IOM UN MIGRATION

edf-r

Enterprise Development Fund

Renewable Energy (EDF-r)

Renewable Energy Feasibility Study

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ABBREVIATIONS AND ACRONYMS

AC	Alternate current	KRG	Kurdistan Regional Government
BAU	Business-as-usual	KII	Key informant interview
CBI	Central Bank of Iraq	kW	Kilowatt
CHP	Combined heat and power	kWh	kilowatt hour
DC	Direct current	LED	Light emitting diode
DESCO	Distributed Energy Services Company	LCOE	Levelized cost of energy
EDF	Enterprise Development Fund	Mbpd	Million barrels per day
EDF-r	Enterprise Development Fund Renewable Energy	MENA	Middle East and North Africa
EoI	Expression of Interest	MJ/m2	Megajoule/square metres
ESMAP	Energy Sector Management Assistance Program	MoEI	Ministry of Electricity
EPC	Equipment procurement and construction	MoF	Ministry of Finance
FDI	Foreign direct investment	MOU	Memorandum of understanding
GDP	Gross domestic product	MW	Megawatt
GEF	Global Environment Facility	MWh	Megawatt hour
GHG	Greenhouse gas	O&M	Operations and maintenance
GNI	Gross National Inco	PAYG	Pay as you go / Pay as you grow
GSM	Global system for mobile communications	PPA	Power purchase agreement
GW	Gigawatt	PURE	Productive use of renewable energy
ICFSME	Iraq Company for Financing Small Medium Enterprises	PV	Photovoltaic
IDP	Internally displaced person	R&D	Research and development
IEC	Information, education and communication	RCREEE	Regional Centre for Renewable Energy and Energy Efficiency
IMF	International Monetary Fund	RETs	Renewable energy technologies
INDC	Intended Nationally Determined Contributions	SHS	Solar home system
INES	Iraq Integrated National Energy Strategy	SME	Small and medium enterprises
INMA	Iraqi National Monitoring Authority	TWh	Terawatt hour
IOM	International Organization of Migration	UNDP	United Nations Development Programme
IPP	Independent power producer	UNFCCC	United Nations Framework Convention on Climate Change
IQD	Iraqi dinar	USc	United States cents
IRENA	International Renewable Energy Agency	USD	United States Dollar
JBIC	Japan Bank for International Cooperation	WTP	Willingness to Pay

DEFINITIONS

Engineering Procurement and Construction (EPC) contractor: the company responsible for the design and construction of a renewable energy project on the basis of a fixed price turnkey contract and completion on a fixed date.

Gigawatt (GW): a unit of energy equal to 1 billion watts; 1 million kilowatts or 1,000 megawatts.

Gigawatt-Hour (GWh): a unit of energy equal to 1 million kilowatt-hours (1,000 megawatt-hours).

Installers: Private sector business enterprises involved in the procurement and installation of renewable energy solar system for domestic, commercial industrial and agricultural applications. These are interchangeably used with developers.

Power grid: An interconnected network for delivering electricity from producers to consumers. It mainly consists of generation, transmission and distribution infrastructure

Kilowatt (kW): standard unit of electrical power equal to 1000 watts, or to the energy consumption at a rate of 1,000 joules per second.

Megawatt (MW): a standard unit of power, equal to 1,000 kW or 1,000.000W.

Megawatt Hour (MWh): the energy expended in one hour at a rate of one million watts unit of energy.

Mini grids: Electric power generation and distribution systems that provide electricity to just a few customers in a remote settlement or a relatively large number of customers.

Net Present Value (NPV): series of cash flows generated by the project discounted to the present value.

Off-grid generation: the generation of renewable energy in an application that is not interconnected to a utility transmission or distribution system.***Operations and maintenance (O&M) contract:*** a third party responsible for running the renewable energy facility and project during its operational phase.

Pay as you go (PAYG): business model that allows end-users to finance their solar home systems through a lease-to-own model, with a down payment and the balance in regular instalments towards the balance of the loan.

Payback: number of years it takes a renewable energy project to recover investment

Permanent full-time solar job: a job held by an individual who spends at least 50 percent of their time on renewable energy project specific work.

Power Purchase Agreement (PPA): An agreement entered into between the developer (seller) and the buyer of energy stating the price at which energy will be sold and the payment arrangements.

Productive Use of Renewable Energy (PURE): refers income generating activities such as agriculture, commercial and industrial activities that are driven by renewable energy sources

Solar farm: a series of decentralized ground-mounted solar photovoltaic (PV) panels installed across large areas used for collecting solar energy. These have different types which include community solar farms and utility-scale solar farms.

Solar home systems (SHS): Standalone PV systems with battery storage and charge controller that can provide clean and cost-effective electricity.

Solar irradiance: a measure of the solar radiation received on a given surface area in a given time.

Watt (W): a unit of power which is the power involved in doing 1 joule of work.

EXECUTIVE SUMMARY

The International Organisation of Migration (IOM) commissioned this study to assess the feasibility and economic viability of renewable energy technologies in Iraq. This was undertaken as part of exploring a business opportunity for small to medium enterprises (SMEs) to promote the use of clean energy technologies and to stimulate post-conflict recovery and reconstruction job creation and livelihood support.

Renewable energy development in Iraq is still in its infancy. This is mainly due to the lack of an enabling policy and regulatory environment, funding as well as heavily subsidized fossil fuel-based electricity generation.

The development of renewable energy in Iraq is inevitable due to the need to diversify the energy sector to address the prevalent power shortages, the ubiquitous abundance of the sunlight, declining technology costs, regional and global geopolitical factors, climate change considerations and commitments.

Iraq has an evolving policy and regulatory framework with a 2030 target of 30% contribution from renewable energy sources towards the energy mix, but there is still dominance by hydrocarbon sources of energy. Renewable energy mostly from hydropower represented only two percent of the Iraq's energy sources in 2017.

Mini grid and off-grid hybrid renewable energy systems are being deployed across the country, and there are plans to develop utility-scale projects by both local and foreign private sector investors. However, energy sector subsidies continue to be a drawback on the deployment of renewable energy, and they are unsustainable for a country that is also experiencing declining revenue as a result of volatile and falling petroleum prices.

The government has competing needs and there is pressure on its budget resources, hence there is need to invite private sector participation to develop and diversify the energy sector.

MAIN FINDINGS

- The renewable energy industry consists of a growing number of large and SME existing and start-up private sector renewable energy developers, technology system installers and a growing network of sales and distribution companies which are working to increase their geographic footprint in the country.
- Distribution companies import renewable energy technologies and products, and they have distribution agent networks with smaller retail businesses and installers.
- The potential of renewable energy SMEs to operate and perform is being is limited by lack of access to finance and the unavailability of credit for and energy end-user customers to procure renewable energy technologies and products.
- More recently, the global COVID-19 pandemic has threatened renewable energy SME operations resulting mostly in delays in project implementation and financially constrained operations.
- Renewable energy projects require a high initial investment outlay and mobilizing capital grant finance for renewable energy SMEs would de-risk the sector and provide the necessary resources to stimulate economic development and create jobs which would address the high youth unemployment that Iraq is facing.
- Capital investment costs for a 50 kilowatts (kW) and a 1 megawatt (MW) off-grid renewable energy solar photo voltaic system ranges between USD 120,000 and USD 3 million, while the cost for grid integrated systems with the same capacities range between USD 55,000 and USD 2 million.
- Job creation costs range from USD 8,000 and USD 15,000 and between USD 4,231 and USD 11,428 for off-grid and grid connected systems, respectively.
- The sector has potential to create between 15 and 200 jobs for 50kW and 1MW respectively, and the youth could at least absorb 62% of the potential jobs.
- Solar photo voltaic (PV) technology installations have the greatest potential to create jobs ahead of other renewable energy technologies. They could on average, employ between 5 to 10 people on a permanent basis, and as high as 200 jobs were reported for large capacity projects that have already been implemented.
- Salaries for implemented projects currently range between USD 4,800 and USD 12,000 per annum depending on the level of experience, job function and skills. The median salary is USD 6,000 per year while the daily rate per temporary job created was in the region of USD 25 per day.

- There is growing adoption and uptake of productive use renewable energy technologies such as solar water pumping systems and irrigation equipment especially in the southern and northern farming regions of the country. However, the sector still faces social acceptance risk, which could be linked to the general lack of awareness and willingness to pay for renewable energy among household end-user customers.
- The sector has potential to create jobs from technology installations, sales and distribution of products as well as the productive use of renewable energy activities, and the latter have the highest capacity and potential for job creation.
- Although the renewable energy sector is capital-intensive with associated high job creation costs, it draws numerous development benefits, and it has the ability to create linkages with economic sectors such as agriculture and manufacturing and potentially stimulating downstream economic activity.
- There is a viable value proposition for the IOM to support private sector renewable energy SMEs and productive use renewable energy by end-users particularly internally displaced farmers and returnees who are seeking to re-establish and engage in economic activity for livelihood support.
- Strong synergies exist between the Enterprise Development Fund agriculture (EDF-a) and the Enterprise Development Fund renewable energy (EDF-r) programmes. Harmonization and collaboration between the two could accelerate deployment and upscaling of technologies and maximize job creation, livelihood development and economic benefits.

RECOMMENDATIONS

Based on the stakeholder engagements and assessment of sector developments, it is recommended that the IOM should:

- Financially support SMEs in the renewable energy sector through the EDF portfolio to achieve the dual objectives of promoting the adoption and use of clean energy technologies and job creation.
- Establish a capital grant facility with a USD 50,000 threshold for renewable energy off grid and on grid solar system installations, which could create a minimum of 10 permanent jobs for solar installations and development; and two permanent jobs for sales and distribution retail agents per outlet.
- Consider entry at the level of registered start-up SMEs as well as existing and operational enterprises which either need capital for business expansion and scaling up or product procurement and restocking.
- Launch a national expression of interest that prioritises and targets renewable energy SME mini-grid and micro grid developers and solar systems installers that support a productive use of renewable energy (PURE) end-users; sales and distribution SME companies which have plans to establish or expand their network and geographical presence in rural areas, farms and areas where they support the establishment of retail agents.
- Embark on an awareness and outreach campaign through publicity and stakeholder engagements.
- During the application stage, technically support and advise companies in order to ensure the provide documentation which is compliant and consistent with the requirements and objectives of the EDF.
- Establish a micro grant model that empowers end-users to purchase productive use appliances.
- Consider accessing climate finance for capitalising EDF-r and develop a blended financing structure that serves to reduce cost of capital through partnership with a financial institution such as the Trade Bank of Iraq.
- Build partnerships that promote capacity development between established private sector SME solar system installers and developers with outsourcing and sub-contracting arrangements.
- Explore and capitalise on the institutional and programmatic synergies between EDF-r and EDF-a.
- Develop information, education and communication (IEC) to expound the benefits of renewable energy in order to influence energy consumption choices at household level and to stimulate the adoption of PURE for domestic end-users.
- Adopt a more integrated approach that does not only consider the cost of job creation through renewable energy deployment, but also takes into account other development co-benefits and economic development spin-offs in supporting private sector SME developers, renewable energy technology installers as well as product sales and distribution players.
- Engage with the relevant government ministries to mainstream PURE initiatives within government supported socio-economic livelihoods programmes for vulnerable and marginalised communities.

1. INTRODUCTION

The International Organisation of Migration (IOM) manages the Enterprise Development Fund (EDF), which is a financing mechanism that provides customised financial support to SMEs for private sector-driven job creation, economic recovery and development. The IOM is considering expanding its mandate to include the EDF-r to unlock the potential of Iraq's renewable energy sector. The renewable energy sector is aligned to the overall IOM's strategic goal of supporting economic recovery through private sector revitalization as the sector has relatively high demand for labour.

This feasibility study was instituted by the IOM to primarily provide a value proposition and business case for supporting private sector driven renewable energy SMEs in Iraq. The study primarily focuses on the financial and regulatory environment for renewable energy in Iraq; context-appropriate renewable energy technologies, their availability and the potential of on-grid, off-grid and hybrid energy solutions; productive use renewable energy-powered appliances; the SME landscape and more specifically renewable energy SMEs and their role in the development and the expansion of SMEs into the sector. The financing landscape for potential consumers of renewable energy products is also considered in a view to assess the economic viability of renewable energy solutions, entry points for SMEs to expand their role in the sector as well as entry points for IOM to support optimal job creation. At the same time, the study also seeks to understand household energy consumption patterns and uptake for PURE usage and demand.

