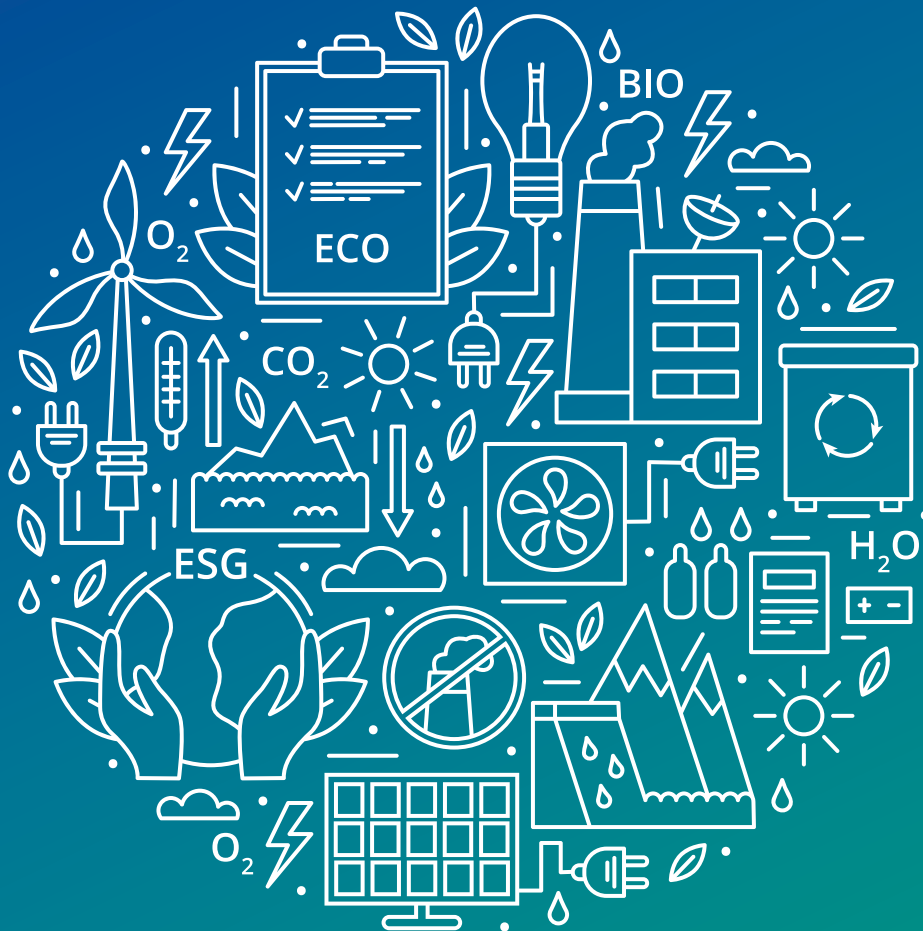


Green Lending in the Kurdistan Region of Iraq: Support Mechanisms for Financing Renewable Energy Systems

A study commissioned by the Financial Inclusion for Economic Restart and Integration in Iraq Project



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Executive Summary

This report examines the financing landscape for renewable energy (RE) in the Kurdistan Region of Iraq (KRI), with a particular focus on photovoltaic (PV) systems. It highlights critical findings regarding financial mechanisms, market demand, and the challenges impeding widespread RE adoption. The study incorporates surveys and interviews conducted with various stakeholders, including PV providers, financial institutions, households, micro and small businesses, and governmental bodies. A detailed analysis of these interactions has been conducted to present actionable recommendations for improving access to green finance and promoting sustainable energy transitions.

The study's methodology combines desk research and primary data collection to provide a comprehensive overview of the current state of RE financing in KRI. Desk research involved reviewing existing literature, policy documents, and international support mechanisms related to renewable energy adoption.

In-depth interviews and surveys were conducted with representatives from six financial institutions, 15 PV providers, 17 households, and 15 micro and small businesses. Additional perspectives were gathered from key stakeholders, including the Central Bank of Iraq (CBI), the Ministry of Labor and Social Affairs (MoLSA), and PV industry leaders. This mixed-methods approach ensured that the findings reflect the diverse perspectives and experiences of all relevant parties.

The survey of PV providers revealed a growing market for solar energy systems in KRI, driven by rising electricity costs and unreliable grid infrastructure. PV Providers cater primarily to households and small businesses, with some extending services to larger commercial clients. Hybrid PV systems (those connected to the national grid and supplemented with battery storage) are becoming increasingly popular due to their reliability during power outages. However, the high upfront costs of PV systems remain a significant barrier. Many customers rely on short-term payment plans offered by the PV providers, but these plans are insufficient for larger or more expensive installations. Financial institutions' lack of accessible and affordable green financing options further exacerbates this issue, limiting market growth.

Household adoption of PV systems demonstrates promising potential, with high satisfaction levels reported by existing users. These households appreciate the cost savings, energy independence, and environmental benefits provided by solar energy. However, financial and cultural barriers hinder broader adoption. High initial costs deter many households, particularly those unfamiliar with available green financing options. Additionally, cultural resistance to interest-based loans limits participation in traditional financing schemes. Many households expressed a preference for sharia-compliant financing options, such as interest-free installment plans, which better align with their beliefs and financial capabilities. The absence of government subsidies and tax incentives further compounds the financial burden on potential adopters.

Among micro and small businesses, PV adoption is primarily driven by the need to reduce operational costs and improve energy reliability. Businesses that have adopted PV systems report significant benefits, including lower electricity expenses and fewer disruptions. Non-adopters, however, frequently cite the high upfront costs and lack of

awareness as the primary barriers. Smaller businesses, particularly those with limited financial resources, are disproportionately affected by these challenges. The survey findings underscore the need for targeted financial products and awareness campaigns to address these gaps.

Financial institutions in KRI play a limited role in supporting green energy projects, with only a few engaging in green finance initiatives. The CBI's green lending program, launched in 2022, is a notable exception. This program offers interest-free loans for RE projects, with a one-time administration fee of six percent to the registered banks under CBI. Despite its favorable terms, uptake in KRI has been minimal, largely due to restricted supplier options, low awareness, and stringent loan conditions. Other financial institutions expressed interest in green finance but face challenges such as high default risks, long payback periods for PV investments, and limited regulatory support. These issues highlight the need for more robust policy frameworks and incentives to encourage financial institutions to expand their green lending portfolios.

Interviews with governmental bodies provided additional insights into the challenges and opportunities for RE development in KRI. MoLSA acknowledged the potential of the PV sector to create jobs and reduce energy poverty but lacked targeted programs to support low-income households and businesses in adopting RE technologies. The absence of mechanisms to feed surplus electricity back to the grid, such as net metering, further limits the economic viability of PV systems. Without these mechanisms, consumers cannot monetise excess electricity production, reducing the financial appeal of investing in solar energy.

The findings of this report emphasise the need for a coordinated approach to overcome the barriers to RE adoption in KRI. Financial institutions should collaborate with the government to develop green loan guarantees, subsidies, and sharia-compliant financing products that cater to diverse market needs. Streamlining the loan application process and providing longer repayment terms with reasonable interest rate/fee/Murabaha would make financing more accessible and attractive. Public awareness campaigns highlighting the benefits of solar energy and available financing options are essential to drive adoption among households and businesses.

The Kurdistan Regional Government (KRG) has a pivotal role to play in facilitating this transition. Developing comprehensive green energy policies, offering tax incentives, and implementing net metering systems are critical steps to create a supportive ecosystem for RE investments. Simplified regulatory approvals and increased public-private partnerships can further accelerate the adoption of solar energy. PV providers should focus on offering tailored solutions, integrating energy storage options, and providing post-installation support to build customer trust and ensure long-term satisfaction.

In conclusion, renewable energy, particularly solar PV systems, holds significant promise for addressing KRI's energy challenges. By addressing the financial, regulatory, and cultural barriers identified in this report, stakeholders can create an enabling environment for widespread RE adoption. This transition will not only enhance energy security and reduce greenhouse gas emissions but also contribute to sustainable economic development in the region.

List of Abbreviations

Ah	Ampere per hour
AMP	Ampere
BoI	KRG Board of Investment
CBI	Central Bank of Iraq
CDM	Clean Development Mechanism
IQD	Iraqi Dinar
KRG	Kurdistan Regional Government
KRI	Kurdistan Region of Iraq
kW	Kilowatt
kWh	Kilowatt per Hour
kV	Kilovolt
MSME	Micro, Small, and Medium-sized Enterprises
MW	Megawatt
MoLSA	KRG Ministry of Labor and Social Affairs
PPA	Power Purchase Agreements
PPP	Public-Private Partnerships
PV	Solar Photovoltaic
RE	Renewable Energy
USD	United States Dollar

1. Introduction

This report investigates the current landscape of Renewable Energy (RE) financing in the Kurdistan Region of Iraq (KRI), focusing on deploying photovoltaic (PV) systems. The study highlights critical findings regarding the role of financial institutions, market demand, and the barriers impeding the widespread adoption of RE systems. Key insights from interviews with PV sector companies and financial institutions provide a comprehensive understanding of customer financing needs, the availability of green loans, and the effectiveness of current government policies. The report concludes with actionable recommendations to enhance the support mechanisms for financing RE systems, addressing the unique challenges faced by different market segments, particularly vulnerable groups such as low-income populations.

1.1 Definition of Solar PV Systems

A solar photovoltaic (PV) system is designed to convert sunlight into electricity, making it a clean and sustainable energy source. These systems typically consist of solar panels to capture sunlight, an inverter to convert the energy into usable AC power, and optional components like batteries for energy storage and monitoring systems to track performance. The mounting structure and wiring complete the system setup, ensuring efficient energy generation and use¹.

Solar PV systems vary in capacity and cost depending on the application. A small one kW system, suitable for rural households, can generate about 4–5kWh of electricity daily, powering basic appliances like lights, a small refrigerator, and electronic devices. Such a system costs between 800 and 1.500 USD, offering an affordable solution for energy needs in off-grid areas.

For urban homes, a 3kW system, costing around 3.000 – 5.000 USD, produces 12–15kWh daily, meeting the energy demands of a medium-sized household with appliances like air conditioning, washing machines, and multiple devices. Larger households or small businesses might consider a 10kW system, which can generate up to 50kWh per day at a cost of 10.000 – 20.000 USD. This capacity is ideal for businesses such as bakeries or small workshops, enabling them to operate energy-intensive machinery while reducing reliance on the grid.

Adding battery storage increases costs but provides greater flexibility, particularly in areas with unreliable grid infrastructure. For example, a household in Erbil using a 3kW system could significantly lower its electricity bills, while a bakery with a 10kW system could run its ovens during peak hours and rely on the grid at night.

1 <https://www.seai.ie/sites/default/files/publications/Homeowners-Guide-To-Solar-PV.pdf>

1.2 Background on Renewable Energy Development in KRI

KRI holds substantial potential for RE, particularly in solar and wind power driven by the region's high sunlight availability and wind speed at 10m and 50m Height², and increasing demand for stable electricity sources. Like many other oil-rich countries, Iraq is beginning to recognise the importance of diversifying its energy sources in response to growing electricity demands, unreliable grid infrastructure, and environmental concerns. KRI with its semi-autonomous governance, has taken steps toward supporting RE, particularly solar power, as a promising solution to alleviate the region's electricity shortages. Despite this, the adoption of RE technologies has been slow, largely due to financial barriers, lack of awareness, and limited government support.

Financing mechanisms are vital in overcoming these obstacles to ensure that RE projects are both economically viable and sustainable in the long run. Financing has emerged as a pivotal factor in developing RE projects.

