advisory Support Context:** technical advisors provide high-level to Federal Iraq and IKR with more macro-level analyses and policies. These institutions are typically international bodies that provide sectoral , federal strategy planning , and funding and implementation for projects that tie to federal and international objectives and benchmarks.
- **Renewable energy capacity growth:** Federal Iraq and IKR has little experience in the sector and needs more capacity to productively work with donors. The IEA, IRENA, RCREEE, and the UNDP are also prominent providers of technical assistance to its renewable energy sector, and with increasing support and interest from the international community, they will need significant support with capacity building, technical advisory, and administrative and managerial strengthening.
- **International Energy Agency (IEA):** the IEA is also working with Federal Iraq to provide a medium-term strategy plan to assist Iraq with cutting its electricity network losses. The IEA provided Federal Iraq with several high-level on its energy sector losses and recommendations for reforming beyond an oil-dependent economy.

¹¹⁴ [IDB confirms its support for Iraq's development and economic growth | News | IsDB](#)

¹¹⁵ <https://www.investopedia.com/terms/e/export-credit-agency.asp>

¹¹⁶

https://www.gtreview.comhttps://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/795780/Letter_from_DIT_Secretary_of_State_to_UKEF_AO_Iraq.pdf/news/mena/commerzbank-to-finance-exports-to-iraq-with-new-deal/

¹¹⁷

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/795780/Letter_from_DIT_Secretary_of_State_to_UKEF_AO_Iraq.pdf

¹¹⁸ <https://www.globaltradealert.org/intervention/70445/trade-finance/united-kingdom-ukef-provides-financing-to-support-uk-contracts-in-iraq>



- **United Nations Development Program (UNDP):** UNDP is heavily involved in helping Federal Iraq move towards energy security and sustainable energy with multiple large-scale projects. These projects include the promotion of carbon reduction through energy efficiency, delivery of solar energy to economically distressed areas, and green energy investment.¹¹⁹

Regional Investors:

- **UAE (United Arab Emirates):** the UAE is a prime potential investor, having historically invested in energy projects across the region through the Abu Dhabi Fund for Development (ADFD) and the Abu Dhabi Future Energy Company (Masdar). In October 2021, Masdar agreed to build five solar power plants in Iraq that total 1 GW of capacity. To attest to the political significance of the investment, Iraq's Minister of Electricity met with the UAE's Minister of Energy to discuss the agreement. Because the UAE is keen to push into Iraq's renewable energy infrastructure and to mitigate the regional influence of Iran, Iraq is well-positioned to further partner with the UAE given their strategic alignment. Masdar can also bring its significant project development experience and knowhow to Iraq. The Abu Dhabi Fund and Masdar are also open to funding fully designed projects as opposed to projects that are still in the planning stages. This could provide an opportunity for USAID to approach ADFD or Masdar with pilot programs or other potentially beneficial energy projects.

Private Sector:

- **Iraq's Private Sector:** the Iraqi private sector's capacity is still limited, given lack of renewable energy capacity and experience, although Iraq benefits from a large population of engineers, and lack of needed capital from local banks. A few stakeholders exist in the renewable energy space, however, such as Al Hadbaa Solar Company, who is conducting RE feasibility studies, and the Shlama Foundation, who is providing training on solar PV home systems at the Solar Power Training School. Connecting regional players with Iraqi private sector companies will be key to developing local capacity and increasing the sustainability of the sector.
- **International Private Sector Context:** there are many international private entities currently operating or have potential of operating within Iraq's energy space, especially for renewable energy development. Regional EPCs, developers, and technology providers, such as the Turkish EPC, Calik, the UAE-based developer, AMEA Power, or the Saudi-based technology provider, Al Fanar, are well positioned to leverage their local understanding and different risk tolerance to develop and execute projects. Many of these relationships can be developed from and capitalized off common political or economic objectives. Integrating private-public partnerships into Iraq's energy investment strategy could provide much needed technical, operational, and commercial support needed in Iraq's renewable energy endeavors.
- **General Electric:** GE has been active in Iraq for 40 years.¹²⁰ GE added 700 MW of generation capacity in 2016 under the Power Up program, and in 2017 signed \$1.4 billion worth of new contracts to add 2,000 MW to the grid.¹²¹ In addition to adding to the generation capacity, GE's