The study assesses the viability of the renewable sector while also identifying the critical factors for deployment of technologies in Iraq. It investigates the cost of job creation within the renewable energy sector and the level of investment requirements as well as identifying the technologies that should be considered for deployment. The study also provides some recommendations on the appropriate entry point and interventions for consideration by the EDF-r for effective deployment of resources to achieve tangible and optimum outcomes.

1.1 COUNTRY AND ECONOMIC OVERVIEW

Iraq has the fifth largest proven crude oil reserve in the world which consists of 141.4 billion barrels of oil. Proven and untapped petroleum reserves were estimated at 130 trillion cubic feet at the end of 2016.[1]

The energy sector contributes significantly to the Iraqi economy with the oil subsector alone accounting for over 65% of the gross domestic product (GDP). This translates into more than 90% of annual government revenue, and 98% of the country's exports. Iraq receives more than 3,300 hours of sunshine per year with an average solar radiation of about 5 kWh/m2/day.[2]

GDP grew by 4.4% in 2019 and is projected to contract by 5.1% in 2020 as the economy will remain subdued as a result of low oil prices and unfavourable global conditions (see Table 2).

TABLE 1: ECONOMIC INDICATORS

ECONOMIC INDICATOR	2015	2016	2017	2018	2019	2020
Real GDP (percentage change	2.5	13.0	-2.1	1.9	6.2	2.9
Non-oil real GDP (percent change)	-14.4	-4.0	0.8	5.2	5.2	-5.4
GDP per capita (US$)	4,812	4,505	4,952	5,597	5,751	5,820
GDP (US$ billion)	207.2	201.4	227.4	263.7	277.9	288.5
Oil production (mbpd)	3.7	4.6	4.5	4.5	4.8	4.8
Inflation (average percentage change)	1.4	0.4	0.1	2.0	2.0	2.0

Source: World Bank Group, 2019

The 2020 World Bank Doing Business Report classified Iraq as an upper middle-income country and ranked it 172nd (out of 190) in terms of ease in registering and conducting business. Average household incomes ranged between IQD 500,000 and IQD 1,000,000 (approximately USD 420 and 840)[3] in 2018 with a national poverty rate of 22.5% estimated for 2019.[4]

1 U.S. Energy Information Administration

2 Journal of Energy Management and Technology, 2018

3 ICB, www.currency-table.com/en/exchangerates-iqd-central-bank-of-iraq, November 2020

4 World Bank, Macro Poverty Outlook, 2020

Iraq has one of the youngest populations in the world where almost 50% of Iraqis are younger than 19 years, and 60% are below 25 years of age. Youth unemployment currently stands at 36% and it is projected to increase from seven to 10 million between 2015 and 2030.[5] The public sector employs 40% of the country's labour force[6] which is unsustainable, especially in consideration of the current fiscal constraints.

The SME sector constitutes a significant share of Iraq's private sector. The sector could potentially represent an engine for growth, act as a key driver of economic development, alleviate the pressure on the public sector, and address the growing challenge of youth unemployment. However, the expansion and development of SMEs is limited by structural challenges, including limited access to finance from both banks and traditional investors as well as cumbersome, costly, and heavily bureaucratized processes for business registration.

SMEs could also play a dual catalytic role in transforming the renewable energy sector while also creating jobs. In 2018 the renewable energy sector employed 11 million people globally and the solar PV industry contributed to a third of the total renewable energy sector workforce where the off-grid solar energy sector contributed the largest share of jobs.[7]

2. ENERGY SECTOR OVERVIEW

2.1 ELECTRICITY SUPPLY INDUSTRY STRUCTURE

The Department of Renewable Energies and Energy Efficiency, established in 2016 contributes to the security of supply through instituting a policy and regulatory framework to attract investment. The Department is also responsible for driving the development of renewable energy technologies in order to contribute to the diversification of the energy mix. The Department is managed through the Renewable Energy Projects and the Technical Designs and Studies Divisions.

The sector is undergoing reforms as the federal budget deficit widens; the Government is finding increasingly difficult to self-fund the necessary investments in the energy sector. The reforms, among other things, include electricity tariff reforms on government-supplied grid electricity as well as stronger regulation of neighbourhood generators. This is geared at developing a more reliable power supply sector and eliminate supply shortage as well as contribute towards the building of a more diversified economy.

2.2 ELECTRICITY MARKET

The demand for electricity in Iraq increased from 9,160 MW in 2015 to 24,5000 MW as of summer 2018. The latter was supplied by state-owned utilities and augmented for 8,000 MW through private sector neighbourhood diesel generators.[8] In 2018, Iraq imported IQD 516,974 million (USD 432.62 million) worth of electricity from Iran and purchased the equivalent of eight tera watt hours (TWh) from private power generators at an average price of US¢ 9 per kWh in 2017. There are existing contracts for 1,000 – 1,150 MW imports with Iran and 200 MW with Kuwait.[9]

About 90% of the households depend on neighbourhood generators as power supply from the national grid is available for less than 15 hours per day. Private generators were paid USD 4 billion in subsidies in 2018[10] whereas an estimated USD 10.1 billion was paid across the entire energy sector.[11] Iraq's electricity is highly subsidised, and the Kurdish Regional Government (KRG) currently subsidizes up to 85% of each kilowatt-hour,[12] which has exerted an additional burden on the government's budget. The cost of power shortages exceeds US$40 billion annually and this is also significantly impacting households' quality of life, business growth, and the capacity of the SME sector to create sustainable jobs for the growing numbers of youth entering the job market.

5 World Bank, 2018

6 http://www.iq.undp.org/content/iraq/en/home/countryinfo.html

7 IRENA, 2019

8 Iraq Energy Institute, 2020

9 Iraq Energy Institute, 2018

10 Middle East Institute, 2020

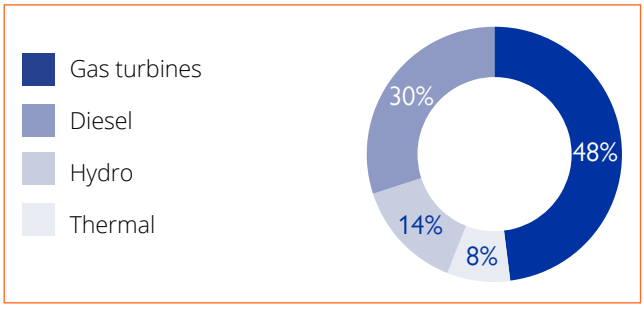
11 World Bank Group, 2019

12 https://documents.worldbank.org/curated/en/771451524124058858/pdf/125406-WP-PUBLIC-P163016-Iraq-Economic-Monitor-text-Spring-2018-4-18-18web.pdf

2.3 IRAQ ENERGY GENERATION MIX

Iraq's electricity generation mix (Figure 2) consists of thermal, gas and hydro power stations. Crude oil supplied 43.1% towards electricity production and natural gas contributed 29.8% in 2017.[13] The balance of the electricity was generated from heavy fluidised oil (21.2%), gasoil (4.6%) and diesel (1.2%).[14] Only 2% of electricity generation comes from renewable energy, mainly hydroelectricity.

FIGURE 1: IRAQ ENERGY GENERATION MIX



Source: Ministry of Electricity, 2017

There are plans to increase the contribution from renewables to 10% by 2020 and to diversify the sector to 30% by 2030.[15] The system only had 19,258 MW capacity available in 2019 due to 50% technical and commercial losses arising mainly from poor maintenance, ageing and damaged infrastructure. There are strategies to reduce these losses to 20% by 2030. The estimated average growth rate of six percent per annum is projected to push generation capacity to over 32,500 MW by 2028.

2.4 ELECTRICITY CONSUMPTION

Iraq's entire population has access to electricity and 99% have access to clean cooking energy. Residential customers constitute 87.7% of the customer base and they consume between 800 - 1,000 kWh per month in low income households and 2,500 - 3,000 kWh per month in the high-income households.[16]

2.5 INSTITUTIONAL AND REGULATORY FRAMEWORK

Iraq is a member of the ***Pan Arab Clean Energy Initiative***[17] which represents political commitment towards a Pan-Arab Strategy for the Development of Renewable Energy Applications 2010 – 2030. The strategy focuses on a 75 giga watt (GW) deployment target for renewable energy technologies (RETs) in the region and has its focus on electricity generation. Member countries collaborate on policy, regulatory levels, technical and financial support at regional level to avoid duplication of effort. The country is classified as a tier two country along with Egypt, Jordan, Lebanon, Libya, Oman, and the State of Palestine in terms of countries with similar level of practices in long-term renewable energy planning.[18] This group consists of countries at varying initial stages of knowledge-gathering process on renewable energy resource mapping, measurement instruments and capacity building are taking place. Countries also have renewable integration objectives incorporated into their national long-term power planning. Iraq still lags behind the rest of the Pan Arab region as the contribution of renewable energy still remains insignificant.

Nonetheless, the Government of Iraq is implementing some over-sweeping economic reforms under the ***'Roadmap to a Brighter Future'*** aimed at diversifying the economy to achieve fiscal sustainability and economic governance, financial sector reforms, business environment reforms, improving human capital development and outcomes, as well as social protection and labour system reforms. The roadmap identifies strategies for reducing blackouts and alleviating the strains on the system to ensure reliable, affordable and a sustainable power system in the longer term. The reforms, among other things, entail the strengthening of regional interconnections as well as stronger regulation for neighbourhood generators. They further make provision for attracting foreign direct investment (FDI) into the renewable energy sector.

Sector reforms are being supported by investor incentives which include tax holidays, customs exemptions, investor-favourable tariffs, land rights and infrastructure support in obtaining permits and licences, and some guarantees for eligible private sector projects identified by the Ministry of Finance (MoF).

The Electricity Law No. (53) of 2017 regulates and promotes the adoption of renewable energy under the Ministry of Electricity. The objective of the Law is to achieve sustainable energy development through increasing the efficiency of currently used conventional sources of energy and renewable sources to ensure long-term sustainability and security of supply and diversified generation mix. It is also further intended to protect the environment and mitigate climate change.

The ***National Development Plan 2018 – 2022***[19] proposes to increase the electricity capacity to 20,869 MW with a per capita consumption of 4,041 kWh per annum. It prioritises the reduction of greenhouse gas (GHG) emissions and promotes the participation of the private sector. The plan also mentions an improved access and distribution of quality energy services to consumers.

13 Ministry of Electricity, 2017

14 Ministry of Electricity, 2017

15 World Bank Group, 2018

16 Ministry of Electricity May 2019

17 Arab Future Energy Index, 2019

18 Power sector planning in Arab countries IRENA, 2020

19 Ministry of Planning, 2018

In 2013, the Cabinet adopted the ***Iraq Integrated National Energy Strategy (INES)*** which covers the period 2013–2030. The Strategy and the Law underpin the sector's reforms and governance and commitment to a private sector driven electricity supply industry specifically for the electricity generation and distribution functions.

The MoEl ***Solar PV Investment Plan for 2017-2020*** set a target of 2,695 MW from solar PV, which were not met as of the time of the present assessment. The plan was developed in coordination with the United Nations Development Programme (UNDP) and the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE), which is a state-owned entity under the MoEl responsible for setting short term targets for utility scale projects. The RCREEE also developed the country's solar resource map, which identifies Iraq's best solar resources, which was subsequently integrated into the Global Solar Atlas by the International Renewable Energy Agency (IRENA).

TABLE 2: SOLAR PV ENERGY (2017 – 2020)

GOVERNORATE	CAPACITY (MW)				
	2017	2018	2019	2020	TOTAL
Baghdad	15	30	30	30	105
Al Muthana	130	30	30	30	220
Al Najaf	100	50	50	50	250
Al Diwaniya	-	50	50	50	150
Dhi Qar	50	50	30	30	160
Messan	150	50	50	50	300
Al Anbar	430	100	100	100	730
Karbalaa	-	30	30	30	90
Wassit	75	30	30	30	165
Diyala	15	25	25	25	90
Babil	185	100	100	50	435
Total	1,150	545	525	475	2,695

Source: Ministry of Electricity, 2019

In order to tackle climate change, the Government of Iraq aims at reducing the GHG emissions by 15% below business-as-usual (BAU) emissions by 2035 under the Intended Nationally Determined Contributions (INDC) to UNFCCC 2015. The deployment of renewable energy constitutes part of the national mitigation policies and plans for achieving the emission targets.