While interest in solar PV systems has grown, the initial cost remains a significant barrier for many households, micro, small, and medium-sized enterprises (MSMEs), and even large institutions. Adequate financing mechanisms, such as green loans, subsidies, and grants, are crucial in enabling more widespread adoption of these technologies

KRI's reliance on fossil fuels has led to environmental challenges and volatile energy costs. The region can improve its energy security, reduce greenhouse gas emissions, and contribute to global climate goals by transitioning to RE projects. The key to this transition, however, lies in developing robust financing mechanisms that can attract investment and mitigate the risks associated with RE adoption. One significant risk associated with RE adoption is market risk, which refers to the uncertainty about the revenue generated from selling electricity. For example, if electricity prices fluctuate or if there is insufficient demand for the power produced by an RE project, the financial viability of the investment can be undermined.

In KRI, where grid infrastructure may be unreliable or where there are delays in integrating renewable energy into the national energy network, this risk becomes even more pronounced. Developers might face difficulties ensuring consistent cash flow, discouraging private sector involvement in RE projects. Robust financing mechanisms, such as power purchase agreements (PPAs) or government-backed guarantees, are essential to offset risks and provide predictable revenue streams.

This report seeks to assess the current financing mechanisms available and evaluate their effectiveness in supporting RE development.

2 Abdulqader, K. K., & Saleh, H. M. (2018). *The potential and social acceptability of renewable energy sources in North Iraq (Kurdistan Region)*. Retrieved from <https://www.researchgate.net/publication/330136209>

1.3 Objectives and Scope of the Study

The objective of this study is to assess the financial support mechanisms for private small-scale PV systems designed primarily for self-consumption in KRI, analyse market demand, identify barriers to adoption, and propose actionable recommendations for improving access to green finance. These systems, typically used by households MSMEs, aim to provide a reliable and sustainable source of electricity while reducing dependence on the grid.

2. Study Design and Methodology

2.1 Desk Research

This study includes a thorough review of existing literature and policy documents to understand the RE landscape in Iraq. Particular attention was given to financial products and banks' interest in providing green loans. In addition, government policies and international support mechanisms promoting the adoption of RE systems in Iraq and KRI are mentioned. The desk research included a desk analysis and insights from interviews with commercial banks, microfinance institutions, and regulatory bodies.

2.2 Primary Data Collection

The primary data for this study was collected through in-depth interviews with PV sector companies, financial institutions, and key stakeholders in the RE market including households and hotels. Representatives from six financial institutions (Al-Thiqa, Erbil Bank for Investment and Finance, Grofin, Safe Home, Tamwil, Trade Bank of Iraq, Bloom Finance³, and Cihan Bank) provided insights into the current availability of green finance products and the challenges they face in expanding their portfolios. PV providers operating in the region shared their perspectives on market demand, customer financing needs, and barriers to adoption. The list of PV providers contacted is included in the annex of this study.

3 Through Project Bloom Kurdistan Regional Government provides accessible loans of up to IQD 150 million for each business with no collateral requirements. <https://bloom.digital.gov.krd/en>

3. The Power Sector Landscape in KRI

3.1 Situation of the Power Sector in KRI

The region operates 15 power plants feeding into the grid, including three hydroelectric stations, seven gas-fired thermal plants, and several diesel power plants. See Table 1 below:

Table 1: No. of power plants and their capacities in megawatt (MW).

No.	Power Plant Name	No. of Units	Designed Capacity (MW)	Average of Designed Capacity (MW)	Type of Project	Owner	Running Fuel
1	Erbil Gas turbine combined cycle	10	1.500	1.200	Investment Independent Power Plant (IPP)	Mass Group	Natural Gas and Diesel
2	Sulaymaniyah Gas Turbine CC (Chamcamal)	10	1.500	1.200	Investment IPP	Mass Group	Natural Gas and Diesel
3	Duhok Gas Turbine Simple Cycle	8	1.000	800	Investment IPP	Mass Group	Natural Gas and Diesel
4	Khormala Gas turbine Simple Cycle	6	960	800	Investment IPP	Kar Group	Natural Gas and Diesel
5	Bazyran Gas Turbine Simple Cycle	4	1.250	900 (with air inlet cooling system)	Investment IPP	Qaiwan Group	Natural Gas and Diesel
6	Baadre Deisel PP	11	150	148 (with air inlet cooling system)	Investment IPP	FOXPOL Energy	HFO

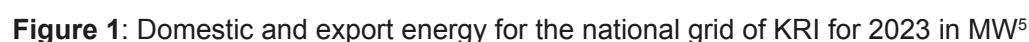
7	Tasluja Diesel PP in Sulaymaniyah	30	51	40	Operation and Maintenance (O&M) Contract	MOE	HFO
8	Erbil 29 MW Diesel PP	4	29	25	O&M Contract	MOE	Diesel
9	Duhok 29 MW Diesel PP	4	29	25	O&M Contract	MOE	Diesel
10	Sulaymaniyah 29 MW Diesel PP	4	29	25	O&M Contract	MOE	Diesel
11	Garmian GG (Agreko)	165	165	165	Investment IPP	Agreko UK	Flare gas
12	Dukan Hydro Power Station	5	400	100	Governmental	MOE	RE
13	Darbendikhan Hydro Power Station	3	249	100	Governmental	MOE	RE
14	Deraluk Hydro Power Station	2	37	37	Governmental	MOE	RE
15	Khabat Thermal PP	2	300	300	Governmental	MOE	HFO
	Total Design Installed Capacity		7.649 Installed Capacity				

In KRI, peak electricity demand occurs in winter, unlike the rest of the country, where it peaks in summer. The region's total installed capacity (national grid) is about 6.000 MW, including dams and small diesel generators, but only around 3.200 MW is operational. Residential and small consumers use about 2.500 MW, while 450 MW is exported to the Iraqi grid (see Figure 1), and industrial users consume 200-250 MW.

The difference between installed and operational capacity is mainly due to a lack of fuel, particularly natural gas for newer gas turbines. Additionally, damaged power lines remain unrepaired due to funding issues. As a result, many businesses and residents rely on diesel generators for power.

The KRG, with U.S. support, is currently developing a master plan for electricity transmission and distribution in KRI (2022-2031). The plan aims to install substations at 400/132 kV, 132/33/11 kV, and 33/11 kV levels, enhance the transmission network by connecting new substations, and expand the distribution network to serve new districts, commercial and industrial areas, as well as provide electricity to villages and rural regions⁴.

4 https://www.jica.go.jp/Resource/english/our_work/evaluation/pdf/iraq_2021.pdf



According to KRG statistics, neighborhood generators sell their power for an average of 10.000 IQD per ampere/month (see Table 2). It is worth mentioning that diesel generation fees are billed in amperes (amps) as a set level of circuit capacity that will cut off if the consumer consumes more amps than they paid for (the circuit capacity then returns after a few minutes).

7 <https://krso.gov.krd/content/upload/1/root/mulidat-kurdish-report-final-2024.pdf>

Table 2: Private Generators' Average Number of Operational Hours and Price per Ampere⁸

City	Average number of operational hours per day	Average price of 1 Amp (IQD)
Duhok	10	11.000
Sulaymaniyah	8	10.000
Erbil	9	11.000

In 2022, the KRG introduced a prepaid electricity system, which has reportedly improved the availability of national power and reduced consumer wastage. According to the Ministry, the system's electronic data collection directly from homes has eliminated the need for staff visits to record electricity usage. A new initiative providing 24-hour electricity to select residential areas and markets in Erbil, Sulaymaniyah and Duhok is also being piloted. Though still a pilot project, it has been successful and is expected to expand to all areas. Under the new prepaid system, consumers pay 156 IQD (0.1 USD) per kW, a substantial increase from the previous rate of 18 IQD per kW⁹.

The KRI's electricity mix is dominated by fossil fuels, with natural gas and oil accounting for most electricity generation. The region's infrastructure heavily relies on these conventional sources, making it vulnerable to supply disruptions and environmental degradation. According to the KRG Ministry of Electricity, the average total electricity consumption per capita is approximately 6.500 megawatts per year, with annual electricity consumption growth around 7%.

The General Director of Production at the Ministry of Electricity, provided detailed and accurate figures for the electricity sources in KRI. See Table 3 and Figure 2

Table 3: KRI's Electricity Mix (MW)

Source	Amount Produced MW	Percentage Produced MW
Natural Gas	3.070	76,79%
Diesel	259	6,48%
Heavy Fuel Oil (HFO)	549	13,73%
Hydropower (Renewable)	120	3,00%
Total Production	3.998	100,00%

⁸ <https://krso.gov.krd/content/upload/1/root/mulidat-kurdish-report-final-2024.pdf>

⁹ <https://en.964media.com/23611/>

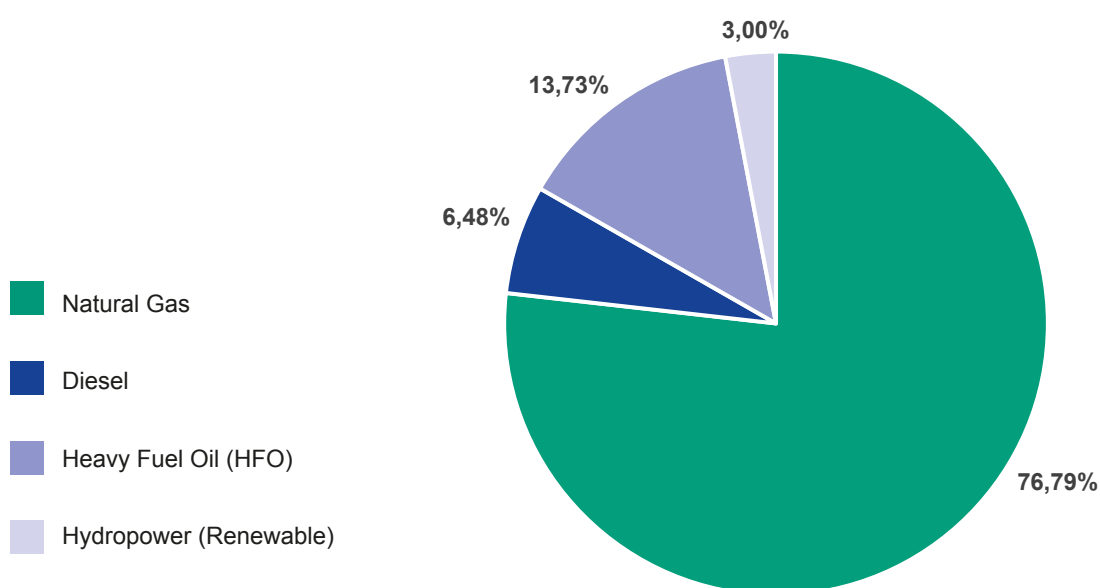


Figure 2: Percentage Electricity Production by Type of Energy Used

3.2 The KRG Lighting Project

The KRG announced the “Lighting Project,” aiming to reform the electricity sector and ensure 24-hour service by the end of 2026.

Key aspects of the project:

- Protects low-income citizens from high prices.
- Managed solely by the National Labor and Government Department, without private sector involvement.
- Uses a postpaid billing system with one monthly electricity bill.
- No introduction of second-generation billing systems.

Current progress:

- Residents are in their third year of receiving uninterrupted electricity under this initiative.
- 30.000 residents and 2.000 businesses now benefit from 24-hour electricity services¹⁰.