¹¹⁹ <https://www.iq.undp.org/content/iraq/en/home/all-projects/Green-Climate-Fund-Readiness-Programme/>

¹²⁰ <https://www.ge.com/news/reports/new-1-4-billion-ge-deal-will-supply-iraq-reliable-power>

¹²¹ Idem

Grid Solutions will work to build out the transmission network, including interconnection with the Jordanian grid.¹²² ¹²³ GE has entered contracts worth over \$6 billion in recent years. However, stakeholder interviews showed that everyday Iraqis do not “trust” GE to deliver high-quality electricity.

- **Siemens:** Under the \$1.4 billion “Roadmap for the Electrification of New Iraq,” Siemens Energy AG (a spinoff of Siemens AG) plans to add 11GW of installed base between 2019 and 2023.¹²⁴ ¹²⁵ ¹²⁶ Siemens Energy AG has entered into contracts totaling \$1.2 billion in recent years¹²⁷
- **Mass Global:** IPP contracts began in 2008 in IKR as Mass Global was contracted to build 750 MW of gas plants¹²⁸, which became operational in 2010. Mass Global is still the largest IPP producer and produces most of the electricity in IKR.¹²⁹

It is important to note, however, that international public and private investors are often hesitant to invest in Iraq’s energy sector, given the complex stakeholder landscape, nonpayment, and corruption issues. These challenges increase investor risk and cause investors to look at other, more stable markets. USAID is well positioned to play an important role in improving the investor landscape.

¹²² <https://www.worldconstructionnetwork.com/news/ge-wins-contracts-worth-12bn-from-iraqi-government-to-upgrade-power-infrastructure>

¹²³ <https://www.ge.com/gas-power/resources/case-studies/iraqi-ministry-electricity>

¹²⁴ <https://www.smart-energy.com/policy-regulation/iraqs-ministry-electricity-defines-electrification-roadmap/>

¹²⁵ <https://www.siemens-energy.com/mea/siemens-energy-in-middle-east/company/megaprojects/national-roadmap.html>

¹²⁶ <https://iraqenergy.org/2020/02/20/overview-of-iraqs-renewable-energy-progress-in-2019/>

¹²⁷ <https://www.wsj.com/articles/iraqi-lawmakers-call-for-probe-into-ge-siemens-electricity-contracts-11629455913>

¹²⁸ [GE secures US \\$200 million power contracts in Iraq - Construction Week Online](#)

¹²⁹ <https://marcopolis.net/mass-global-supplying-iraqi-kurdistan-with-electricity.htm>

APPENDIX C: FEDERAL IRAQ TARIFF STRUCTURE

130

تعرفمة وحدة الطاقة دينار / (ك.و.س)	فئة صنف الاستهلاك
المتزلي	
10	1500 - 1
35	3000 - 1501
80	4000 - 3001
120	فاكثر 4001
التحاري	
60	1000 - 1
80	2000 - 1001
120	فاكثر 2001
الصناعي	
60	كل الفئات
الحكومي	
120	كل الفئات
الزراعي	
60	كل الفئات
كيفية الاحتساب	
لمعرفة احتساب الفاتورة يتم احتساب الفرق بين وحدات القراءة السابقة (اي اخر قراءة لديك في قائمة الكهرباء) والقراءة الحالية (اي القراءة الحالية في عداد الميزانية) والنتاج سيكون عدد الوحدات المستهلكة	
المثال الاول : في حال عدد الوحدات المستهلكة 600 وحدة $6000=600*10$ دينار	
المثال الثاني : في حال عدد الوحدات المستهلكة 2000 وحدة $15000=10*1500$ $15000 + (35 * 500) = 32500$ دينار	
المثال الثالث : في حال عدد الوحدات المستهلكة 5000 وحدة $15000=10*1500$ $67500 = (35 * 1500) + 15000$ $147500 = (80 * 1000) + 67500$ $267500 = (120 * 1000) + 147500$ دينار	