2.6 CURRENT PROGRAMMING ON RENEWABLE ENERGY

The Iraqi electricity industry will require USD 50 billion between 2018 and 2028 for capacity expansion, efficiency improvements through retrofits, and renewable energy generation capacity development. Part of the investment will be channelled towards the rehabilitation and upgrade of transmission and distribution substations in order to cut down on transmission and distribution losses. There is currently about 20GW of new power generation capacity either under construction or planned in the medium term in line with the 2018 Reconstruction and Development Framework (see Table 4). The Framework also outlines some planned renewable projects across Iraq.

TABLE 3: ELECTRICITY SECTOR INVESTMENT

COMPONENT	SHARE OF INVESTMENT
Combined cycle generation (new capacity)	40%
Renewable energy development programme	25%
Rehabilitation and upgrade of existing plants	15%
Transmission infrastructure (improvement, upgrade, and expansion)	10%
Substation improvement (upgrade and expansion)	10%

Source: International Energy Agency, 2019

The World Bank Group is collaborating with the Regional Centre for Renewable Energy and the RCREEE on Iraq Electricity Services Reconstruction and Enhancement Project which is focused on the development and integration of about 2GW renewable energy solar PV projects into the grid. This integral project is being implemented in support of the government's equitable growth and job creation objectives.

MoEl currently has a Transmission Plan to strengthen the transmission network throughout Iraq from the South to the Mid-Euphrates and Central areas of Iraq. The Ministry is receiving support from the Japan Bank for International Cooperation (JBIC). The development will be important for the deployment of on-grid renewable energy projects given the vision of turning Iraq into a net energy exporter.

The MoEl is collaborating with the UNDP on the establishment of a regulatory framework, technical guidelines, capacity building and institutional arrangements for the development of public and private sector Independent Power Producer (IPP) solar projects. The policy is expected to unlock US$35.1 million towards the deployment of 5 MW of residential PV capacity and construction of grid connected utility-scale PV power plants.

The IOM and the UNDP are among humanitarian development agencies that have provided grant funding for solar PV

systems in Iraq. Some of the funding for the implementation of renewable energy projects in Iraq has been secured from the Green Climate Fund (GCF) and the Global Environment Facility (GEF) which both advance the climate change agenda.

Iraq presents strong potential for deployment of off-grid and distributed solar PV solutions at micro level. These solutions could present a viable and sustainable option for extensive deployment of renewable energy technologies and replacement for diesel generators. Due to uniform distribution of solar radiation throughout Iraq, solar PV and concentrated solar power systems are suitable for producing electricity. These along with wind turbine technologies can be deployed as decentralised mini-grids to provide off-grid electricity for urban and rural load centres. They can also be hybrid in form and combine the use of mini grids.

As early as 2007 solar streetlights were installed in Fallujah as well as markets in Baghdad to improve public community security and safety. Off grid rooftop solar and other smaller off grid applications were also increasingly gaining popularity and these together are approximately 0.1 gigawatts (GW). Solar PV systems were also being installed to service social infrastructure such as schools, and health centres.

Four utility-scale solar PV projects are planned in Anbar province (240 MW) and one in Babylon (225 MW). The KRG is planning to integrate wind and hydropower sources and the government is proposing wind feasibility studies in all of its three northern Iraq provinces of Dohuk, Erbil and Sulaymaniyah are being earmarked for wind farms. Several other smaller private sector initiatives exist.

Grid codes to connect small scale PV systems to low voltage grid, medium – large scale PV and wind systems are being developed.[20] The Ministry of Science and Technology installed nine towers to measure wind potential in support of the resource mapping process.

3. RENEWABLE ENERGY LANDSCAPE

There is a growing adoption of solar technologies in Iraq where uptake is happening at household, commercial and industrial levels. This could present an opportunity for the EDF-r to introduce and support PURE income generation and livelihood support activities, projects, and initiatives. Embarking on such interventions for instance using solar powered mills, sewing machines, drills, water pumps, etc. ideally generate economic activity and creates the capacity for households to pay for energy.

Renewable energy technologies have significant local and national economic socio-economic development benefits. These range from job creation, improved access to energy and GHG emission reduction. In 2018 the renewable energy sector employed 11 million people globally with the solar PV industry contributing to a third of the total renewable energy workforce .[21] The off-grid solar sector contributed the largest share of jobs.

The deployment of renewable energy technologies and scaling of mini grids requires access to finance, effective geospatial planning, private sector participation, enabling regulatory and business environment, robust community engagement, PURE equipment and appliances to effectively support the creation of value chains to achieve for sustainable income generation, innovative technology and training and skills development.

The contribution of renewable energy to electricity generation in Iraq - excluding hydro - remains insignificant.[22] The combination of existing hydropower and planned projects is expected to increase the capacity of renewable energy into the power generation energy mix in line with the electricity generation capacity and per capita consumption targets set to meet the objectives of the National Development Plan 2018 – 2022 stated above.

3.1 RENEWABLE ENERGY RESOURCES

Iraq is targeting to develop 21 GW of solar PV and 5 GW of wind power by 2030[23] through investment from the private sector. The development would improve the affordability, reliability, and sustainability of electricity supply. Deploying this level of solar PV and wind power would contribute to the 30% renewables energy deployment target.

Solar irradiance in Iraq averages between 4 MJ/m2/day and 10 MJ/m2/day for five months in the north, six months in the central and southern regions, respectively. The western desert of Al-Anbar has almost eight months of sunshine. Overall, Iraq has an estimated 3 300 hours of sunshine during the year.[24] The country's deserts alone generate a mean power density between 3,140 to 3,373 MJ/m2, (87,222-93,700 kWh) reaching a peak power density of 26,860 MJ/m2/year,[25] making it one of the best places in the world in terms of the number of hours of sunshine. The entire country has sufficient solar intensity for PV operations (see Figure 3 for details).

20 Arab Future Energy Index, 2019

21 IRENA, 2019

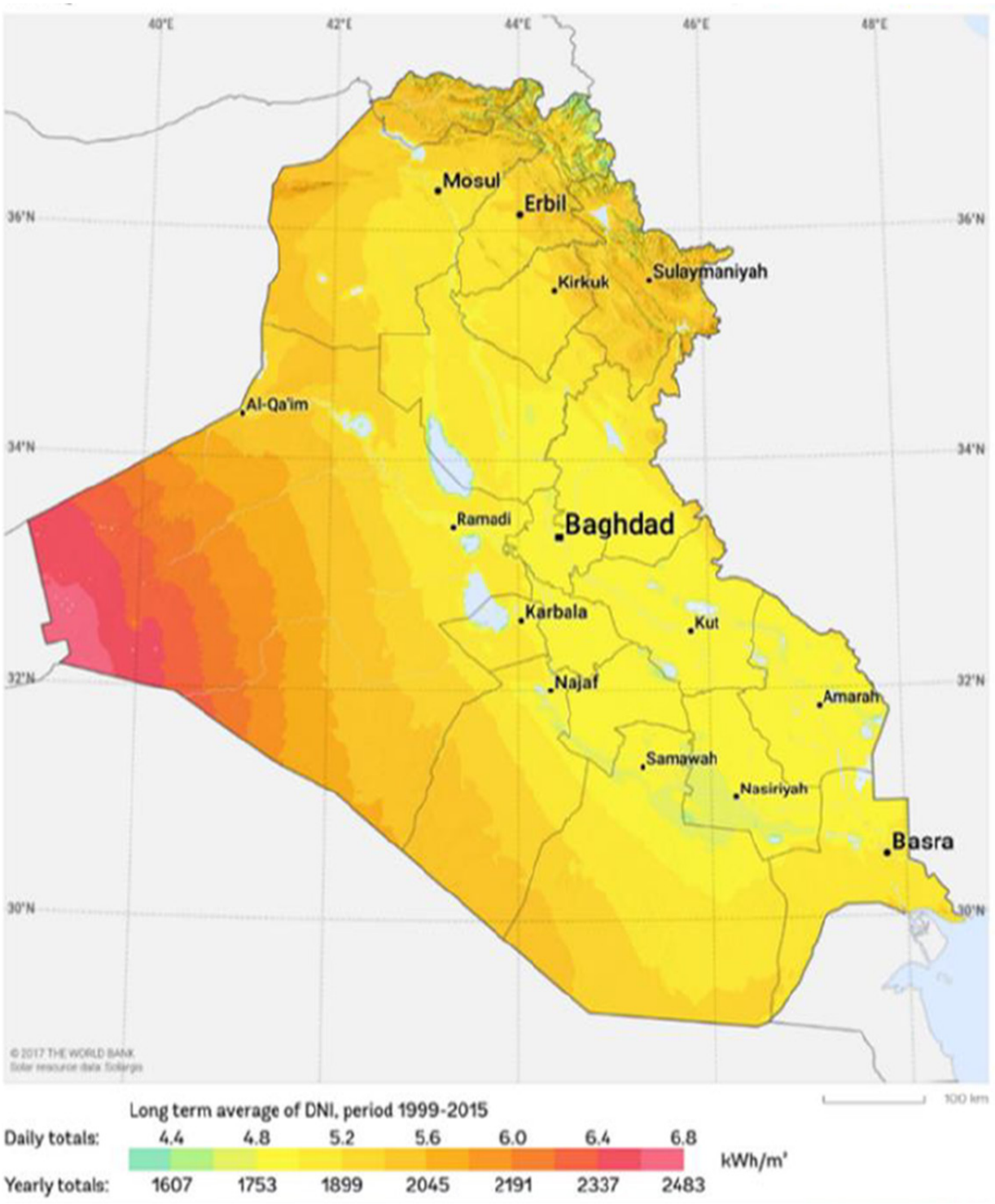
22 Energy Forum, 2018

23 PV Magazine International, 2019

24 Chaichan, et. al, 2018

25 Energy Systems Research, 2019

FIGURE 2: IRAQ SOLAR RESOURCE MAP



Source: World Bank, 2017

Wind resources are modest across Iraq and speeds range between 2m/s to more than 5 m/s in some regions.[26] The Gulf offshore near Basra has been identified as one of the potentially most viable locations for wind farms. Deserts in the provinces of Al-Anbar, Karbala, and Al-Muthanna are associated with sustainable wind speeds. Speeds are generally higher in summer than in winter. Technology cost declines and improvements make wind power a potentially attractive option for Iraq.

Biomass energy in Iraq is mostly derived from dates, corn and sugar cane and other cane varieties grown in Al-Ahwar. These can be converted to renewable hydrocarbon fuels like biodiesel and bioethanol, which can be used for combined heat and power (CHP) applications. However, the abundance of oil and gas in Iraq has suppressed their use.

26 Chaichan, et al 2018

3.2 RENEWABLE ENERGY DEVELOPMENT DRIVERS AND INHIBITORS

Regressive electricity subsidies, the availability of cheap oil, an inadequate renewable energy policy framework and a general lack of investment incentives, bureaucratic and grid access limitations have continued to inhibit the rapid deployment of renewable energy in Iraq. In 2018, electricity subsidies reached IQD 2.9 trillion (US$ 2.4 billion) on electricity sales alone.[27] The lack of government subsidies and incentives as well as bank loans for households to cover the high initial cost of rooftop PV panels are also among the barriers for deployment.

Nonetheless, a strong wave of favourable push factors are driving the adoption of renewable energy, including the recurring power cuts triggered by electricity shortages, the availability of renewable energy sources (dominated by solar energy), regional and global geopolitics, socioeconomic considerations, environmental factors, policy developments, and the declining technology costs.

Grid access limitations can present an opportunity for small scale hybrid off grid PV systems. More work still needs to be done in order to create an enabling policy and the regulatory environment. The coordinated regional Pan Arab efforts have also put Iraq under the spotlight and built pressure for the country to move along with other member states.