¹⁰ <https://www.ava.news/news/15156>

3.3 Adoption of RE

The KRG has recently implemented policies to diversify the energy mix by integrating renewable sources. The clean energy production (through flare gas capture and combined cycle power gas turbine production) to provide electricity to the national grid supply has increased by 6,75% since 2019, in otherwards, the share of actually generated electricity to the grid increased by 6,75%, from 25,60% to 27,40%)¹¹. Currently, around 8% of electricity is produced from RE, 20 MW of solar power and 150-250 MW from hydropower, depending on precipitation¹².

According to KRG Ministry of Electricity, various private sector initiatives are generating electricity through solar panels, with some achieving production levels of up to one megawatt. However, these outputs are not integrated into the national grid and are excluded from the KRG's energy mix data.

In late 2022, the Oil and Electricity Syndicate in Erbil, the capital of KRI, established a solar power committee for Erbil and its surroundings. According to Rudaw Media's interview with the deputy chairman of the committee, Mr. Mohammed Hassan, in recent years, a growing demand for solar panels has been witnessed, especially after 2022, due to increased awareness and knowledge among citizens, in addition to the lack of a stable electricity supply.

Currently, KRI has two operational solar power plants, with plans underway to construct another facility in the Soran Independent Administration. This new plant will have a budget of 235 billion IQD and a capacity to generate 100 MW of electricity. The KRG aims to expand its reliance on solar energy by developing additional similar projects. Moreover, a solar energy power station located in Minara village near Erbil is set to produce 25 MW of electricity and will be integrated into the national energy grid¹³. The project, estimated to cost 100 million USD and spanning 590 dunams of land, is expected to be completed within a year.

Despite these initiatives, the share of RE remains low due to persistent challenges in financing and infrastructure.

Solar panels started to become cheaper and more cost-effective, with the price of some panels having decreased by 50%. While the market for solar panels was valued at around 2 million USD in 2022, the higher demand and awareness regarding environmental issues are expected to cause the figure to triple in the coming years.¹⁴

11 <https://www.rudaw.net/english/kurdistan/090920231>

12 <https://kurdistanchronicle.com/babat/3297>

13 <https://gov.krd/english/government/the-prime-minister/activities/posts/2023/may/prime-minister-opens-the-first-eco-friendly-energy-power-plant/>

14 <https://www.rudaw.net/english/kurdistan/150220242>

3.4 The Market Potential for PV Panels

While PV power has been explored since the 1980s, Iraq's market for this technology did not exhibit self-sustaining growth until recently. The slow growth was primarily due to a lack of systematic policies and financial incentives from the government, which is now signaling a shift in its approach.

However, the market has accelerated since the end of the so-called Islamic State conflict 2018, particularly in regions like Erbil and Baghdad. In the KRI, the market is showing clear signs of readiness, with increasing numbers of companies offering and individuals adopting PV systems, indicating growth in demand.

This market expansion is occurring in a regulatory vacuum. The lack of government regulations has led to the influx of substandard, low-cost equipment to flood the market, undermining investor confidence, and damaging the reputation of solar PV systems. This quality issue presents a significant challenge to the technology's widespread adoption.

Despite KRI's strong potential for year-round solar energy, as highlighted by data from the Food and Agriculture Organization of the United Nations (see Table 3 and Figure 2), and the photovoltaic power output by the Global Solar Atlas (see Figure 3), the adoption of solar panels remains slow due to the general public's limited awareness of RE, particularly solar power, and the absence of robust financial incentives from the government. Without addressing these gaps, the expansion of solar technology will continue to face obstacles and struggle to gain broader acceptance.

Table 3: Monthly Sunshine and Average Solar Radiation in KRI per Month

Month	Monthly Sunshine (h/month)	Average Monthly Solar Radiation (kWh/m ² /month)
January	158,10	77,21
February	160,79	91,03
March	208,22	134,26
April	209	154,51
May	303,80	207,53
June	375	237,22
July	360,12	231,50
August	360,12	219,73
September	301	173,06
October	255,49	131,97
November	175,50	84,31
December	112,38	60,78
Average (per day)	8,16 h	4,94 kWh/m ²

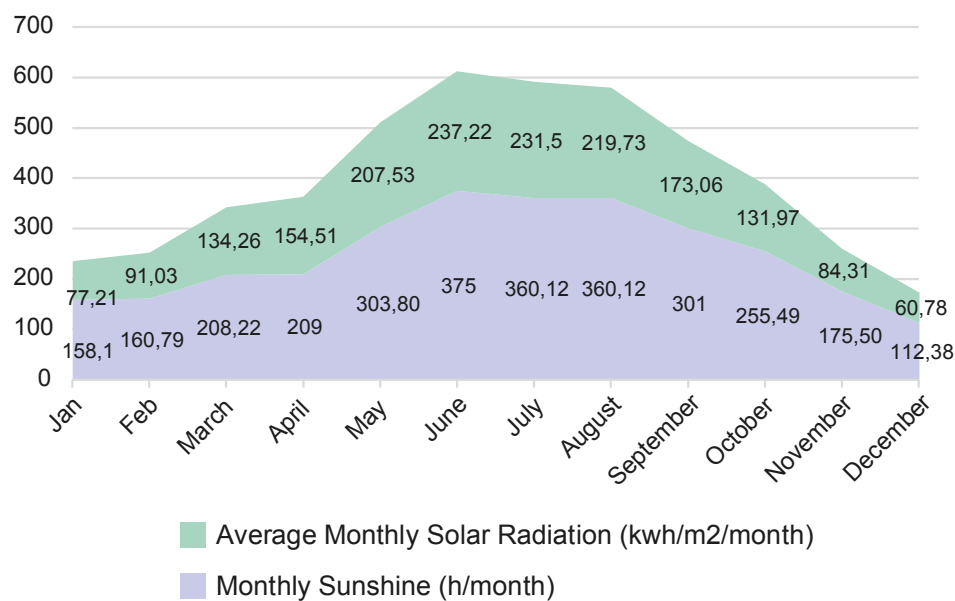


Figure 2: KRI's Average Monthly Solar Radiation¹⁵

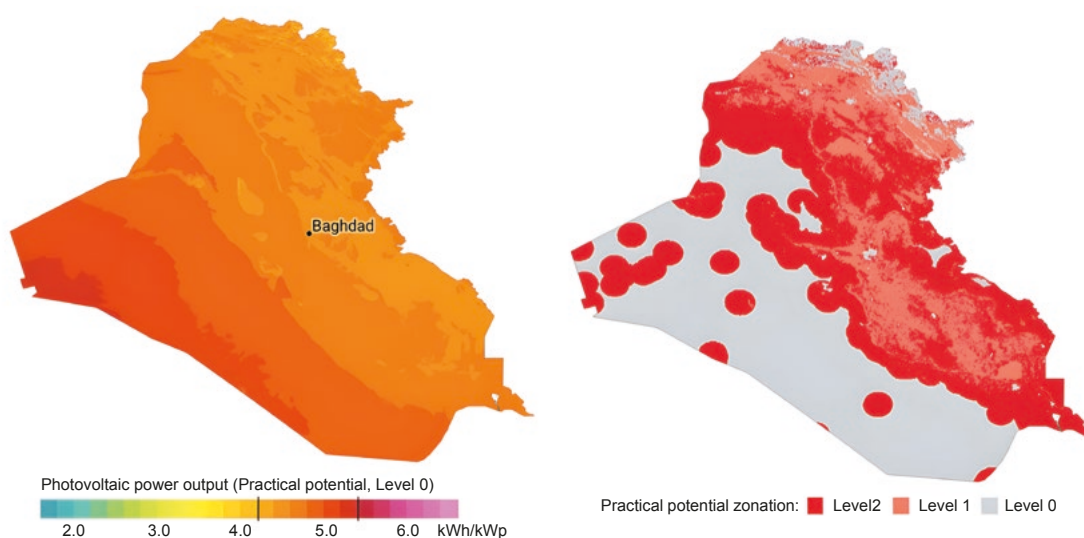


Figure 3: Iraq Photovoltaic Power Output and Practical Potential Zonation¹⁶

¹⁵ https://www.esru.strath.ac.uk/Documents/MSc_2007/Husami.pdf

¹⁶ Global Solar Atlas <https://globalsolaratlas.info/map>

3.5 Costs of PV Components and Systems

Since the Central Bank of Iraq (CBI) initiated green lending programs, the price of PV systems in Iraq has gradually decreased, dropping by approximately 40%. Today, the total cost of small and medium-sized PV systems, including installation and inverter devices, typically ranges from 1.000 to 1.200 USD per kW without battery storage and 1.100 to 1.700 USD per kW with battery storage. Variations in price and quality exist, with solar panels ranging between 75 and 110 USD per panel and lithium batteries priced between 900 and 2.000 USD.

For instance, a standard hybrid system comprising solar and battery components that supports a daytime load of 50Ah and a 24Ah evening load for nine hours costs around 15.000 USD. This system includes 45 solar panels with a capacity of 585 watts each, four batteries with a total capacity of 61kW, and a 20kW inverter, including installation fees and a five-year battery warranty. Alternatively, a high-quality hybrid system with similar capacity but enhanced components, such as 12 lithium batteries (5kW-100Ah high voltage) and a control box, costs over 22.000 USD. This system also features a 10-year warranty covering installation defects.

The average of PV system cost for small businesses and for households. The ideal offers for PV installation are described in detail in Box 1,2,3, and 4.

Box 1: PV System Offer 1

The offer includes a solar power system package. The key components and details are described below:

Inverter:

- 12kW three-phase hybrid inverter (Model: LP-AI-512300) with a built-in LiFePO4 battery (51.2V, 200Ah)
- Lifespan exceeds 6.000 discharge cycles
- Dimensions: 669x300x1600 mm

Solar Panels:

- Bifacial N-Type TOPCon 700W panels with dual glass technology (Tier 1, Japan)
- Advanced N-type cells for higher efficiency

Battery System:

- 30kWh capacity all-in-one battery system

Installation:

- PV system installation and cabling using HIS cables from Germany

Warranty: Five years for the system

Total Cost: 15.540 USD

Box 2: PV System Offer 2

The offer includes a solar power system package. The key components and details are described below:

Inverter:

- 12kW three-phase hybrid inverter (Model: LP-AI-512300) with built-in LiFePO4 battery (51,20V, 200Ah)
- 15kWh energy capacity with a lifespan of over 6.000 discharge cycles.
- Dimensions: 669x300x1200 mm

Solar Panels:

- Bifacial N-Type TOPCon 700W panels featuring dual glass and advanced circuit design

Battery System:

- All-in-one battery and inverter system

Installation:

- PV system and cabling included

Warranty: five years for the system

Total Cost: 12.980 USD

Offer 1 includes a 12kW inverter with a 30kWh battery capacity, producing approximately 60Ah. It uses advanced Bifacial N-Type TOPCon 700W panels, making it highly efficient and durable. The total cost of this system is 15.540 USD. In comparison, offer 2 features a similar 12kW inverter but with a 15kWh battery capacity. It also produces around 60Ah and utilises the same panel technology, with a total cost of 12.980 USD. Offer 1 is better suited for extended operational requirements due to its larger battery capacity, while Offer 2 provides a more cost-effective solution for smaller operations.