Electricity sector reforms are being implemented to remove the subsidies that are a drain to government revenue at a time when oil incomes are declining. These reforms are also encouraging the participation of the private sector in both conventional and renewable energy to ensure reliable and secure energy supply.

Global technology costs have sharply declined. The price of solar panels has dropped by 75% between 2010 and 2017. Utility-scale solar PV cells and wind are also now competitive against gas, and particularly against oil, (see Table 5). The decline in renewable energy technologies which is attributed to steadily improving technology efficiencies influenced by intensive research and development (R&D), competitive supply chains, growing developer experience, competition among manufacturers, declining material costs, and economies of scale. The declining cost of solar panels for instance, is attributable to replicable and modular designs.

TABLE 4: TECHNOLOGY COST TRENDS

TECHNOLOGY	2010 – 2019 PERCENTAGE DECLINE	COST RANGE (USD/KWH)
Solar photovoltaic (PV)	82%	0.455 - 0.063
Utility-scale solar PV	90%	0.378 - 0.068
Residential and commercial sector rooftop solar PV	42% and 79%	0.063 - 0.265
Concentrated solar power	47%	0.07 - 0.08
Wind energy (offshore)	18%	0.161 – 0.115

**Cost increased*

Source: IRENA, 2020

Iraq also has vast tracts of land which are needed for renewable energy infrastructure development near cities.

3.3 RENEWABLE ENERGY TRENDS IN IRAQ

Iraq presents strong potential for deployment of off-grid and distributed solar PV solutions at micro level. These solutions could present a viable and sustainable option for extensive deployment of renewable energy technologies and replacement for diesel generators. Due to uniform distribution of solar radiation throughout Iraq, solar PV and concentrated solar power systems are suitable for producing electricity. These along with wind turbine technologies can be deployed as decentralised mini-grids to provide off-grid electricity for urban and rural load centres. They can also be hybrid in form and combine the use of mini grids.

As early as 2007 solar streetlights were installed in Fallujah as well as markets in Baghdad to improve public community security and safety. Off grid rooftop solar and other smaller off grid applications were also increasingly gaining popularity and these together are approximately 0.1 gigawatts (GW). Solar PV systems were also being installed to service social infrastructure such as schools, and health centres.

27 Middle East Institute, 2020

Over the past two years the use of rooftop PV among residential and retail end users has gained significant ground especially in the northern part of Iraq. The use of renewable energy is also increasingly gaining application at internally displaced persons (IDP) and returnee settlements. For instance, in Domiz 9MW of grid-tied solar PV power plants have been installed. The plants provide sustainable electricity to the settlements during the peak hours of summer months when the use of air conditioners is at its peak.

Four utility-scale solar PV projects are planned in Anbar province (240 MW) and one in Babylon (225 MW). The Kurdistan Regional Government (KRG) is planning to integrate wind and hydropower sources and the government is proposing wind feasibility studies in all of its three northern Iraq provinces of Dohuk, Erbil and Sulaymaniyah are being earmarked for wind farms. Several other smaller private sector initiatives exist.

In early 2019, the MoEI announced the procurement of a combined capacity of 755 MW from seven PV power projects in line with its renewable energy plan targets. Government is also planning to install rooftop solar PV for 3,000 low-income houses. At provincial level, councils can invest part of their budget in the establishment of solar power plants, and this is particularly important in provinces that have low access to energy.

Grid codes to connect small scale PV systems to low voltage grid, medium – large scale PV and wind systems are being developed.[28] The Ministry of Science and Technology installed nine towers to measure wind potential in support of the resource mapping process.

There is a growing adoption of solar technologies in Iraq where uptake is happening at household, commercial and industrial levels. This could present an opportunity for the EDF-r to introduce and support PURE income generation and livelihood support activities, projects, and initiatives. Embarking on such interventions for instance using solar powered mills, sewing machines, drills, water pumps, etc. ideally generate economic activity and creates the capacity for households to pay for energy.

3.4 PURE DEPLOYMENT MODELS

Different business models can be employed to stimulate effective procurement and deployment of PURE end-user appliances and technologies to foster the development of value chains. The private sector and the financial sector can be effective in driving the process.

PURE appliances for both residential and commercial use such as sewing machines, drills and welders coupled with lighting provide micro-enterprises longer productive hours. The ownership of appliances like refrigerators and freezers open up opportunities in the retail value chain for micro trading as perishable and cold foods can be preserved and their shelf life extended, allowing goods to be sold over longer periods.

PURE technologies such as solar water pumps and irrigation equipment can be purchased on credit. However, repayments are heavily dependent on incomes which are by nature seasonal and heavily depend on crop yields. Any credit financing model and repayments and collections should be tied to the seasonality of income to minimise default risk.

Increasing the uptake of PURE technologies and appliances requires access to affordable end-user and consumer finance and acquisition of productive use assets is associated with relatively high upfront costs. Credit in the form of ***microfinance***, ***leasing*** and ***concessionary loans*** as well as ***grants*** become important to unlock the potential. These models usually take into account end user affordability, ability to generate income and thus the ability to repay.

Credit and leasing forms such as ***Pay-as you-go and Pay-as you grow*** (PAYG) model can be used for solar home systems and solar water pumps and irrigation equipment respectively. Developers and installers can finance the upfront purchase of appliances and systems through leasing arrangements. The model is linked to Global System for Mobile communications (GSM) remote monitoring to manage the status of the system in real time from a distance.

Variation models such as ***lease for life*** provide end users the option to pay an upfront instalment with the balance repayable in monthly instalments over an agreed period of time. Ownership of the PURE asset will only be assumed when payment has been made in full. This therefore implies that the developer or installer should have the financial means to assume the liability of upfront financing. This is generally not the case with SME developers and installers in Iraq as they also do not have access to finance and free cash flow. It is important for the developer to have skills and capacity to conduct credit checks and assessment as well as loan monitoring, and regular follow-up on repayments.

The lack of access to finance from financial institutions makes it difficult for end-user micro-entrepreneurs to secure credit as like the SMEs, they have no collateral and track record. The capacity of microfinance organisations in Iraq is limited such that they cannot actively complement SME developers and installers to broaden sources of credit for end-users.

Negotiating for ***third party financing*** on behalf of PURE end-users with financial institutions or equipment and appliance suppliers to bridge the gap is also a model that could potentially be used by developers in Iraq. In this instance the developer is directly and actively involved in stimulating demand and consumption of the installed capacity and the ability to pay through the economic activity generated.

28 Arab Future Energy Index (2019)

After sales support in the form of direct business and technical mentorship as well as customer care services in the form of warranties and operations and maintenance have been used to increase uptake of PURE.

Power purchase agreements (PPA)[29] can be negotiated to provide a mini grid developer a guaranteed tariff (price) that can sustain operation of the system to meet the electricity needs of a localized group of customers. Demand and the ability to pay is generally created when the system generates sufficient power to meet the energy needs for PURE as end users undertake different economic activities. In some instances, the developer deliberately stimulates demand for energy by providing credit for users to purchase appliances that generate economic activity and generate revenue and capacity to repay the credit and energy usage.

3.5 END USER TECHNOLOGIES

PURE activities are meant to enhance income generation, entrepreneurship for livelihoods sustainability and ability to pay for the energy services provided. The productive use of energy also stimulates economic activity and local job creation.

PURE loads in Iraq include welding machines, refrigeration and lighting in small shops, shavers as well as kiosks for charging mobile phones.

At a larger scale, PURE is supporting agricultural activities such as solar water pumping with application in irrigation on farms, water pump stations for portable water, and incubators in the poultry industry among other sectors. In the poultry industry companies are using industrial solar incubators to hatch eggs. The incubator is attached to solar PV panels with battery storage to ensure constant power supply. Smaller incubators are also available on the market and these can be adapted for end-user PURE while also meeting household food security needs.

Similarly, pressurised automated solar water pumps attached to solar PV panels can also be used to supply water at affordable cost to meet sanitation needs for communities with limited water supply and access to electricity.

Solar driven carts are also increasingly becoming popular in the tourism sector where they are used for local pilgrimage transportation and hotels.[30]

4. SME OVERVIEW

The private sector has an important role to play in bringing investment and innovation to the renewable energy sector in Iraq. The sector in general contributes almost 90% to private sector employment. In the Middle East and North Africa (MENA) region, small enterprises are classified based on a loan size between $5,001–250,000 and businesses with a loan size above $250,000 are considered medium enterprises.[31] Lending to SMEs accounted for only 9 percent of bank loans in 2017.[32]

SMEs in Iraq operate under poor under-developed credit systems. The banks which service them are generally under-capitalized and this restricts their lending capabilities and the majority of the SMEs have largely remained informal and stagnant. SMEs are affected by:

- lack of an enabling institutional framework and incentives to promote SME development. This includes weak legal and institutional framework relating to property rights, weak protection of shareholder rights, poor contract enforcement, among other things;
- poor governance and corruption which undermine the business climate; and
- high start-up costs which are compounded by lengthy bureaucratic procedures and arbitrary taxation. This make the transitioning process into formal businesses both complicated and expensive.

Generally, SMEs also lack project development skills, which limits their ability to develop bankable projects which meet the banks' viability criteria. Their financial reporting standards are poor, and this combined with the lack of credit history and collateral discourages banks from lending to the sector.

29 US Department of State, 2018

30 A Jordanian company with a subsidiary in Iraq distributes and sells carts in Iraq. The company was informally interviewed, and it falls outside the SME definition.

31 IFC, 2014 Islamic Banking Opportunities Across Small and Medium Enterprises in MENA

32 IMF Country Report No. 19/249 IRAQ, 2019

4.1 SME FINANCING ENVIRONMENT

Iraq's financial sector is small, underdeveloped, uncompetitive and dominated by public banks which account for 80% of the credit to SMEs. The sector consists of 70 operating banks, seven of which are state owned, 45 private sector and 18 foreign-owned banks. However, only nine of the local private banks were reported to be actively functional.

There is low efficacy and confidence in the banking system as the majority of the banks, and in particular public banks lack independence and impartiality and have poor corporate governance which often entails deviations from international standards and prudential practices and poor financial reporting standards. Lending standards are stringent, and banks generally demand collateral of more than 150 percent of the loan value. They also have high and wide interest rate spread which entails high financing costs.

Poor risk management systems and poor governance affect the ability of the banks to effectively screen and monitor borrowers as this entails compounded operational costs. This includes weak legal and institutional framework relating to property rights, the protection of shareholder rights, and contract enforcement, among other things.

4.2 SMES FACILITIES AND FINANCING LANDSCAPE

The Government of Iraq has a number of facilities, which provide financial support for SMEs. The more active ones include the One Trillion Dinars Initiative Access and the Iraq Company for Financing SMEs (ICFSMEs) administered Iraqi Vulnerable Groups Support Program, Tijira Provincial Economic Growth Program and Iraqi National Monitoring Authority (INMA) facilities.

The One Trillion Dinars Initiative was established by the Government of Iraq through the Iraq Central Bank support private sector SME start-ups[33] as part of the wider Iraqi government strategy to boost economic growth, create new job opportunities, and the production of local goods and services. The fund is administered through local state-owned and private banks. The main benefiting sectors are the commercial, services, industrial and the agricultural sectors.

While the Initiative encourages youth entrepreneurship and innovation, no clarity was provided on the extent to which this also included the renewable energy sector. Loan size ranges between IQD 5 million IQD and 50 million (approx. USD 4,2000 and USD 42,000) and in exceptional circumstances up to IDQ 1 billion (USD 840,000).[34] Interest rates range between two and four percent and loans have a tenure of five years.

The Iraq Company for Financing SMEs (ICF-SMEs) is an intermediate financial institution that administers donor funds from international organisations and government destined to the banking sector for long term lending to develop or expand small businesses. The ICFSMEs finances eligible projects under the following three pillar programmes:

- The INMA grant has a capitalisation of USD 1 million which is meant to benefit SMEs in the agricultural sector is administered through four banks (Ashur International Bank for Investment, Bank of Baghdad, the Iraqi Middle East Bank for Investment and the North Bank for Finance and Investment).
- The Tijira Provincial Economic Growth Program is a USD 6 million loan facility earmarked for the trade, industry, agriculture, health, tourism and services sectors. The facility charges a maximum of 10% interest with guarantees from the Iraq Company for Bank Guarantees.
- The Iraqi Vulnerable Groups Support Program benefits is a USD 9 million grant facility for displaced citizens and low-income people with ability to run small enterprises that create jobs and contribute to rebuilding the economy.