Box 3: PV System Offer 3

This system supplies 25-30Ah during the day and 10Ah during the night (for 8 hours)

No	Description	Quantity	Unit Price	Total Price
1	Solar Panel 590W	10	80	800
2	Invertor 10KW	1	800	800
3	Lithium Battery 10,20KW, 51V-200A	2	1.300	2.600
4	Installation Fee	1	600	600
Grand Total				4.800 USD

Box 4: PV System Offer 4

This system supplies 15Ah during the day and 8Ah during the night (for eight hours)

No	Description	Quantity	Unit Price	Total Price in USD
1	Solar Panel 590W	8	70	560
2	Invertor 4,50KW	1	450	450
3	Lento Battery 12V-260A Tubular Batteries	8	165	1.320
4	Installation Fee	1	600	600
Grand Total				2.930 USD

Offer 3 supplies 25 to 30Ah during the day and 10Ah at night. The system includes ten 590W solar panels, a 10kW inverter, and two lithium batteries with a total capacity of 10,20 kWh. The total cost for this offer is 4.800 USD. Offer 4, designed for households with lower energy needs, supplies 15Ah during the day and 8Ah at night. It uses eight 590W panels, a 4,50 kW inverter, and eight tubular batteries (12V-260A), with a total cost of 2.930 USD. While Offer 3 meets higher energy demands, offer 4 provides a more economical solution for households with moderate energy requirements.

Moreover, households in KRI typically spend 70 USD per month on private generators, amounting to 840 USD annually. Replacing this expenditure with PV systems can lead to significant cost savings over time. For Offer 3, the payback period is approximately 5,7 years, calculated by dividing the total cost of 4.800 USD by the annual generator cost of 840 USD. Offer 4 has a shorter payback period of 3,5 years due to its lower initial cost of 2.930 USD.

4. Solar Energy Financing

Solar energy, particularly by installing PV panels, is a viable option due to the region's abundant sunlight as shown in Table 1 and Figure 1. However, the high upfront costs of these systems often necessitate financial support mechanisms. Therefore, robust financial support mechanisms are crucial for enabling households and businesses to invest in RE solutions.

Green lending, a financial practice that prioritises funding environmentally friendly and sustainable projects, is rapidly gaining traction worldwide. It is a crucial mechanism for promoting RE, energy efficiency, and other sustainable development initiatives. In the context of the KRI, the potential for green lending to drive RE projects is particularly significant, given the region's abundant natural resources and growing energy needs.

4.1 Overview of RE Financing Mechanisms

RE financing mechanisms are critical to scaling up clean energy projects and ensuring their long-term viability. These mechanisms address the financial challenges faced by investors and project developers, facilitate risk management, and attract diverse funding sources. Furthermore, effective mechanisms are essential to reduce financial barriers for investors and encourage the widespread adoption of RE technologies. This section explores various financing mechanisms that could support RE development in the KRI.

I. Public Sector Financing

- **Government Support and Incentives:** Governments often provide direct financial assistance to reduce capital costs and promote investment in renewable technologies. These may include tax rebates, feed-in tariffs, and production-based incentives.

The KRG as reported by the Board of Investment, is starting to recognise the strategic importance of renewable energy. Current initiatives and discussions include tax incentives as a potential reduction in corporate taxes for PV providers; Government subsidies include financial support programs aimed at reducing the upfront cost of PV systems for households and businesses and low-interest loans aimed at offering affordable financing options to reduce the financial burden on small scale adopters.

- **Shift from Fossil Fuel Subsidies:** Redirecting subsidies from fossil fuels to RE is another potential mechanism. This would involve gradually phasing out fossil fuel subsidies and reinvesting those funds into RE development through grants, rebates, and funding programs for technology upgrades and installations.
- **Tariff and Import Exemptions:** Providing tax and tariff exemptions for companies importing advanced RE technologies would lower the cost of entry for businesses

and foster a competitive market for high-quality RE systems. This would also encourage local adoption of efficient technologies.

- **Local Financing Sources:** Local financial institutions, including the central banks, can play a significant role by creating green credit lines and offering tailored loan products for RE projects.
- **International Financing Opportunities:** The KRG, despite financial constraints, can explore international funding mechanisms such as Green Climate Fund (GCF), established under the UN Framework Convention on Climate Change (UNFCCC), which provides financial support for climate-resilient and low-emission projects, including RE development. Multilateral Development Banks (MDBs) such as the World Bank and the International Finance Corporation (IFC) offer concessional loans, grants, and technical assistance for RE projects. Another financing sources is the funds announced at COP28, global pledges for financing climate and RE initiatives at COP28 represent a significant opportunity for KRI to secure funding for green projects.
- **Public-Private Partnerships (PPPs):** Engaging private sector players through PPPs can help mobilise funding and expertise for large-scale RE projects. Private investors can benefit from guaranteed returns through feed-in tariffs or power purchase agreements (PPAs) backed by the government.

By implementing these mechanisms, KRG can create a supportive ecosystem for renewable energy investments, balancing local needs with international commitments to climate action. A clear framework and transparent processes will be critical in building investor confidence and fostering sustainable energy development in the region.

II. Private Sector Financing

Private sector contributions are essential for accelerating renewable energy deployment through equity and debt financing, green bonds and corporate power purchase agreement.

- **Equity Financing:** Investors provide capital in exchange for ownership stakes in renewable energy projects. This method includes venture capital, private equity, and investments by utility companies.
- **Debt Financing:** Loans from commercial banks or institutional investors are secured to finance renewable energy projects. These can be structured as term loans or revolving credit facilities, often with favorable interest rates for clean energy initiatives.
- **Green Bonds:** A rapidly growing segment of the bond market, green bonds are issued to raise funds for projects that have positive environmental benefits, including renewable energy installations.
- **Corporate Power Purchase Agreements (PPAs):** These contracts allow private companies to directly purchase renewable energy from project developers, ensuring stable cash flow and reducing reliance on traditional energy sources.

III. Risk Mitigation Instruments

Investors face various risks in renewable energy projects, including policy changes, technological challenges, and market fluctuations. These challenges need risk mitigation tools such as Insurance Products which provides Coverage for project delays, equipment failure, or resource variability (e.g., low wind or solar radiation). Another risk mitigation tool is the Government-backed or multilateral guarantees which protect lenders from defaults.

IV. Carbon Financing

Under international climate agreements, carbon financing mechanisms (carbon credits and clean development mechanism) have emerged as important tools for renewable energy development. Renewable energy projects can generate tradable carbon credits by reducing greenhouse gas emissions, which can then be sold to organisations needing to offset their carbon footprint. Moreover, the Clean Development Mechanism (CDM) established under the Kyoto Protocol, allows emission-reduction projects in developing countries to earn certified emission reduction (CER) credits.

V. Local Financing Solutions

In many developing regions, local financing plays a crucial role. For example, Microfinance, small loans are extended to households or small enterprises to install renewable energy solutions such as solar home systems. Another type of finance is Community-Based Financing, where local communities pool resources to fund and manage renewable energy projects, fostering local ownership and engagement.

It is important to highlight that the success of renewable energy financing requires strategic alignment of public policies and private sector initiatives. Policymakers should ensure transparent regulations and stable incentive structures to attract investment. Collaboration between financial institutions, technology providers, and governments is essential for reducing perceived risks and accelerating the deployment of clean energy projects.

4.2 The Financial Institutions in KRI

KRI's banking sector, comprising 49 banks (43 private banks and six state-owned) remains underdeveloped and has made a limited contribution to KRI's economy. Table 4 provides a list of banks operating in KRI that have provided financial services and loans to different business categories and individuals. It is important to mention that the CBI launched a RE financing initiative supporting sustainable projects that reduce climate change and desertification. This initiative, developed in collaboration with the Higher Committee for Lending, focuses on reducing carbon emissions and funding clean energy developments at both individual and investor levels. As part of the initiative, the CBI is also installing solar power systems in its buildings across major cities, contributing to the country's transition toward greener energy solutions.

Table 4: List of Registered Banks in KRI Provide Financial Services and Loans

Bank Name	Website
Central Bank of Iraq (CBI)	https://cbi.iq/
Abu Dhabi Islamic Bank (ADIB)	https://www.adib.iq/en/Pages/Personal.aspx
Bank of Baghdad	https://www.bankofbaghdad.com
BBAC Bank	https://bbacbank.com.iq/Contact
Byblos Bank	https://www.byblosbank.com/arabic/iraq/personal-banking
Cihan Bank	https://www.cihanbank.com.iq/en/
Erbil Bank for Investment & Finance	https://www.ebif.iq/EN/
Trade Bank of Iraq (TBI)	https://tbi.com.iq
Regional Trade Bank	https://www.rtb.iq

In addition to the banks, microfinance and small business loans are provided by different local and international organizations such as CHF Vitas Iraq (<https://www.vitasiraq.com/en/home>), Al-Thiqa organisation for small business loans (<https://www.al-thiqa.org>), Grofin, an international organisation and private development finance institution (<https://nii.grofin.com>). The Islamic finance and investment organization (Safe Home) is another financial service provider in the region (<https://www.safehomesaving.com>), which provides microfinance and small business loans of up to 15.000 USD.

Moreover, international aid organisations, development institutions, and foreign governments have been at the forefront of financing and implementing small-scale RE projects in Iraq. Institutions such as the World Bank Group, GIZ, UNDP, USAID, and the Iraq Reform, Recovery, and Reconstruction Fund (I3RF) have collaborated with Iraq's federal government and the KRG to strengthen the microfinance sector. This involves developing a grant system to catalyse private investment in local start-ups, including those in the RE sector.

5. Survey of PV Panel Providers in KRI

This section provides a detailed analysis of the insights gathered from 15 PV panel providers operating in KRI (Appendix A). The purpose of the survey was to explore the experiences of these providers, assess the current market demand for PV systems, identify financing needs and challenges, and evaluate the role of financial institutions and government policies in supporting the sector. By examining these areas, the study offers a comprehensive overview of the opportunities and obstacles facing the PV industry and outlines potential interventions to facilitate its growth. The survey questionnaire is attached in the appendix.

5.1 Overview of the PV Providers

The PV sector in KRI is well-developed, with providers offering a broad range of services, including installation, sales, and maintenance. A large proportion of these companies focus primarily on households and MSMEs, responding to the growing interest in RE within smaller markets. However, some providers cater to larger institutions and commercial clients, suggesting the existence of a dual market with distinct needs. Most companies also engage in wholesale activities, distributing PV products to other businesses within the supply chain. Maintenance services, offered by nearly half of the respondents, have emerged as a crucial component of customer service, indicating that long-term system reliability is becoming increasingly important to consumers.

5.2 Current Market Demand

The majority of respondents reported that demand for PV systems in the KRI has been steadily increasing over the past few years, driven by rising electricity prices and frequent power shortages. This surge in interest is particularly pronounced in urban areas, where electricity costs and supply issues are more severe due to poor infrastructure and the absence of private generator businesses in villages which force the villages to depend on their own supply for electricity and from the national grid. While some providers described demand as moderate, they noted that it is on an upward trajectory as more customers become aware of the benefits of solar system.

The PV providers emphasise to customers before purchasing the system the long-term advantages of adopting solar systems. While it is true that customers may incur higher expenses during the initial three years compared to relying on conventional electricity sources, the financial benefits become apparent after this period. Once the upfront costs are recovered, the solar system begins to generate substantial savings on energy bills, making it a cost-effective and sustainable investment in the long run.

A significant trend identified by the survey is the growing preference for hybrid PV systems, which allow users to generate solar power while remaining connected to the national grid. Energy storage solutions, such as batteries, are also becoming more popular as customers seek to mitigate the effects of power outages during the hours of darkness, when panels would not generate electricity but batteries do. Additionally, high-efficiency PV panels with extended warranties are gaining traction, as consumers prioritise long-term performance and reliability.

5.3 Financing Needs

One of the most pressing issues facing the PV market is the lack of accessible and affordable financing options. Customers, particularly households and small businesses, frequently request low-interest loans or installment plans to help cover the upfront cost of PV systems. While some providers offer internal payment plans, these tend to be short-term, usually between six and twelve months, which limits their appeal for larger or more expensive installations.

Many customers face challenges in securing loans due to high interest rates that often range between 8-15% depending on the financial institution and applicant's credit profile. Additionally, the loan approval process can be time-consuming, typically taking 1–3 months for households and 2–6 months for commercial clients.

For households, the higher interest rates and shorter repayment periods, often limited to 3–5 years, make the monthly installment burden heavier, discouraging adoption. Commercial clients, on the other hand, usually require loans with repayment terms of 7–15 years to ensure manageable cash flow. However, the lack of such long-term, low-interest financing options leaves businesses struggling to justify the high upfront investment. Without addressing these challenges, the adoption of PV systems remains constrained for both residential and commercial customers.

5.4 Support from Financial Institutions

Although some financial institutions such as Erbil Bank of Investment and Five One Lab have started offering green loans to support the adoption of RE systems in the region, this support is still limited. Very few respondents reported that their customers had successfully obtained green loans, while the remainder indicated that their clients struggled to find affordable financing options. Many PV providers expressed frustration with the current loan conditions, citing high interest rates, slow approval processes, and strict collateral requirements as major impediments to market growth.

Providers were unanimous in their call for more flexible and accessible financing solutions. They suggested that banks and other financial institutions could help stimulate the sector by offering lower interest rates, quicker loan approvals, and government-backed green financing programs. These measures would help alleviate the financial burden on customers and encourage broader adoption of PV systems across the region.

5.5 Government and Policy Support

The survey revealed a mixed perception of government policies aimed at promoting PV adoption. While some PV providers acknowledged that current policies provide a degree of support, many argued that they are insufficient to drive significant market growth. In particular, the lack of clarity around policy implementation and the absence of strong incentives were cited as areas needing improvement.

Providers suggested that government incentives, such as tax breaks, subsidies, and grants, would be instrumental in making PV systems more affordable for households and businesses. A few respondents also recommended public awareness campaigns to highlight the benefits of solar energy and encourage more widespread adoption. Overall, it is clear that government intervention will play a critical role in shaping the future of the PV market in KRI.

Moreover, the Iraqi government is working on a draft of the RE law that would support this sector and provide incentives for tax exceptions and financing mechanisms. The draft proposes a Development Fund for financing¹⁷.

5.6 Analysis and Implications

The PV sector in KRI is evolving rapidly, catering to a diverse market of consumers ranging from small households and MSMEs to larger commercial and institutional clients. This duality in the market presents distinct challenges and opportunities, especially in how policies and financing models are tailored to meet these varied demands. As electricity costs rise and supply becomes increasingly unreliable, demand for PV systems continues to grow, but several barriers remain.

There is a clear indication of increasing demand for PV systems in the region, particularly driven by unreliable electricity supply and rising costs. Providers are responding by offering off-grid and hybrid solutions¹⁸. The growing preference for storage solutions highlights an opportunity for providers to expand their offerings in this area.

The demand for PV systems is strong, but it is constrained by financing challenges. The majority of customers require affordable and flexible financing, yet access to such options remains limited. Providers are filling this gap by offering short-term payment plans (6–24 months), but long-term (2–5 years) financing solutions are still needed, especially for larger clients and projects.

¹⁷ <https://iq.parliament.iq/blog/الجنة-الطاقة-النيابية-تناقش-قانون-الط/>

¹⁸ Hybrid solar system intelligently switches between using solar power, battery storage and grid power. It allows users to avoid using grid power at peak prices leading to bill savings. Hybrid inverters have the capability to feedback into the grid, since these inverters cannot store excess power, any surplus electricity generated during peak solar hours is returned to the grid, generally at a reduced compensated rate.

Although some financial institutions are beginning to offer green loans, the support is still not widespread enough to meet the needs of all PV providers and their customers. The lack of flexible and accessible financing remains a significant barrier, especially for SMEs and low-income households.

While there is some government support for PV adoption, it is not seen as comprehensive enough to drive substantial growth in the sector. Tax incentives, subsidies, and clear implementation of policies are needed to lower the cost barrier and make PV systems more attractive, particularly for households and smaller businesses.

6. RE Adoption in Households: A Survey Analysis

The transition to renewable energy sources, particularly PV systems, represents a significant shift in how households meet their energy needs. Data collected from 17 households through a survey to explore household experiences with PV systems, capturing both current users and potential adopters. The analysis reveals important insights into adoption patterns, satisfaction levels, and the broader implications for sustainable energy transition.

6.1 Description of Data

The survey encompasses diverse household sizes and energy consumption patterns, providing a representative sample of the population's energy preferences and experiences. The data reveals that households primarily rely on a combination of PV systems, national grid power, and private generators for their electricity needs. The survey captures detailed information about electricity costs, with households reporting monthly bills of average 75.000 IQD¹⁹, highlighting the significant financial impact of energy consumption on household budgets.

6.2 Analysis of the Results

The satisfaction levels among PV system users are notably high, with most respondents reporting being “satisfied” or “very satisfied” with their installations. This positive feedback primarily stems from three key factors: cost savings, energy independence, and environmental considerations. The data indicates that larger households, particularly those with five or more members, show a stronger tendency to invest in comprehensive systems including both panels and batteries, likely due to their higher energy demands.

The survey reveals a striking pattern regarding the quality perception of different energy sources. While the national grid consistently receives poor ratings, PV systems maintain high quality scores, suggesting a strong value proposition for renewable energy adoption. The minimal familiarity with green lending programs among respondents indicates an untapped opportunity for financial institutions to support renewable energy adoption.

¹⁹ The average of minimum and maximum electricity bill is calculated only for the households that rely on private generators and national electricity supply.

6.3 Household Heads' Perspectives

In addition to the data collection through survey, some other household heads were face to face interviewed to get more insight about their perspectives. The interviews with household heads revealed different concerns and preferences, largely driven by cultural and religious beliefs, as well as financial constraints. Households tend to prioritise smaller, more affordable PV systems designed to meet basic electricity needs, such as powering lights and essential appliances during the day such as fridge and air coolers. Most household heads respondents expressed an interest in simple PV systems that do not require extensive energy storage solutions. Since many families only need power during daylight hours, they prefer systems that can harness solar energy during the day without the added expense of batteries. Some household's heads mentioned the KRG lighting project, if it reached their home, they might evaluate it in terms of cost and quality and then decide whether to adopt PV systems or not. Some pointed that if they adopt PV system, they will only go for the PV system without batteries if the KRG lighting project was successful, in this way they will pay a very small amount for electricity bill as they utilise the national grid only during the night.

A significant barrier for households is their aversion to interest-based loans, which they believe contradicts the teachings of Islam. Many respondents explained that while they are interested in adopting PV systems, they would prefer financing options that align with sharia-compliant principles. They are not comfortable with paying interest, even for loans aimed at promoting RE, which has led to a reluctance to engage with traditional loan structures.

However, households are not opposed to paying for PV systems in installments, provided that these plans do not involve interest. A common suggestion from interviewees was the introduction of interest-free installment plans that could stretch over 12 months. Households would be willing to pay a one-time service fee to cover the administrative costs of providing the loan.

For example, several respondents mentioned that they would be comfortable paying 10% of the total system cost upfront as a one-time fee to the loan provider and then spreading the remaining cost evenly over 12 months. This approach would allow them to manage their cash flow without violating their religious principles, making it a more appealing option.

This feedback highlights a significant opportunity for financial institutions to offer sharia-compliant financing solutions for the household sector. By offering flexible installment plans without interest, or designing products with one-time administrative fees, banks and microfinance institutions could unlock a significant portion of the household market that is currently hesitant to invest in PV systems due to cultural concerns.

6.4 Recommendations and Implications

The analysis suggests several strategic directions for stakeholders in the RE sector. Financial institutions should develop targeted green lending products, considering the

demonstrated willingness to invest in PV systems despite limited awareness of existing financial support mechanisms. The consistently poor ratings of national grid service quality indicate a need for infrastructure improvements, while simultaneously presenting an opportunity for expanded PV system adoption.

Energy policy makers should consider implementing comprehensive support mechanisms for PV system adoption, particularly focusing on initial installation costs, which appear to be a significant consideration for potential adopters. The high satisfaction rates among current users suggest that expanding access to PV systems could significantly improve overall energy service quality for households.

The findings demonstrate a clear trajectory toward RE adoption, driven by both practical and environmental considerations. The high satisfaction rates among current PV system users suggest that expanded adoption could lead to broader improvements in household energy security and satisfaction. The financial sector has a crucial role to play in facilitating this transition through appropriate lending products and support mechanisms.

The data strongly indicates that PV systems represent a viable solution to current energy challenges, offering improved service quality compared to traditional grid systems.

The positive user experiences documented in this survey suggest that removing barriers to adoption, particularly financial ones, could accelerate the transition to renewable energy sources at the household level.

This analysis underscores the potential for significant positive change in household energy consumption patterns through expanded PV system adoption. The high satisfaction levels and clear benefits reported by current users suggest that facilitating broader access to these systems could lead to substantial improvements in household energy security and environmental sustainability.

Moreover, the insights gathered from some households' heads highlight that they prefer simpler and smaller PV systems that meet their immediate electricity needs without the complexity or cost of large storage solutions. Their preference for interest-free financing options reflects deep-rooted religious beliefs, indicating the need for sharia-compliant financial products in the PV sector. Households are willing to pay a one-time administrative fee (about 500 USD) and spread the cost over manageable monthly installments, making this an attractive model for financing PV systems in the residential market.

Addressing these distinct needs through tailored financing products (long-term loans for hotels and interest-free installment plans for households) can significantly boost PV adoption in the region. Financial institutions and policymakers should collaborate to create solutions that cater to both markets, thereby overcoming the current barriers to entry and promoting the wider use of RE technologies.

7. RE Adoption in Micro and Small Businesses: A survey Analysis

This section analyses survey data collected from micro and small businesses regarding their energy usage, familiarity with PV systems and adoption status. The primary objective is to understand the factors influencing PV adoption, assess perceptions of cost and reliability, and provide actionable recommendations to improve adoption rates. The findings are based on responses from businesses of varying sizes, operational years, and energy needs, offering a comprehensive view of the current landscape. The survey covered 15 businesses in Erbil, six of them have PV system already adopted.

7.1 Analysis and Interpretation of Results

Among the PV adopters, the majority expressed satisfaction with the performance of PV systems, citing significant reductions in operational costs and improved reliability of energy supply. These businesses predominantly rely on PV systems as their primary energy source, with some supplementing it with other sources such as the national grid. The reliability of PV systems was rated highly, with nearly half of the respondents describing them as “very reliable.” This indicates that PV systems are meeting the energy demands of businesses effectively, particularly in areas where the national grid may be less dependable.

On the other hand, non-adopters highlighted several barriers to PV adoption. The most frequently mentioned obstacle was the high upfront cost of installation, which was perceived as prohibitive for small businesses with limited financial resources. Additionally, a lack of familiarity with PV technology and its benefits was evident among non-adopters. Many businesses were either unaware of the long-term cost savings associated with PV systems or uncertain about their reliability. This lack of awareness has contributed to hesitation in considering PV as a viable energy solution.