There were also other initiatives and financing schemes available through such institutions as the Iraqi Industrial Bank with interest rates on loans pegged around 6% per annum. However, no dedicated and preferential financing facility for the renewable energy sector was confirmed

The MoEI through the Renewable Energy Department was reportedly consulting with the financial sector to establish a loan and grant facility for residential rooftop solar PV systems. The handful of local and foreign private sector IPPs who are actively developing projects use their own equity and equipment supplier credit.

33 IMF Country Report No. 19/249

34 https://cbi.iq/static/uploads/up/file-15499512402561.pdf

5. METHODOLOGY

The study mainly consists of qualitative research methods, mostly interviews. These included the following:

- A household demand assessment and PURE to understand consumption patterns for energy including renewable energy sources.
- Key Informant Interviews (KII) with private sector renewable energy SME developers, technology systems installers and sales and distribution companies of technologies and products. The interviews were intended to understand the role and extent of involvement of the different players in the renewable energy sector and provided some insights into the Iraq financial sector based on their perceptions and experience on access to finance.
- Financial sector interviews in order to assess the role and extent of their involvement in the renewable energy sector, and further to assess whether there was scope for collaboration with the EDF-r.
- Informal interactions with academia actively involved in research of renewable energy.

Central to this study is the assessment of the potential of the private sector renewable energy SME sector to create jobs. The solar PV sector is here used as proxy for renewable energy technologies.

While the cost of job creation is an important metric, it is considered within the context of other factors such as affordability, the strategic fit of the proposition in relation to the EDF strategy and the wider potential benefits to be delivered in as far as job creation benefits economic development.

5.1 SAMPLING

The ***household end-user and PURE demand survey*** (see Annex 1) was administered through the IOM call centre to 40 households. The household sample was drawn from consumer survey respondents previously sampled by IOM through market visits, and was drawn from Basra, Missan and Thi-Qar. Basra represented 45% of the sample while Thi-Qar and Missan had 37.5% and 17.5% respectively. The objective of the survey was to assess energy demand and consumption at household level as well as their PURE, sources of energy and consumer willingness to pay (WTP) for the energy.

The ***renewable energy SMEs*** questionnaire (see Annex 2) was administered to 20 start-up and existing renewable energy grid and off-grid private sector SMEs across Iraq. The exponential non-discriminative snowball sampling technique was used, which relied on referrals to identify developers, installers as well as renewable energy technologies sales and distribution entities. Fifteen per cent of the interviewed SMEs are from Baghdad, whereas Sulaymaniyah, Kirkuk, Niniveh, Basra and Najaf represented 10% of the sample, each. The remaining three governorates represent 5% of the sample each.

TABLE 5: SAMPLE COVERAGE BY GOVERNORATE

GOVERNORATE	NO. OF SME COMPANIES	% CONTRIBUTION TO SAMPLE
Karbala	1	5%
Sulaymaniyah	2	10%
Kirkuk	2	10%
Mosul	3	15%
Erbil	1	5%
Niniveh	2	10%
Missan	1	5%
Baghdad	3	15%
Basrah	2	10%
Najaf	2	10%
Thi-Qar	1	5%
TOTAL	20	100%

Source: SME Survey. KI

The financial sector questionnaire (See Annex 3) was sent to four banks consisting of one foreign-owned private bank, a local private bank and two state-owned banks. Only the foreign-owned bank responded. A combination of cold calling and referrals from other renewable energy stakeholders was used.

5.1 LIMITATIONS

Inconsistency due to inaccurate recording of electricity usage was noted. In some instances, households were reported to spend more than their household incomes for electricity. The sample also fell out of the IOM's vulnerable target group threshold. Nonetheless, the survey shed some light on the household perceptions about renewable energy technologies and the inherent social acceptance risk among households.

There was relatively slow and poor response from the SMEs and the banks. This was mainly due to the limited interviewing options of telephonic and email methods used for reaching out to the respondents under the current restrictive environment. The response rate for SMEs improved after switching from random cold calling to SME developers and installers to the snowball sampling technique with several follow up calls.

There was 100% response for the household end-user demand assessment survey and 44.5% response rate for the private sector SMEs interviews. Some companies were reluctant to disclose sensitive information to a third party. Only Bank Audi Iraq responded, representing 25% of the financial sector sample.

6. FEASIBILITY ASSESSMENT AND FINDINGS

The feasibility assessment involves the analyses and findings of the consumer demand assessment as well as private sector renewable energy SMEs across Iraq. The latter consisted of solar PV developers and installers who were primarily involved in the deployment of energy generation technologies to identified customers.

6.1 END USE DEMAND ASSESSMENT

The average household size for the sample was 8.25 people. About 8% of the interviewees were unemployed while 92% were employed or involved in some form of income generating activity to sustain their livelihoods. At least 12.5% of the households were interested in starting their own businesses for which they would require a grant of between IDQ 1 million and IQD 20 million (USD 840 and USD 16,800) for start-up.

PURE end-user activities reported include masonry, farming, retail, electric works, carpentry, barbering, and hairdressing. The energy demand profile was composed of a full range of household loads which included lighting, cooking, heating and cooling, radio, television, cell phone charging and other powering appliances. These activities depended on some productive use of energy. However, activities were being supported by conventional energy sources from grid power and neighbourhood generators.

All the households relied on grid supplied energy and 42.5% of the households also supplemented with neighbourhood generators during power cuts and 57.5% of the households relied exclusively on grid supplied electricity. Only 2.5% of the households confirmed that they supplemented grid electricity and neighbourhood generators with other unspecified sources. While this was not disclosed, there was likelihood that they were using solar water pumps and other solar powered agricultural equipment.

Annual household expenditure on electricity ranged between IQD 240,000 to IQD 1,080,000 (USD 201.8 and USD907.5)[35] per household and largely depended on the size of the household and appliances in use. The household demand for electricity was high and domestic customers were paying in cash on a monthly basis. Electricity spending accounted for 16% to 73% of household income based on USD 1,241 average annual household income as determined by the provincial average household income and electricity consumption survey from MoEI.[36] This is well above the World Bank / Energy Sector Management Assistance Program (ESMAP) Regulatory Indicators for Sustainable Energy (2018)[37] which places a threshold of 5% of household monthly Gross National Income (GNI) for the most vulnerable members of a population. The electricity spending share is also above the World Health Organisation (2004) affordability ratio, which determined a 10% electricity expenditure threshold for low income households.

There was still strong preference for grid supplied electricity from the utilities as well as the use of neighbourhood generators among domestic consumers. At least 80% of the households expressed willingness to pay (WTP) for improved electricity supply, but there was no WTP and switching to renewable energy as an alternative source of energy. This reluctance could be attributed to the high level of state subsidies and a lack of awareness of renewable energy technologies within the domestic customer category. Such views were likely slowing down the rate of uptake within this customer segment.

Contrary to the results of the demand assessment, SME developers reported a slow but steady uptake and shift to off grid solar home systems (SHS) to meet the electricity needs for household lighting and appliances in upcoming housing estate developments. The Pay-As-You-Go (PAYG)[38] model was being used for the payment of electricity generated from the SHS. Domestic energy loads (household appliances) were being supported by capacity options ranging between 2 -3 kilowatt and 4-5 kilowatts. The size of installation largely depended on the size of the property, the electric loads being supported and the size of the household.

35 Electricity consumption levels are inconsistent with those reported by the Ministry of Electricity (2019).

36 Ministry of Electricity, May 2019

37 ESMAP. 2018. Regulatory Indicators for Sustainable Energy. ESMAP Report. Washington, DC: World Bank.

38 https://www.rudaw.net/english/lifestyle/10072018 10-07-2018

6.2 RENEWABLE ENERGY SME SURVEY

6.2.1 Access to capital

Only 5% of the companies had at some point applied for a bank loan but did not get approval. A further 5% of the companies had initiated the loan application process in the past. However, they abandoned the process due to the cumbersome requirements and the high interest rates on loans. Interest rates were reported to be around 30% per annum. The requirement for collateral security also represented an additional challenge for the companies.

The majority of the businesses had not attempted to apply, citing the same reasons as well as the bureaucracy and the documentary requirements during the application process. They were also discouraged as chances of approval were considered low. They attributed this to the perceived risks associated with renewable energy attributable to a poor understanding and lack of appreciation of the sector by the financial sector and government in general. This perception was prejudicing the approval process.

Feedback from the international private bank that was interviewed for this study confirmed the lack of interest from the financial sector. The bank was only involved in short-term lending not exceeding one year. Although this bank had provided some lending to an energy sector project on the strength of the World Bank financing and equipment suppliers, it had limited appetite for infrastructure projects. Lending to SMEs was outside the bank's target market, and renewable energy was not a sector for consideration.

Political risk and perceived SME risk associated with default and lack of understanding of renewable energy technologies were some of the reasons provided. International banks were also not keen on local long-term lending due to the exchange rate risk associated with restrictions on the repatriation of dividends. Furthermore, high transaction costs for lending did not match with the comparatively lower return margins that are generally associated with renewable energy projects.

6.2.2 Renewable energy product and technology supply industry

The renewable energy market in Iraq consists of a competitive group of small and large renewable energy technology installers and a network of sales distribution companies. In most instances, distributers are also developers and they are involved in solar installation projects. All the businesses interviewed characteristically fit within the definition of SMEs provided above.

Fifty five percent of the SMEs that were interviewed were existing and already operational. They had been registered between 2010 and 2019, and as early as 2005 for one company. Forty five percent of the companies were start-ups which were registered between 2016 and 2020. About 15% of the start-ups were undergoing the final stages of registration. A further 25% of the start-ups were unregistered businesses and they were reluctant to formalise their operations for fear of being prejudiced by arbitrary taxation, which was believed to have a bearing on their margins. All the companies considered the registration process both overly bureaucratized and costly. Companies reported registration costs as high as USD 7,000 and at least seven months to finalise the process. This is much higher than the officially documented registration cost of around USD 2,000[39], and this does not take into account the cost of corruption which was widely reported by SMEs.

At least 15% of the existing companies had diversified from electronics and information technology companies into renewable energy, which now constituted their main line of business.

6.2.3 Capital investment

The SMEs interviewed acknowledged the high capital-intensive nature of the sector. While technology costs were generally coming down, the high levels of initial capital outlay were affecting the entry into operation of start-up business and limiting the implementation of capacity expansion plans by the existing businesses. Companies lacked the financial wherewithal to finance installation projects and procuring stock of the different technology products as funding was not easily accessible and expensive.

Existing companies confirmed varying amounts of equity contribution into their business operations and they undertook to inject more funding. Similarly, start-up companies also expressed willingness to invest equity. Companies involved in sales and distribution were for strategic reasons considering forming joint ventures with equipment suppliers in order to gain more access to developed markets and product diversification.

6.2.4 Business turnover

Operating companies reported turnover between USD 10,000 and USD 900,000. One company indicated a USD 12 million turnover.[40] Some of the start-ups also reported some turnover although it was relatively much lower. No turnover was reported for early start-up companies that were either still undergoing registration or were still developing their business plans and feasibility studies.

39 World Bank Group, Doing Business 2020, Iraq

40 This may not qualify in the standard SME definition in Iraq, but the developer claimed to be a medium enterprise

6.2.5 Renewable energy products and technologies

Companies were involved in installation of systems in the domestic, commercial, industrial, agricultural, tourism, security and as well as social and public safety infrastructure sectors.

Renewable energy products found on the market included solar water heaters (SWH), solar home systems (SHS), solar panels, inverters, batteries, battery banks and battery chargers for grid and off-grid systems. The use of solar water pumps and irrigation equipment for PURE in the agricultural sector on the increase. Other innovative products reported included powered solar egg incubators for the poultry industry, motorized solar carts for mobility in the tourism sector, alarm systems as well as solar street lighting and traffic signals.