The size and type of businesses also played a role in PV adoption. Smaller businesses, particularly those with 1-5 employees, were more likely to express concerns about cost and reliability. In contrast, larger businesses with more employees and longer years of operation were more inclined to adopt PV systems, likely due to their greater financial capacity and energy demands. Retail businesses and service providers were among the most common adopters, reflecting the diverse applicability of PV systems across different sectors.

Cost perception was another critical factor influencing PV adoption. While adopters generally found PV systems to be affordable or even cheap in the long run, non-adopters perceived them as expensive. This discrepancy highlights the need for better communication about the financial benefits of PV systems, including potential savings on energy costs and the availability of financing options. The survey also revealed that businesses using PV systems were more likely to describe their energy costs as manageable, further emphasizing the economic advantages of PV adoption.

8. Financial Institutions Survey Analysis

This section synthesises the responses from six financial institutions (Al-thiqa, Erbil Bank for Investment and Finance, Abu Dhabi Islamic Bank (ADIB), Trade Bank of Iraq (TBI), Cihan Bank, Grofin, Safe Home, Tamwil, and Bloom Finance), regarding their involvement in green finance, specifically in RE projects such as PV systems. The goal of the survey was to gather insights into the challenges and opportunities these institutions face when offering green loans and to assess the role of government policy in shaping the future of green finance in KRI.

8.1 Institutional Overview and Involvement in Green Finance

According to the survey, Cihan Bank was the only entity participating in the CBI initiative for green lending, the rest of the financial institutions surveyed are not engaged in green finance, however, they show interest in engaging in green finance initiatives. Erbil Bank for Investment & Finance, Tamwil and Grofin stated that if they started to get involved in financing PV projects, they would offer green loans with favorable interest rates and flexible terms. These institutions focus on supporting both SMEs and public institutions in their transition to RE.

Al-thiqa is in the process of developing green loan products but has yet to finance PV or other RE projects. Al-thiqa sees growing interest from potential customers but is still exploring the feasibility of offering green loans. Safe Home provides home improvement loans that have been used by some residential clients for solar installations, though they do not yet offer a dedicated green finance product.

8.2 Challenges in Offering Green Finance

The surveyed institutions recognise significant challenges in providing green finance for RE projects, particularly for PV systems. One of the primary obstacles is the high upfront cost of PV systems, which deters many potential customers, especially households and small businesses. Several institutions pointed out that many clients lack the financial capacity or creditworthiness to qualify for green loans, especially given the stringent collateral requirements. This is a particular challenge for low-income households and SMEs, which often struggle to meet traditional lending criteria.

Furthermore, the relatively long payback period for RE investments does not always align with the loan terms typically offered by financial institutions. Most green loans are

structured over one year, but customers may take longer to fully realise the financial benefits of their PV systems through electricity cost savings. This disconnect between loan terms and the expected return on investment from PV systems has been a significant hurdle for both financial institutions and their clients.

Another challenge lies in customer awareness. Some financial institutions emphasised that many potential clients are still unfamiliar with the long-term financial benefits of PV systems, such as lower electricity costs and energy independence. This lack of awareness creates hesitation, particularly among residential customers, who are more cautious about investing in new and relatively unfamiliar technologies like PV.

8.3 Government and Regulatory Support

The role of government policy emerged as a critical factor in the responses from all financial institutions. There was a consensus that current government policies are insufficient to fully support the development and expansion of green finance in KRI. While some financial institutions, such as Erbil Bank, have seen limited tax incentives for RE projects, these incentives are not robust enough to significantly encourage the widespread adoption of PV systems. The interviewees pointed out that government-backed loan guarantees or subsidies could significantly reduce the financial risks associated with RE projects, making it easier for both customers and lenders to engage in the green finance market.

Several institutions also highlighted the importance of policy clarity and enforcement. Some of the interviewees noted that the lack of clear regulations and structured policies, especially regarding the import duties for PV equipment, poses an additional barrier. Financial institutions need a stable and supportive regulatory environment to confidently expand their green lending portfolios.

In conclusion, the survey of financial institutions revealed that while several banks and non-bank financial institutions are willing to offer green loans, the scope and accessibility of these products vary significantly. These green loans typically feature competitive interest rates and flexible terms, but they are not widely available to all customer segments. Moreover, all green loans have short repayment periods (12 months up to 24 months), which do not always align with the payback period of PV investments of at least five years, limiting their appeal to customers, particularly low-income households and smaller businesses.

9. Interview Insights with Cihan Bank (Erbil)

During the interview, the Branch Manager of Cihan Bank in Erbil, highlighted that Cihan bank has participated in the CBI initiative to support solar PV system financing. Despite the program being active, no loan applications have been submitted under this initiative so far to the Cihan Bank. Furthermore, the bank remains prepared to process applications and support eligible customers interested in transitioning to renewable energy solutions. The Branch Manager emphasised the bank's commitment to promoting sustainable energy projects and encouraged potential applicants to explore available financing options. Box 5 explains the loan eligibility and purchase conditions for OV system according to Cihan Bank rules and regulations.

Box 5: Report on Loan Eligibility and Purchase Conditions for Solar PV Systems (Cihan Bank Requirements)

This box outlines the key conditions and requirements for obtaining a loan to purchase solar PV systems. Compliance with these terms is mandatory for successful loan processing and approval.

1. Income Requirement

Applicants must demonstrate a minimum verified monthly income of 800,000 IQD.

2. Down Payment

A 15% payment of the total system purchase cost is required upfront.

3. Financial Guarantees

For loans up to 12 million IQD, applicants must provide two financial guarantees. Loans exceeding 12 million IQD require a mortgage as collateral.

4. Interest Rate or Islamic Murabaha

An annual Islamic Murabaha²⁰ of 10% applies to the remaining loan balance.

5. Vendor Selection: There is no designated PV business for system purchases. Applicants may select any preferred vendor to procure the system.

20 Murabaha is an Islamic financing method where a seller and buyer agree on the cost and a profit margin for an asset. This arrangement, known as cost-plus financing, complies with Islamic law by avoiding interest, which is prohibited. In a Murabaha contract, the seller discloses the asset's cost and the profit margin to the buyer. The buyer then pays this agreed-upon amount, often in installments. Ownership of the asset typically transfers to the buyer once all payments are completed

9.1 Implications of Loan Conditions for Solar PV System Purchases

While the initiative aims to support solar energy adoption, certain conditions present significant challenges:

- **High Interest or Murabaha Rate:** The 10% annual rate on the remaining loan balance is financially burdensome for many applicants. In addition to that, compared to international renewable energy financing programs, this rate is disproportionately high, making solar investments less attractive.
- **Limited Borrower Interest:** Despite Cihan Bank's participation, no loan applications have been received, potentially due to the steep financing costs. Yet, the high cost undermines the initiative's goal to promote clean energy adoption and financial ease for consumers.
- **Call for Regulatory Action:** The CBI plays a critical role in managing the financial stability of the country, especially in terms of facilitating growth in various sectors, including renewable energy. It is essential that the CBI reviews its loan credit line policies to encourage investments in sustainable projects, such as renewable energy. A more comprehensive credit line could provide the necessary financial support for businesses and individuals looking to invest in renewable energy infrastructure, which is crucial for Iraq's future development. Currently, limited access to financing hinders the growth of renewable energy projects in the country.

Addressing these financial barriers is crucial to ensure the success of renewable energy financing programs and foster widespread interest in clean energy solutions.

10. Interview with the Central Bank of Iraq (CBI)

The CBI has established itself as a key player in advancing financial inclusivity and supporting RE initiatives in Iraq. With branches in Erbil and Mosul, the CBI plays a crucial role in overseeing banking operations and financial regulatory activities in KRI. This regional presence reflects the central bank's commitment to ensuring that financial services and initiatives reach all parts of the country, including areas with specific energy and financial needs.

10.1 CBI's Green Lending Initiative

In 2022, as part of its broader commitment to sustainable development, the CBI introduced a green lending program to promote RE adoption across Iraq, the budget allocated for the program is around 763 million USD. This initiative aligns with the country's climate goals and commitments under the Paris Agreement, demonstrating Iraq's dedication to transitioning towards a more sustainable energy framework. This green lending program is focused on supporting the purchase and installation of electricity generation systems powered by RE, such as PV solar panels, which offer clean, sustainable power solutions.

Under this initiative, the CBI provides financing for individuals and institutions interested in purchasing RE systems through registered banks. All operating banks in Iraq are registered. The total number is 81 (seven public and 74 private banks). The loan program is structured with favorable terms to make RE accessible to a broader audience, encouraging more households and businesses to reduce their dependence on traditional power sources. Specifically, the CBI's green loan is a 5-year loan with no interest, although there is a one-time administration fee totaling 6% of the loan's principal. Of this fee, 1% is designated for the CBI itself, while the remaining 5% goes to the loan-providing bank to cover associated administrative costs. This transparent fee structure is designed to cover necessary costs without burdening borrowers with ongoing interest, making the program financially appealing to citizens across Iraq²¹.

21 For additional information on the eligibility requirements, application process and guidelines, CBI has provided detailed documentation, which is publicly accessible on its website. The guidelines can be viewed directly through the following link: <https://cbi.iq/static/uploads/up/file-164130485743553.pdf>.

10.2 Challenges in Accessibility and Regional Adoption

Although the CBI's policy does not restrict participation based on region, uptake of the green lending program in KRI has been limited thus far. According to insights gathered during the interview, no residents have yet accessed these loans, even though the policy is inclusive and extends to citizens throughout Iraq, including those residing in the northern regions.

One notable barrier is the bank's requirement that loan recipients purchase PV systems exclusively from specific suppliers designated by the financing bank. This restriction limits the options available to applicants, who may prefer to select systems from a broader range of suppliers to ensure the best quality and suitability for their needs. This constraint has led to some dissatisfaction among applicants, as they feel that the quality and range of PV panels provided by the specified suppliers do not always meet their expectations. Applicants have expressed a desire for more flexibility in choosing suppliers, arguing that, as end-users who will ultimately pay for the system, they should be allowed to select products that best serve their interests and long-term goals.

The limited awareness of the program in KRI also points to an opportunity for enhanced communication and outreach efforts to raise awareness and promote the initiative across all regions. Ensuring that residents in KRI have access to information on green lending could improve regional participation and support the broader goal of transitioning to RE.

10.3 Conclusion and Recommendations

The CBI's green lending program represents a promising step toward sustainable energy in Iraq. By providing accessible financing for RE projects, the initiative aligns with Iraq's environmental commitments and contributes to national efforts to reduce greenhouse gas emissions. However, for the program to achieve its full potential, several enhancements may be beneficial that are provided below:

- 1. Increased Awareness Campaigns:** The CBI could collaborate with local media, community organisations and banks in KRI to conduct information sessions, workshops, and awareness campaigns. This would ensure that potential beneficiaries in KRI are well-informed about the program's benefits, eligibility criteria and application processes.
- 2. Flexible Supplier Choices:** Allowing borrowers the freedom to select PV system suppliers may increase satisfaction and encourage more applicants to participate in the program. This flexibility could be implemented while still maintaining oversight to ensure quality standards are met.
- 3. Feedback Mechanisms:** Establishing channels for applicants to provide feedback on their experiences with the program, including loan application processes, supplier satisfaction, and system performance, would enable the CBI to make ongoing adjustments to meet customer needs effectively. The insights gathered from the interview underscore the importance of regionally inclusive policies

and the need for robust communication to ensure initiatives like the CBI's green lending program reach their intended beneficiaries. Enhanced accessibility and flexibility within the program could play a pivotal role in increasing the adoption of RE systems across all parts of Iraq, fostering a cleaner, more resilient energy future for the country.