Main customers included farmers in the north and southern parts of Iraq, residential customers, water treatment companies as well as government departments and institutions without access to the main electricity grid. Installations included solar water pumping systems, small hybrid SHS as well as grid connected microgrids of at least 20kW capacity. The humanitarian sector to provide access to energy for refugees and IDP was also part of the market.

6.2.6 Product prices / trends

The market is competitive and there is a proliferation of cheap sub-standard solar products by players who were taking advantage of customers lack of product knowledge. These traders tend to disappear after making quick sales and returns. Price variations were reported on the range of renewable energy products available on the market. Table 7 presents the average standard prices for some of the products.

TABLE 6:RENEWABLE ENERGY TECHNOLOGY PRODUCTS PRICES

RENEWABLE ENERGY TECHNOLOGY PRODUCT	INDICATIVE PRICE
Solar water heater	$250
Solar water pumping and irrigation systems (including solar panels, an inverter and pump)	$ 10,000 - $15,000
Solar panels	$100
Inverter	$600
Battery	$200
SHS (2kW – 5kW)	$2,000 - $5,000

Source: SME Survey, KI

6.2.7 Procurement and route to market

China was the leading supplier of renewable energy products for all the companies in the installation as well as the sales and distribution sector. Turkey, India Taiwan, Spain, Germany, Italy and the USA were alternative sources for products. Installers were also handling customized orders for customers with specified system types and configurations.

Three distinct distribution routes were noted:

- Large distribution warehouses which have links with international suppliers and import from international markets. They subsequently sell to installers and other local distributers. They also handle customised orders on behalf of installers, and they are also involved in large installations. One company had a large warehouse for a sales and distribution company based in China while another installation company was an agent for an Australian-based company. Larger installers also work with agents in smaller towns and rural communities.
- Some installers were local agents for larger distributers who sold to retailers some of whom were rural and preferred to buy in smaller quantities for resale in rural areas particularly in remote areas where agriculture was the economic mainstay; and
- Localised small, unregistered dealers who still traded informally were not traceable for the survey. Orders in the region of USD 10,000 per month were reported for the smaller businesses.

Most large distributors and installers were based in Baghdad and either had retail stores in other governorates, or they had plans to expand their geographical footprint to networks of retailers and agents especially in rural and remote areas to improve distribution networks. A number of the installers were targeting the farming regions in the north and south of Iraq. One Jordanian company with a subsidiary in Iraq[41] was involved in the installation as well as sales and distribution of incubators for the poultry sector.

One company reported that it had expanded its product line from sales and distribution of electronic products to include the sales and distribution and installation of solar systems. Operational companies reported that they had previously invested some equity into their operations mainly for increasing stock and undertaking capital expenditure installation projects, and they were willing to invest more equity.

41 The company was excluded from the sample due to its size.

6.2.8 Consumer credit and leasing

No credit facilities were being extended to customers and all transactions were on cash basis. SME companies were not in a position to offer credit facilities as they did not have access to finance from the banks or any form of regular injection for working capital to cover their receivables for the tenors of the customers' credit.

Although it was not standard practice for companies to offer consumer or customer credit, 10% of the companies reported that they had previously attempted to do so. However, the facility was discontinued due to high default rate as the customers did not have stable cash flows and incomes to afford repayment instalments.

6.2.9 Other services

Instead of providing credit, some installers were offering small customer discounts. All installers extended one-year warranty on system malfunction, and general operations and maintenance (O&M) repair and replacement of components as well as periodic performance monitoring of installed systems for three years.

Other services provided included training on the installation of solar panels and electrical connection of battery banks, testing and commissioning of the system. These services were mostly rendered by sales and distribution companies to other installers.

6.3 FINANCIAL AND ECONOMIC EVALUATION

6.3.1 Investment outlay

Seventy percent of the companies provided estimates of their capital investment needs, which ranged from USD 40,000 to USD 10 million.[42] About 43% of the companies had investment capital requirements between USD 100,000 and USD 105,000 while 29% of the companies required between USD 40,000 and USD 72,000 of capital injection. Approximately 14% of the businesses estimated their capital needs to be between USD 200,000 and USD 250,000 and a further seven percent estimated capital investment to be between USD 500,000 and USD 10 million.

TABLE 7: ESTIMATED CAPITAL AND APPLICATION OF FUNDS

NO.	STATUS OF COMPANY	ESTIMATED CAPITAL INVESTMENT	PROPOSED APPLICATION OF FUNDS
1.	Start-up	10,000,000	Local manufacture of renewable energy technology products
2.	Start-up	100,000	Develop solar hybrid projects
3.	Start-up	50,000	Develop solar hybrid projects
4.	Existing	250,000	Bulk procurement of products, increasing distribution network develop solar hybrid projects
5.	Existing	100,000	Develop solar hybrid projects
6.	Existing	72,000	Develop solar hybrid projects for irrigation
7.	Start-up	50,000	Develop solar hybrid projects
8.	Existing	100,000	Installation of solar hybrid systems
9.	Existing	100,000	Installation of solar hybrid systems and expanding product distribution network
10.	Existing	105,000	Establish factory for solar water heaters
11.	Existing	100,000	Solar hybrid systems for irrigation and training
12.	Existing	500,000	Expanding operations and R&D
13.	Existing	40,000	Develop solar hybrid projects
14.	Existing	200,000	Manufacturing plant for solar panels

Source: SME Survey, KI

All the existing SME companies interviewed had relatively high capital-intensive business expansion plans whose implementation was being hampered by lack of access to finance.

Some companies were in need of funding for operational expenses related to restocking and diversification of renewable energy product lines. Access to finance would also enable companies to do direct bulk procurement at negotiated

42 This amount is rather too high, and far much more than the requirements stated by other companies.

discounted prices. Those involved in distribution wanted to strategically expand their footprint to other governorates and penetrate rural and agricultural markets for SHS as well as solar water pumps and irrigation equipment, respectively. They also needed capital injection to create the capacity to provide credit especially to farmers.

Two companies had plans to establish local manufacturing plants for solar water heaters and solar panels. Part of the funds would be directed towards research and development and capacity development to improve the skills of their technical staff. Setting up local production plants was expected to create jobs, while eliminating high import duty and transportation costs.

Similarly, start-ups were in need of seed capital to meaningfully start operations and were also experiencing the same challenges associated with lack of access to capital as the established businesses.

The cost breakdown structure for projects typically includes panels, batteries, grid integration costs (if systems are being tied to the grid) as well as project development costs which vary with the size of the project being developed. The cost breakdown of a typical off grid 1kW capacity system ranges in the region of USD1,223 and USD 1,6427 (see Table 9) and can be scaled up to any capacity to match demand.

TABLE 8: PRODUCTS PRICE ESTIMATES

COMPONENT AND DESCRIPTION	QUANTITY	UNIT COST (USD) LOWER LIMIT	UPPER LIMIT
Solar panels	2 – 3 (1kW)	800	1,000
Battery	12v – 200A	200	275
Inverter		150	200
DC cables	6m, 4mm diameter	12	
Connections		1	15
DC circuit breaker solar panels	1	15	35
DC circuit breaker for batteries	1	15	35
AC circuit breaker for input	1	15	35
AC circuit breaker for output	1	15	35
TOTAL		1,223	1,6427

Source: SME Survey, KI

Prices tended to vary based on the type and quality of inverter and batteries and the number of batteries being installed.

Solar water pumps cost much lower and benefit many end users mostly with portable water for households and irrigation water at farms. Investment ranges for grid connected solar water pumping systems falls in the region of USD1,100 – USD1,500/kW. A hybrid system with battery backup costs approximately USD3,500 - USD4,000/kW.

6.3.2 Payback period

All the project developers indicated a financial payback period of between two and five years for recouping their initial capital investment. The energy payback period, which is the equivalent energy used in the manufacturing, installation, operation, maintenance and decommissioning of the respective solar systems after their useful life was not considered.

6.4 JOB CREATION

Job creation costs which are at the core of this study are considered in relation to investment outlay per job created as well as the remuneration for the job created. Jobs created per kW invested in are also calculated. The cost of job creation is particularly relevant and an important consideration of the cost-effectiveness of deploying the EDF-r resources. It is intended to clearly demonstrate the additionality and value for money of new jobs to be created in relation to the level of estimated capital investment.

6.4.1 Job creation cost

Renewable energy projects are by nature relatively capital intensive. Job creation cost assessment is considered using two approaches; i) the financial approach as a function of capital investment needs and ii) capacity approach, the potential jobs to be created in relation to investment per kW of capacity installed.

The costs considered in Table 10 below are company specific based on the 16 of the 20 companies that provided sufficient information to conduct the analysis. Feedback from some of the developers confirmed that the cost per job to be created from expansion plans and start-up projects ranged widely between USD 2,500 and USD 400,000 with the latter reflecting job costs in the manufacturing of renewable energy products and technologies.

There was no variation noted between salaries for existing SME businesses and those being proposed for expansion and start-up operations. The amount of investment per job is a function of the potential number of jobs projected. The companies which have lower investment outlay per job reported higher potential job creation or relatively lower capital or both.

The companies that did not provide the requisite information did not have finalised business plans.

TABLE 9: JOB CREATION COSTS

TYPE OF BUSINESS	CAPITAL INVESTMENT REQUIRED (USD)	POTENTIAL JOBS	INVESTMENT PER JOB CREATED
Existing	10,000,000	25	400,000
Existing	250,000	26	250,000
Existing	50,000	20	2,500
Existing	100,000	12	8,333
Existing	72,000	12	6,000
Existing	100,000	6	16,667
Existing	100,000	20	5,000
Existing	105,000	10	10,500
Existing	100,000	10	10,000
Existing	40,000	5	8,000
Existing	200,000	10	20,000
Existing	500,000	22	22,727
Existing	14,000		
Existing		15	
Start-up	50,000	8	6,250
Start-up	100,000	5	20,000
Start-up	50,000	20	2,500
Start-up	50,000	15	3,333
Start-up	10,000,000		
Start-up		5	

Source: SME Survey, KI

Table 11 and 12 show the job creation costs based on actual projects developed by different installers. Lower and upper investment limits represent average cheapest and most expensive capital investment ranges for selected grid and off-grid capacities of between 50kW and 1MW projects implemented by different SME companies.

TABLE 10: OFF-GRID SOLAR PV SYSTEM WITH BATTERY STORAGE INVESTMENT LIMITS AND COST PER JOB CREATED

MEASURE	CAPACITY AND ASSOCIATED INVESTMENT AND JOB CREATION COSTS				
	50KW	100KW	150KW	200KW	1MW
Lower investment limit (USD)	120,000	240,000	360,000	500,000	2,000,000
Upper investment limit (USD)	200,000	380,000	520,000	660,000	3,000,000
Jobs created	15	25	35	50	200
Jobs created per kW	3.3	4.0	4.3	4.0	5.0
Lower investment limit cost per jobs created (USD)	8,000	9,600	10,286	10,000	10,000
Upper investment limit jobs creation cost (USD)	13,333	15,200	14,857	13,200	15,000

Source: SME Survey, KI
**Cost of job creation – lower investment limit*
***Cost of job creation – upper investment limit*

Average investment costs for selected capacities between 50kW and 1MW ranged between USD 120,000 and USD 2 million for the cheaper off-grid systems and USD 200,000 and USD 3 million for the more expensive investment limits, respectively. Between 15 and 200 jobs were created per project across the respective capacities. The cost per job created ranged between USD 8,000 and USD 10,286 for the lower investment limit while it ranged between USD 13,333 and USD 15,000 for the higher investment limit. There was no consistent pattern on the cost per job created across the different capacities. The comparatively high investment capital requirements for off-grid systems was associated with the cost of battery storage.