4. The CBI plays a critical role in facilitating economic growth by offering financial instruments such as the credit line for lending to key sectors, including renewable energy. However, despite the potential benefits, there are several barriers preventing banks from fully utilising this credit line. Lengthy application processes, unclear requirements, and unattractive conditions, such as a 5% one-time administrative fee, have contributed to the underutilisation of this facility. Addressing these challenges is crucial for unlocking the potential of the credit line and ensuring that it effectively supports the growth of critical sectors, such as renewable energy, which are essential for Iraq's long-term sustainability and development.

11. Interview with the Governmental Bodies of KRI

11.1 Interview with the KRG Board of Investment (BoI)

The section will not be included in the main body of the current study. The focus of the study is on small scale green lending for micro and small businesses and households. Since GIZ is not involved in public investment (a domain more relevant to IFC and the World Bank for example), the interview content does not align with the target groups of this study. While the interview was conducted to support the study's objectives, it did not address the specific areas of interest. Therefore, this section will be placed in the annex for future reference.

11.2 Interview with the KRG Ministry of Labor and Social Affairs (MoLSA)

During an interview with the Director of the Microfinance Department, the discussion focused on their stance and strategic direction regarding support for low-income individuals and small businesses in the growing PV sector. The objective was to understand the current and future initiatives aimed at assisting these groups in entering the PV industry, which presents significant potential for job creation and economic development.

The director acknowledged that while the PV sector could indeed create employment opportunities, MoLSA does not currently categorise it as a distinct industry with unique support mechanisms. Instead, the ministry views it as part of the broader labor market, providing general opportunities to workers, similar to other industries. However, the director emphasised that PV panel installation and associated energy storage systems are seen as vital for the development of remote, low-income villages across KRI. In these areas, access to affordable and reliable electricity is limited, placing a significant financial strain on households.

If properly managed and adequately funded, the director highlighted, PV projects in these remote villages could play a pivotal role in reducing electricity costs for households, while simultaneously contributing to environmental sustainability by lowering greenhouse gas emissions. The long-term potential for the PV sector in these regions includes not only alleviating energy poverty but also stimulating local economies through the creation of new businesses and jobs. However, this requires coordinated efforts in policy design, funding, and implementation to ensure that small businesses and impoverished communities can effectively benefit from and participate in this growing industry.

The potential of this industry to transform remote communities and improve electricity access depends heavily on proper funding, management, and support. Without differentiating the PV sector and recognising its unique challenges and opportunities, MoLSA risks missing the chance to foster sustainable development in these areas. As the director pointed out, the installation and maintenance of PV and storage systems are critical to addressing both the economic needs of impoverished communities and the broader environmental goals of the region.

11.2.1 Conclusion and Policy Implications

The implications of MoLSA's generalised approach are clear: While there is potential for substantial job creation, electricity cost reduction, and environmental sustainability, much of it could remain unrealised without targeted interventions. The industry's growth could slow, and with it, the chance to alleviate energy poverty in remote villages. Likewise, the opportunity to contribute meaningfully to national and regional sustainability goals could be missed, delaying progress toward reducing greenhouse gas emissions.

In short, while the PV industry presents an opportunity to address both economic and environmental challenges, its success will hinge on whether it receives the targeted support it requires. MoLSA's current strategy may limit the sector's ability to drive change, especially in remote areas where the need is greatest. To fully unlock the potential of the PV industry, specialised programs, fundings and workforce development will be essential.

12. General Conclusion and Actionable Recommendations

12.1 Challenges and Opportunities for Grid Integration of Small-Scale PV Systems in KRI

The absence of mechanisms in KRI to feed surplus electricity back to the grid, such as net metering or power purchase agreements, significantly impacts the economic viability of small-scale PV systems. Without these mechanisms, consumers are unable to monetise excess electricity production, limiting the financial benefits of investing in photovoltaic systems. This also reduces the appeal of such systems for both households and businesses, as they must either size their systems conservatively to match self-consumption or invest in costly battery storage to manage surplus energy.

This lack of integration with the grid poses a barrier to widespread adoption and makes renewable energy systems less attractive for financial institutions that might otherwise provide loans or incentives. Incorporating policies to enable surplus electricity feeding could be transformative. For instance, introducing net metering or buyback programs would provide a dual benefit: consumers could offset their investment costs, and the grid could benefit from additional clean energy input during peak production periods.

In the absence of these mechanisms, actionable recommendations could include:

- **Encouraging Policy Development:** Advocating for net metering laws or similar frameworks in KRI to support renewable energy integration.
- **Fostering Localised Energy Storage Solutions:** Promoting affordable battery technologies as a stopgap until grid mechanisms are developed.
- **Pilot Projects:** Implementing small-scale pilot programs to demonstrate the feasibility and benefits of grid-connected PV systems.

12.2 Recommendations for the KRG

I. Develop Comprehensive Green Energy Policies

The KRG should create a clear, long-term policy framework that promotes the use of RE, including solar power, across all sectors. This could include clear guidelines for the installation of PV systems, incentives for both businesses and households, and mandates for public sector usage of RE. Furthermore, the KRG needs to establish

clear implementation rules and timelines to increase transparency and predictability for businesses and consumers looking to adopt PV systems.

II. Introduce Financial Incentives

To promote the adoption of solar PV systems, KRG can implement a series of financial incentives designed to reduce investment costs and encourage investment. One such measure is the introduction of **tax incentives**, which could include exemptions or reductions on taxes for individuals and businesses installing PV systems. These incentives may apply to equipment purchases, installation services, and even import duties for PV components, significantly lowering the financial burden on adopters.

Another effective strategy is the provision of **subsidies and grants**, particularly aimed at low-income households and MSMEs. By offering direct subsidies, the KRG can reduce the upfront costs of installing PV systems, making RE more accessible to a wider segment of the population. Additionally, grants can be provided to support the installation of batteries, which complement solar panels and ensure a reliable electricity supply.

Finally, the government could collaborate with local financial institutions to establish **loan guarantees** for green energy projects. Through this partnership, the KRG would back green loans, reducing the financial risk for banks and enabling them to offer more favorable terms to customers. These loans could feature lower interest rates and extended loan terms, making them more attractive to households and businesses interested in transitioning to solar energy.

III. Strengthen Public Awareness and Education Campaigns

To promote solar PV adoption, the KRG should prioritise public awareness and education campaigns to highlight financial and environmental benefits. These initiatives can leverage media, community outreach, and school curricula to inform citizens and future generations. Showcasing successful PV adoption in sectors like hospitality, manufacturing, and residential areas can further build public confidence by demonstrating cost savings, reliability, and overall feasibility.

IV. Regulatory Approval

To encourage the widespread adoption of solar PV systems, the KRG should design simplified regulatory approvals. Streamlining the permitting and approval processes for PV installations will make it easier for both businesses and individuals to embrace solar energy. This can be achieved by reducing bureaucratic hurdles and ensuring that all related permits, including construction, environmental, and energy-related approvals, are processed swiftly and efficiently. By cutting down on administrative delays, the transition to solar energy becomes more accessible and appealing to potential adopters.

Additionally, contractors and businesses involved in the PV sector must be well-informed about the regulatory processes through the KRG portal and disseminate the information to the chambers of commerce and other relevant bodies. They should be equipped to guide their customers through the approval stages smoothly, ensuring that individuals and companies interested in installing PV systems encounter minimal obstacles. This not only increases the efficiency of the installation process but also enhances confidence

among prospective customers, knowing they have clear guidance through every step of their solar energy journey.

12.3 Recommendations for the PV Businesses

I. Offer Flexible and Customised PV Solutions

To drive broader adoption of solar PV systems, PV providers should focus on offering flexible and customised solutions tailored to the needs of specific market segments. By developing differentiated products, they can cater to a wide range of customers, from small households to MSMEs and large commercial clients. For instance, small households may benefit from simpler systems designed for daytime electricity use, providing cost-effective solutions for those with minimal electricity needs. On the other hand, larger businesses with greater electricity demand may require more advanced, hybrid systems equipped with storage capabilities to ensure continuous power supply.

A key aspect of these tailored solutions is the growing importance of **energy storage**. As more customers seek ways to manage power outages and reduce their reliance on the national grid, PV providers should include batteries as part of their standard offerings. By educating customers on the long-term benefits of combining PV systems with battery storage, such as enhanced energy security and cost savings, providers can create more comprehensive solutions that meet the evolving needs of the market. This focus on customisation and storage will ultimately make PV systems more accessible, reliable and attractive across different sectors.

II. Collaborate with Financial Institutions

To enhance the adoption of solar PV systems, PV providers need to collaborate closely with financial institutions. By working together, they can help develop green loan programs that are tailored to meet the specific needs of customers in the PV market. PV providers can play a crucial role in this partnership by educating banks and other financial providers on the unique dynamics of the PV sector, including the technical and financial viability of solar investments. This will allow financial institutions to better assess the creditworthiness and potential of their customers as well as associated credit risk, leading ideally to more favorable loan terms for PV adopters.

In addition to fostering relationships with banks, PV providers should assist their customers directly in navigating available financing options. By offering in-house consultations on green loan programs and guiding customers through the loan application process, PV providers can help alleviate financial barriers to adopting solar energy. This proactive approach not only simplifies the financing process for customers but also strengthens the overall ecosystem for RE investments, making it easier for individuals and businesses to transition to clean energy solutions.

III. Introduce Long-Term Payment Plans

To make PV systems more financially accessible, PV providers could partner with financial institutions to introduce long-term payment plans that offer flexibility to

customers. One option is to provide installment plans ranging from 24 to 36 months for smaller systems, with low or even 0% interest rates. For larger commercial systems, extended payment terms could be introduced, allowing businesses to spread the cost over several years. By breaking down the upfront expenses into manageable monthly payments, both individuals and businesses will find it easier to transition to solar power without the financial burden of large initial investments.

Moreover, PV providers can explore partnerships with third-party financial institutions to help ease the financial strain on their businesses while still providing these flexible payment options to customers. Through these collaborations, the financial institutions could manage the installment plans, offering favorable terms to customers while ensuring that the PV providers maintain steady cash flow. This approach not only makes solar energy more accessible but also creates a sustainable financial model for the PV industry.

IV. Provide Post-Installation Support and Maintenance

To foster trust and ensure long-term customer satisfaction in the solar PV market, providers should prioritise post-installation support and maintenance. By offering affordable maintenance services and comprehensive warranties for installed systems, they can reassure customers of the reliability and durability of their investments. Establishing service packages that include regular inspections, system performance monitoring, regular maintenance and replacement of certain parts (inverters have to be replaced after 10-15 years, whereas the system as a whole has a lifetime of 20-25 years). This will not only enhance the longevity of the systems but also provide customers with peace of mind knowing their investments are being well cared for.

Furthermore, it is essential to highlight the total cost of ownership when discussing the benefits of solar energy systems. By emphasising that professional maintenance can significantly lower long-term costs, PV providers can help customers understand that timely upkeep allows them to recoup their initial investments more quickly through reliable system performance. This focus on post-installation support not only enhances customer satisfaction but also contributes to the overall sustainability and success of the PV sector.

12.4 Recommendations for Financial Providers

I. Creation of Green Loan Guarantees or Subsidies

This will reduce risks for financial providers and enable them to offer more accessible financing options. This partnership can significantly enhance the availability of green loans, making it easier for a wider range of customers to invest in solar energy. Institutions can partner with governments or international organisations to establish risk-sharing mechanisms, such as loan guarantees or credit enhancement schemes. For example, a government-backed green financing fund or collaboration with entities like the Green Climate Fund can absorb a portion of the default risk, making low-interest loans more viable.