TABLE 11: GRID-CONNECTED SOLAR PV SYSTEM CAPACITY INVESTMENT LIMITS AND JOB CREATION COST

MEASURE	CAPACITY AND ASSOCIATED INVESTMENT AND JOB CREATION COSTS				
	50KW	100KW	150KW	200KW	1MW
Lower investment limit	55,000	110,000	165,000	220,000	1,100,000
Upper investment limit	60,000	120,000	170,000	220,000	2,000,000
Jobs created	13	20	30	45	175
Jobs created per kW	3.8	5.0	5.0	4.4	5.7
Lower investment limit Jobs creation cost	4,231	5,500	5,500	4,889	6,286
Upper investment limit Jobs creation cost	4,615	6,000	5,667	4,889	11,429

Source: SME Survey, KI

Investment ranged between USD 55,000 and USD 1.1 million for the 50kW and 1MW capacities, respectively (Table 12). The cost for the higher investment implementation cost was between USD 60,000 and USD 2 million. The cost per job created was between USD 4,231 and USD 6,286 for the lower investment outlays across capacities. The upper investment limit was associated with job creation costs of between USD 4,615 and USD 11, 429 for 50kW and 1MW respectively. The number of jobs created were between 13 and 175 for both investment limits.

While there was no consistent pattern between the cost per job created and the scale of projects, there was correlation between energy capacity and the number of jobs created. Wide disparities were noted between proposed investment capital for projects still to be implemented as part of expansion plans by existing companies and start-ups and the actual capital investment for projects already implemented. The cost per job created generally fell within the cost ranges of projects already implemented. However, the cost per job created for a manufacturing project was an outlier, USD 400,000. The variance between investment costs for implemented and planned projects could be a reflection of inflated investment capital needs for the latter.

6.4.2 Job creation in terms of capacity

A more generic and standard approach within the installation sub sector, is the jobs per kW metric. Information on selected capacities from previously developed estimates a job creation factor of 3.3 and 5.7 jobs per kW for an off-grid system with battery storage for 50kW and 1MW respectively. Jobs levels for grid integrated systems ranged between 3.3 and 5.0 jobs per kW for 50kW and 1MW grid integrated systems.

TABLE 12: JOB CREATION COSTS FOR DEVELOPED PROJECTS

MEASURE	CAPACITY AND ASSOCIATED INVESTMENT AND JOB CREATION COSTS				
	50KW	100KW	150KW	200KW	1MW
Investment level (USD)	120,000	3,000,000	55,000	2,000,000	1,100,000
Number of jobs	15	175	13	200	2,000,000
Jobs per kW	3.3	5.7	3.8	5	175
Youth job contribution	67%	70%	62%	75%	5.7

Source: SME Survey, KI

6.4.3 Remuneration

Remuneration or salary (wage) relates to the periodic payment to a job holder for the services rendered to the SME company. This cost excluded investment capital and other establishment costs. Annual salaries and wages ranged between USD 4,800 and USD 12,000 across the country depending on the level of experience and skills, with engineers being paid the most. The median potential salary was USD 500 per month, and cost per temporary job created was in the region of USD 25 per day with no variations noted across governorates. Developers confirmed that they would maintain the same remuneration for any new jobs to be created through start-ups and expansion projects.

6.5 JOB CREATION POTENTIAL

Solar PV technology installations have potential to create jobs ahead of other renewable energy technologies. The solar PV sector in Iraq has capacity to create skilled, semi-skilled and unskilled jobs. Although job creation happens across job functions and technologies, potential was noted more in the sales and distribution, installation as well as operations and maintenance (O&M). The nature of jobs and capacity to create them varied across different technology systems being installed.

6.5.1 Permanent job creation

Most installers tended to rely mostly on existing internal human resources or external advisors to undertake the necessary project planning and appraisal activities. As such, job creation capacity at this stage was minimal or non-existent. There was, however, evidence of job creation on a permanent basis where capital investment for operational expansion and start-up business provided there was access to finance.

Renewable energy SMEs claimed that on average they employed between 5 to 10 people on a permanent basis. At least 15% of the companies employed up to 20 people in the installation and O&M sub sector. A permanent full-time solar renewable energy job is generally defined as a job held by an individual who spends at least 50% of their time on solar-related work.

One installer estimated farm solar water pump and irrigation systems capacity to create up to 400 jobs per 100 hectares in the agricultures sector in the north of Iraq, where large tracts of land were being targeted for food production. More indirect jobs are also created along the value chain as well as other downstream industries. The measurement of jobs created along the renewable value chain falls outside the scope of this work and would ordinarily not be feasible to track within the timeframe of this study.

6.5.2 Temporary job creation

Some of the temporary work created was in the areas of fabrication and mounting of the steel structures, erecting foundations, electrical wiring, and support during the installation of solar systems. The experience gained during temporary attachments was advantageous for rehire for new projects.

Downstream indirect jobs would also be created within the agriculture supply chain. Linkages were also being established with, among other industries, the steel fabrication industry which supplied mounting structures for solar system installations. PURE projects of this nature had high capacity for replication and scaling up. The execution of renewable energy projects has an incremental and multiplier effect and has the ability to create direct and indirect jobs and stimulate downstream economic activity.

6.5.3 Skills categories

Welders, drivers, and general unskilled workers were also employed during installations. Different engineering fields also undertake specialised activities. At least two jobs were retained on a permanent basis during the operations and maintenance (O&M) stage which initially lasted for three years under the installer's service agreements. These jobs would be retained at the expiry of the O&M contract for the life span of the system which lasts at least 10 to 20 years. The capacity for job creation varies with the size of the system under consideration, and the greater the planned system, the higher the number of jobs created.

There was evidence of potential incremental job creation if received funding to implement their expansion plans. In most instances, job creation numbers were expected to at least double. The sector also created opportunities for temporary jobs that would last up to 10 days per installation project undertaken. The duration of employment for larger hybrid mini grid projects could last up to 40 days depending on the type of skill required.

6.5.4 Job creation and gender

Due to cultural reasons, there was more preference for male civil and electrical engineers and technicians. Women generally constituted less than a third of the workforce and they mostly occupied the administrative positions. Companies noted the potential of PURE particularly in the agricultural sector which has potential and absorption capacity for women to work on farms. SME companies committed to training to boost skills and increasing the number of jobs for women so as to achieve gender balance if they received funding to implement their projects.

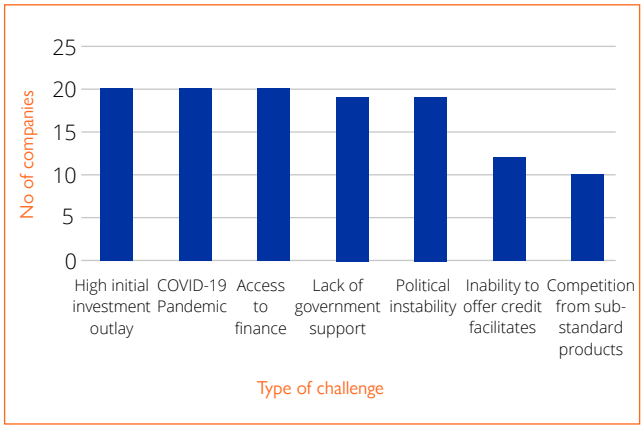
6.5.5 Youth employment

Companies took cognisance of the importance of youth employment and empowerment. Although the exact number of jobs could not be ascertained as there was no consensus on the age definition of youth among companies, most companies estimated that youth employment constituted around 60% - 75% of their workforce.

6.6 RENEWABLE ENERGY SME CHALLENGES

All the companies cited a multitude of challenges that were hindering their operations and affected the entry of start-up companies. These are summarized in Figure 5 below.

FIGURE 3: RENEWABLE ENERGY SME CHALLENGES



Source: SME Survey, KI

All the SME companies cited the high initial and expansion investment capital outlay, the COVID-19 pandemic as well as the lack of access to capital as the major challenges for the sector. The unprecedented effects of the COVID-19 pandemic had significantly slowed down operations and presented uncertainty which was affecting the freedom of movement to efficiently undertake installations. Turnover levels were adversely affected with some installers having to draw from their personal saving to finance operations.

Findings from the survey confirmed that access to finance was also a major obstacle for all the companies. The cost of capital was reportedly prohibitive with interest rates as high as 30% per annum. SMEs considered the application process cumbersome and the need for collateral by banks presented a major barrier. Lack of government support and political instability was cited by 95% of the companies as the second most problematic set of challenges affecting operations.

The findings further confirmed that the lack of awareness about renewable energy technologies, and in particular solar energy in the market was impacting on the rate of technology deployment. The high cost of the technology systems relative to the low-income levels of the majority of the customers, particularly farmers, and lack of credit were further suppressing demand for installation of renewable energy systems. The price of the various solar systems was being compounded by high transportation costs and import duty which was around 25%. Government was also not providing any subsidies to renewable energy SMEs.

CONCLUSION

The renewable energy sector in Iraq is still in its nascence, but it exhibits significant potential, especially in the PURE sector. The shortage of electricity in Iraq has seen a proliferation of solar PV systems across the country. Installers mainly target residential estates, farms and street lighting as well as industrial and commercial customers. Humanitarian organizations have been supporting energy access initiatives for internally displaced persons, social infrastructure as well as the provision of street lighting for safety and security. PURE is also being incorporated into renewable energy programming as a complementary thematic area to sustain economic activity and livelihoods.

This study has confirmed that the high incidence solar radiation in Iraq is a key enabler for the deployment of renewable energy solutions. Although there is growing potential along the value chain, scaling up of renewable energy technologies continues to be hampered by the lack of funding and the absence of a clear and enabling policy environment.

More active private sector participation in the deployment of renewable energy alongside Arab regional policy initiatives and climate change will inevitably have strong influence on Iraq's renewable energy geopolitics.

At a global scale, the fast-declining cost of renewable energy technologies in particular solar will influence diversification of Iraq's energy mix from the dominance by hydrocarbons while also improving the security of energy supply and access. At the same time, private sector participation will stimulate job creation and downstream economic activity, and in order for this to obtain fiscal and financial support would be important to unlock the potential of the sector.

The initial capital outlay for renewable energy projects has direct influence on the cost of job creation. Jobs arising from renewable energy projects often bring additional benefits, and as such, job creation should be considered as a component of an integrated economy wide as well as social and environmental co-benefit framework.

Financing of SMEs in the energy sector remains a challenge at a time when the potential of the sector needs to be unlocked to stimulate job creation and spearhead economic development. This provides scope and a sound value proposition for the IOM intervention through capital grants for private sector driven SME development to stimulate enterprise development and job creation.

The EDF-r could be a catalytic programme to transition Iraq's energy sector into a clean, sustainable and job creation sector. This could also pave the way for more active collaboration and engagements with policy makers such as the Ministry of Industry Small Projects Department and the Department of Renewable Energies and Energy Efficiency. Such collaboration could strengthen renewable energy awareness, skills development, co-financing and joint programming and targeting of SMEs for optimal outcomes, thereby improving the potential to unlock a multitude of other development co-benefits and transform the quality of life and uplift the standard of living.

RECOMMENDATIONS

The point of entry by the IOM is important for optimising resources, impactful and effective scaling up deployment PURE to stimulate job creation and economic development. It is recommended that the IOM:

- Establishes a capital grant facility with a USD 50 000 threshold for renewable energy off grid and on grid solar system installations. While the amount is relatively high, it demonstrates prudential lending in a sector that is relatively capital-intensive without presenting the risk of IOM over exposure . The amount is significant enough to provide seed capital that can be used to leverage additional funding to support business continuity.
- Considers entry at two levels:
    - Registered start-up SMEs. While start-ups may not have records, registration signifies compliance and preparedness to commence operation. Such companies are at a stage where they can easily support technology deployment and create jobs and make an impact.
    - Existing and operational enterprises which either need capital for business expansion and scaling up or product restocking stage. Established businesses already have a track record and a customer base and also have the ability to create incremental jobs that bring livelihoods sustainability. This will also enable the IOM to register quick wins and tangible job creation, renewable energy capacity development co-benefits for community upliftment.

- Sets a job creation minimum target of five permanent jobs for solar installations and development; two permanent jobs for sales and distribution retail agents.
- Launches a national expression of interest that prioritises and targets:
    - Renewable energy SME mini-grid and micro grid developers and solar systems installers that support PURE end-users such as the agriculture sector where farmers want to install hybrid solar water pumping and irrigation systems to support farming operations in remote rural areas, farms and areas that are not served by the national grid.
    - Developers should take into account the appropriate size and capacity of the system.Sales and distribution SME companies which have plans to establish or expand their network and geographical footprint to rural areas, farms and areas with limited grid connectivity where energy assess has potential to stimulate PURE.
    - Extending financial support to companies involved in the sales and distribution of renewable products will enable them to structure a credit for end user customers particularly those in the agricultural sector to purchase solar systems on favourable credit terms; and
    - Energy for social infrastructure such as schools and healthcare facilities can also be considered to stimulate job creation and economic development.
- Conducts more extensive due diligence to verify and validate the capital costs for selected eligible projects submitted in response to the expression of interest.
- Embarks on an awareness and outreach campaign through publicity and stakeholder engagements. Participants in the key informant interviews should be approached directly as engagements during interviews confirmed that they were active, knowledgeable, and committed players whose business expansion plans were being stalled by lack of funding. They are generally in a good position to mobilise and act as key informants to other players in the sector.
- Hosts an expression of interest briefing workshop to unpack the application process and eligibility criteria, establish gaps and needs and provides technical assistance and advisory support to companies to develop the necessary documentation that is compliant and consistent to the requirements and objectives of the call;
- Establishes a micro grant model that empowers end-users to purchase productive use appliances. Such a grant could be co-administered with the grid developer and installer credit facility.
- Considers the importance of EDF-r sustainability and capitalisation through resource mobilisation and replenishments that ensure continuity and financial capacity to support scaling up and accelerating deployment of PURE activities.
- The combination of energy access for vulnerable people (internally displaced persons, women, children and the youth) combined with renewable energy and agriculture as a PURE activity provides an opportunity and positions the EDF-r as a strong candidate for accessing blended and concessional climate finance (grants, concessional loans and guarantees) from the Green Climate Fund (GCF). It is therefore recommended that the IOM submits a Concept Note to the GFC to leverage additional grant and concessional funding that would ensure continuity of the EDF-r.
- Establishes partnerships to:
    - Promote capacity development partnership between established private sector SME solar system installers and developers with outsourcing and sub-contracting arrangements as these can also promote technical skills development and close any existing gap and open opportunities for renewable energy SME development and job creation; and
    - Establish a blended financing structure that serves to reduce cost of capital through partnership with a financial institution such as the Trade Bank of Iraq which is well capitalised and has working capital and project finance products and institutional capacity to administer a loan portfolio to support the financial needs of SMEs. The structure should be capitalised with grants which have a variation of recoverable grants to de-risk business operations, concessional loans and guarantees to mitigate default on credit extended to developers or installers and PURE customers. Grants act as a form of credit enhancement for concessional loans.
- Explores the institutional and programmatic synergies between EDF-r and EDF agriculture to accelerate the uptake of PURE for agricultural development which would strengthen food security and create more jobs.
- Effectively engages with the relevant government ministries such as the MoEI and the Ministry of Industry Small Projects Department to target government supported socio-economic livelihoods programmes to mainstream PURE among the vulnerable communities.
- Creates awareness and education on the benefits of renewable energy especially for PURE at household level. Such awareness could significantly reduce the cost of energy at domestic level while also providing clean and sustainable energy options. A multi stakeholder awareness campaign programme could be coordinated through the MoEI and developers.
- Develop knowledge management products and lessons learnt that will inform the programming and development of a fully-fledged integrated national SME renewable energy deployment programme centred on PURE.

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ANNEX 1: DEMAND ASSESSMENT: HOUSEHOLD AND PRODUCTIVE USE OF ENERGY SURVEY

GOVERNORATE		COMMUNITY	
NAME OF INTERVIEWEE		DATE OF INTERVIEW	

HOUSEHOLD DEMOGRAPHIC INFORMATION AND HOUSEHOLD INCOME	
1. What is the size of your household?	Size □ No. of children □
2. Do you have any household income?	Yes □ No □
3. What is the source of your income?	
4. What is your average household income?	

HOUSEHOLD ENERGY CONSUMPTION / USAGE BY LOAD	
5. What are your current sources of energy?	Grid power □ neighbourhood generators □ Solar Home System □ Do not know □ Other (specify) □
6. How much do you pay for electricity (daily / weekly / monthly? (indicate)	
7. What is / are your alternative electricity sources during power cuts?	
8. Would you be willing to switch or supplement your current energy needs with any alternative renewable energy sources such as solar home systems, lanterns, battery cells, etc.?	
9. If your answer above is yes, please indicate the type?	
10. If you are already using any renewable energy products, please indicate the type?	
11. Where did you buy your renewable energy products?	
12. How much did you pay?	
13. How did you pay for the products?	Cash □ Credit □
14. If you bought on credit, please indicate the source?	
15. Which domestic appliances do you use? (indicate usage time for each)	Lights □ Number □ Usage Hours □ ..... Cooker: Gas □ Electricity □ Other □ (specify) ..... Usage Hours ..... Radio □ Usage Hours Cell phone(s) □ Number □ Usage Hours □ ..... Cooling / heating □ Usage Hours □ Other □ (Specify) ..... Usage Hours □ .....

PRODUCTIVE USE OF RENEWABLE ENERGY (PURE)	
16. Are you currently involved in any productive use of energy activities / using energy to earn income?	Yes □ No □
17. If no, would you be interested in starting an income generating venture?	Yes □ No □
18. Where do you OR would you operate from?	
19. Which of the following activities are you currently involved in OR would be interested in pursuing?	Agriculture □ Food processing □ Carpentry □ Sewing □ Hair salon □ Energy kiosk □ Construction □ Smithery □ Manufacturing □ General trading □ Other (specify) □ ..... Please provide a brief explanation of the selected activity
20. How many people do you employ for the activities above? 21. Do you have any plans to expand your activities? 22. How much money would be required for the expansion / start up? 23. What is the anticipated source of capital? 24. What assets would you procure OR What would you use the money for? 25. Where would procure the assets from? 26. How many additional people would you employ? 27. What are the main challenges / limitations being experienced by your income generation activities if you are already operating?	**Men:** **Women:** **TOTAL:** Yes □ No □ Own money □ Credit facility □ Grant□ Source of credit ..... Source of grant ..... **Men:** **Women:** **TOTAL:**

PAYMENT METHOD	
28. How much do you currently pay for electricity / energy per month? 29. What payment method do you use to pay for electricity? 30. How much more would you be willing to pay for any other alternative and new supply of energy?	Cash from own income □ Cash from other sources (indicate) □ (specify) ..... Pay as you go mobile money □ cash □ Free electricity grant □ Other □ (specify) .....

ANNEX 2: RENEWABLE ENERGY SME PROJECT DEVELOPER AND SALES & DISTRIBUTION QUESTIONNAIRE

Name of Interviewee:

Name of your business:

Address of business:

1. Are you a registered business?
2. When was your business registered?
3. Is your business already operating or a start-up?
4. In which governorate is your business located?
5. What is your annual turnover?
6. What renewable energy business are you involved in?
7. What renewable energy products / technologies do you sell / distribute? (provide a list)
8. Where do you procure the products from?
9. Do you provide consumer credit if you sell any renewable energy products?
10. What other services do you provide to your customers?
11. How many people do you currently employ? (provide breakdown by gender)
12. Do you have plans to expand your business?
13. If yes, what could be stopping or delaying you?
14. If you receive funding, what activities would you undertake?
15. How many more people would you employ if you received additional funding? (provide breakdown by gender)
16. How many jobs would be permanent and how many would be temporary?
17. If temporary, how long would they last?
18. What is the nature of the jobs that would be created (e.g. technicians, general, etc.)?
19. How much does it cost you to create a job / employ a person?
20. Have you so far invested any capital in the business?
21. Have you ever applied for a bank loan?
22. Was it approved?
23. If rejected, what was the reason?
24. If granted, what were the terms and conditions of the loan?

Repayment period: **Interest rate:**

25. What challenges is your business experiencing?
26. How are you addressing the challenges?
27. Would you require any grant (financial support)?
28. How much financial support does your company require?
29. What would you use the funds for?

ANNEX 3: RENEWABLE ENERGY SME FINANCING QUESTIONNAIRE

1. What is the definition for SMEs in Iraq? (universal or bank specific)
2. What is the general overview of the financial sector in Iraq in terms of:
3. Number of banks
4. Ownership (public and private (international))
5. General lending terms
6. How active are the banks?
7. What is your market share of SME financing?
8. What are your bank's lending requirements?
9. What are the lending terms?
10. Which sectors do you target?
11. Do you have a specific facility for renewable SMEs or are there any plans to establish one?
12. If you have a renewable energy financing facility which sub-sectors do you finance (e.g. Solar technologies sales and distribution, solar mini / micro grid installations)?
13. What is the minimum and maximum grant funding that you give?
14. What is the minimum and maximum loan funding that you give?
15. What are the terms attached to the loan (interest and prepayment time)?

ANNEX 4: LIST OF INTERVIEWED RENEWABLE ENERGY SMES

	COMPANY	TYPE OF BUSINESS	TURNOVER (USD)	CAPITAL INVESTMENT REQUIRED (USD)	CONTACT PERSON / FOCAL POINT	MOBILE NUMBER	EMAIL ADDRESS	LOCATION
1	Electroin Showroom	Start-up		10,000,000	Ali Abbas Ali	+964 780 150 870	alikakany10@gmail.com	Karbala
2	Big Power Company	Existing			Blnd Atta Muhammed	+964 770 158 4330	blnd@bigpower.com	Sulaymaniyah
3	North Power Company	Existing	500,000		Daban Namil Ali	+964 770 158 4330	daban.nabil@npciraq.com	Sulaymaniyah
4	Smart Technology Firm	Start-up	70,000		Sirwah	+964 771 922 8492	srwa.rawf1995@gmail.com	Kirkuk
5	Ardunic Kirkuk – Vertical access wind turbine	Start-up	10,000	100,000	Dr. Omer Jamal	+964 771 589 2668	alazzawi.omer1986@gmail.com	Kirkuk
6	Nawar Aaena	Start-up	50,000	50,000	Nawar Aaena	+964 773 410 6461	nawareenaa@gmail.com	Mosul
7	Tigris office -Mosul	Existing	150,000	250,000	Ghassan Mohsen Ahmed	+964 751 535 7359	ghassan208@yahoo.com	Mosul
8	Power Men Company	Existing	12,000,000		Sahar Shirafcan	+964 750 447 6604	commercial@power-men.com	Erbil
9	Alhadbaa Modern Company / Infinity Green Power	Existing	1,500,000	100,000	Saleem M. Abdullah	+964 770 200 0002	saleem@alhadbaa.com	Niniveh
10	Trade and Modern Technologies	Existing	14,000		Ali Abid Jabur	+ 964 780 140 6799	ibmu_amara@yahoo.com	Missan
11	Mashtel Allraq	Existing	100,000	72,000	Mohammed Hussein	+964 771 039 9335	mscmohammed@yahoo.com	Baghdad
12	West of Basrah Co	Start-up	200,000	50,000	Abdulbaqi K. Ali	+964 780 101 2423	abdulbakiuob@yahoo.com	Basrah
13	Solar Innovation Club	Start-up	35,000		Tahsee Ali Jabbar	+964 770 734 6995	tahseenali.ali114@gmail.com	Basrah
14	Nudum for Technical Solutions	Existing	24,000	100,000	Hussam Loai Raoof Al-Haboby	+964 780 134 5121	hosamhaboby25@gmail.com	Najaf
15	Dareda Solar	Existing	600,000	100,000	Brwa Majid	+964 771 152 1907	m.mohammed@gmail.com	Niniveh
16	Ibi UTU	Existing	70,000	105,000	Hayder Qays	+964 780 933 2469	info@biladutu.com	Baghdad
17	Solar System Projects	Existing	200,000	100,000	Saad Salim	+964 774 093 4119	saadsalem93@yahoo.com	Mosul
18	Knozulhikma Company	Existing	900,000	500,000	Esam Alkalidy	+964 780 152 3887	info@knozco.com	Najaf
19	Tofaha Co. General Trading	Existing	40,000	40,000	Hayder Khudair Abbas	+964 780 000 0850	haider19741972@yahoo.com	Thi-Qar
20	Al Zobiadee & Al Najafee	Existing	100,000	200,000	Ali Mohammed Mohsan Al-Khalaf	+964 773 379 4700	Alias7872@gmail.com	Baghdad

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