II. Increasing Loan Flexibility

Increasing loan flexibility is essential for promoting PV adoption, but the financial realities of for-profit institutions must be acknowledged. While offering interest-free loans is impractical for long-term financing exceeding five years due to operational and risk management costs, financial institutions can adopt alternative strategies to reduce risks and increase the profitability of PV-related loans. One strategy is to mitigate the risk through guarantees and partnerships.

III. Streamlining the Loan Application Process

This is essential to reduce barriers to financing. This could involve simplifying the application and approval processes for green loans, making them more user-friendly. Implementing pre-qualification tools, offering rapid loan decisions, and minimising documentation requirements can all contribute to a more efficient system. Furthermore, lowering collateral or credit history requirements, especially for MSMEs and contractors (such as hotels) who may not own the properties they manage but have stable revenue streams, would facilitate access to financing for those who might otherwise be overlooked.

Promoting financial literacy around green financing is crucial in empowering potential customers. Engaging in customer education initiatives, such as workshops and online resources, can help individuals and businesses understand the benefits of green financing for PV systems. Collaborating with PV providers can further enhance these efforts, ensuring customers grasp how financing options work and how investing in solar energy can lead to long-term savings.

Finally, financial institutions should **ensure that their loan officers are well-educated on the specifics of PV loans**. By equipping them with the necessary knowledge, they can effectively communicate the benefits of these loans to prospective customers and address any concerns related to interest rates and repayment terms. This comprehensive approach to expanding access to green loans will not only promote the adoption of solar energy but also foster a more sustainable future for the region.

The much bigger need is for loan officers and the credit department to understand the specific risks associated with medium-long term green loans to design loan products that are both attractive and accessible to the client, and profitable for the bank.

12.5 The CBI

The CBI's 2022 green lending program represents a significant step toward providing green lending through registered banks. Despite this program's potential, uptake in KRI has been limited due to challenges such as limited awareness of the program and restrictions on supplier choices imposed by banks.

Feedback from interviews reveals a general dissatisfaction with the restricted supplier policy, as some applicants prefer greater freedom in selecting higher-quality PV products. The limited program awareness also underscores the need for region-specific outreach to ensure that all eligible citizens, regardless of geographic location, have equitable

access to financial resources that support RE adoption. Addressing these challenges is crucial for realising the CBI's vision of a greener, more sustainable Iraq aligned with the country's climate commitments.

To improve the effectiveness of the CBI's green lending program and support RE adoption in KRI, several targeted actions and strategies are recommended, aim to foster a more inclusive and responsive green lending environment, driving sustainable development in KRI while supporting Iraq's environmental commitments.

Firstly, expanding awareness campaigns in KRI is essential. The CBI, in collaboration with affiliated banks, should engage in outreach initiatives tailored to the region, including workshops, informational sessions, and partnerships with local community organisations. These efforts would ensure that potential borrowers, especially those in rural and underserved areas, are well-informed about green lending opportunities, the application process, and the benefits of the program.

Additionally, increasing supplier flexibility for loan recipients would likely enhance program satisfaction and uptake. Currently, recipients are limited to specific suppliers for PV systems, which restricts their ability to choose products that meet their unique quality and performance needs. Allowing borrowers, the freedom to select from a broader range of suppliers could foster greater confidence in the program and increase participation.

Establishing a robust feedback mechanism is another critical step. By enabling borrowers to share their experiences and challenges with the green lending process, the CBI can gather valuable insights to identify and address emerging issues, ensuring that the program evolves to better meet beneficiaries' needs.

Another important point is that enhancing collaboration between the CBI and local financial institutions within KRI can strengthen the region's financial networks. Working closely with these banks will help streamline lending procedures, making them more accessible and transparent, ultimately promoting broader adoption of green loans and encouraging RE investment.

Finally, there is a regularity actions needed to limit interest rates, to encourage broader participation and reduce financial burdens, the CBI should do the following:

- **Implement Interest Rate Caps with Subsidised Refinancing:** Implement a regulatory ceiling for interest rates on green loans to ensure affordability.

Evidence does suggest that such caps can lead to unintended consequences, such as reduced availability of credit, especially in markets where lenders need to balance risk and profitability. To address this concern while still promoting affordable financing for renewable energy projects, a more balanced approach could be adopted.

Instead of enforcing strict interest rate caps, the CBI could consider a subsidised loan program in which it offers refinancing at a reduced rate (e.g., 5%) for banks that provide financing for renewable energy projects. This would allow banks to offer lower rates while maintaining their profitability. Coupled with a ceiling rate of 8%, this would ensure that loans remain affordable for borrowers, without undermining the financial sustainability of lending institutions.

This approach provides a dual benefit: (1), **Incentivises lower rates** without directly mandating them, and (2), **Ensures that financial institutions remain willing to lend** by offering them a financial cushion through the subsidised refinancing program.

Additionally, this method would allow the CBI to monitor the program's effectiveness and adjust refinancing rates or the cap as needed to maintain a healthy balance between affordability and lender incentives.

- **Incentivise Lower Rates:** Offer financial rewards or subsidies for banks that adopt lower interest rates for RE financing. These can reduce risk for banks and incentivise them to provide financing for renewable energy projects at lower rates.
- **Monitor and Enforce Compliance:** Conduct regular audits of registered banks to ensure adherence to the set rate caps.
- **Subsidised interest rates through existing financial institutions:** The CBI could collaborate with commercial banks to offer subsidised refinancing options, which would encourage lower lending rates without the complexity of establishing a new fund.

Together, these strategies aim to foster a more inclusive and responsive green lending environment, driving sustainable development in KRI while supporting Iraq's environmental commitments.

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Appendix A: List of PV Providers Interviewed

No.	Company Name	Contact Number	Email	Address
1	Help Tech	+964 750 905 1010	info@helptechco.com	Erbil - Sultan Mothaffar Street
2	Blueray Energy	+964 751 242 3333	info@varinenergy.com	151, House No 53, St, 214 Bakhtiari, Erbi
3	Sunlid Solar	+964 750 380 5050	info@sunlidsolar.com	60 Metri Street. Unit 76 Erbil
4	Medal Power	0750 180 6633		Sultan Mudhafer, Erbil
5	MTS	0751 000 0186		Makhmur Road
6	Delta Solar	+964 750 233 8337		100 mt Str
7	Green Solar	0751 466 9767		
8	Moderna Green Energy	0750 223 2470		Makhmoor Road, Erbil,
9	Solotech erbil	7511906257	sales@solotech-iq.com	Near Asiana Hotel, Kuran, Erbil
10	Solar Green Agate	964 770 662 9000	shamalbek@solar-ga.com	Empire Towers-T3, 15th Floor, 2 Erbil-Iraq.
11	Clean Power Co.	0750 886 1991	rasper.rh@gmail.com	100 meter, qazi mohammed Str
12	Durable Solutions	0750 302 5900	info@durablesolutions-iq.com	Bnaslaw Old Rd, Erbil, Iraq
13	BeTel Energy	0750 383 8501		#90, BAHKKA ROAD, ERBIL,
14	FAIDH AL-SALAM (F.S.C) LLC	0770 444 8383		C28-13 GANJAN-CITY-150M Street
15	Hawsan	0751 420 0141	hawsanco@gmail.com	Makhmur Road

Appendix B: Questionnaires

I. Questionnaire for PV Panel Providers

1. Company Overview

- Can you briefly describe your company's experience in the PV sector (e.g., installation, supplier, maintenance, sales, wholesales,)?
- What main customer segments do you serve (e.g., households, MSMEs, public institutions)?

2. Current Market Demand

- How would you describe the current demand for PV systems in the Kurdistan Region?
- What trends have you observed in customer preferences for PV systems in recent years?

3. Financing Needs

- What types of financing do your customers typically request for purchasing PV systems?
- Do you offer any internal financing or payment plans? If yes, please describe.
- What challenges do your customers face in obtaining financing for PV systems?

4. Support from Financial Institutions

- Are there any banks or financial institutions that have supported your customers through green loans? If yes, which ones?
- What improvements would you like to see from financial institutions to better support the PV sector?

5. Government and Policy Support

- Do you believe that current government policies adequately support the adoption of PV systems?
- What additional support or incentives would help increase the uptake of PV systems?

II. Questionnaire for Adoption of PV System and Preferences for Green Loan (Adopter and non-adopter Households)

Section 1: Household Information

A. What is your household size?

- ☐ 1. (1-2) members
- ☐ 2. (3-4) members
- ☐ 3. Five or more members

B. What is your primary source of electricity?

- ☐ 1. National Grid
- ☐ 2. Private Generator
- ☐ 3. National and Private
- ☐ 4. PV System
- ☐ 5. All
- ☐ 6. Other (please specify)

Section 2: Current Adoption of PV Systems

C. Do you currently have a PV system installed?

- ☐ 1. Yes
- ☐ 2. No

D. If not, are you willing to have a PV system in the future?

- ☐ 1. Yes
- ☐ 2. No

E. If yes, what is your preferred type of system to adopt?

- ☐ 1. PV panels only (rely on panels during day light and use other sources during night)
- ☐ 2. PV panels with batteries (rely heavily on PV system and utilise the national grid to charge the batteries)

F. If you already have a PV system installed, what type of PV system do you have?

- ☐ 1. Panels Only
- ☐ 2. Panels and Batteries
- ☐ 3. Other (please specify)

G. How satisfied are you with your PV system?

- ☐ 1. Very satisfied
- ☐ 2. Satisfied
- ☐ 3. Neutral
- ☐ 4. Dissatisfied
- ☐ 5. Very dissatisfied

H. What factors influenced your decision to adopt a PV system? (Select all that apply)

- ☐ 1. Environmental concerns
- ☐ 2. Cost savings
- ☐ 3. Energy independence
- ☐ 4. Incentives/financial assistance
- ☐ 5. Other (please specify)

I. Minimum and Maximum Monthly electricity bill payment (From national and private generators)

- ☐ 1. Minimum Amount paid
- ☐ 2. Maximum Amount paid.....

Section 3: Preferences for Green Loans

J. How familiar are you with green loans?

- ☐ 1. Very familiar
- ☐ 2. Somewhat familiar
- ☐ 3. Not familiar at all

K. What features do you consider most important in a green loan? (Rank in order of importance)

- ☐ 1. Low-interest rates
- ☐ 2. Flexible repayment terms
- ☐ 3. No upfront costs
- ☐ 4. Government incentives or subsidies
- ☐ 5. Other (please specify)

Section 4: Trade-offs Between Energy Sources (For adopters of PV systems)

L. In your opinion, which source of electricity supply is cheaper?

- ☐ 1. National Grid
- ☐ 2. Private Generator
- ☐ 3. PV System

M. How would you rate the quality of service provided by each energy source? (Rate from 1-5, (bad, acceptable, good))

- ☐ 1. National Grid
- ☐ 2. Private Generator
- ☐ 3. PV System

Section 5: Additional Comments

N. Do you have additional comments or suggestions regarding PV systems or green loan options?

III. Survey Questionnaire for Micro and Small Businesses on Electricity Usage and Renewable Energy Adoption

Section 1: Business Demographics

1. **Business Name:**
2. **Business Type:** ☐ Retail ☐ Manufacturing ☐ Services ☐ Other (please specify):
3. **Number of Employees:** ☐ 1-5 ☐ 6-10 ☐ 11-20 ☐ More than 20
4. **Years in Operation:** ☐ Less than 1 year ☐ 1-5 years ☐ 6-10 years ☐ More than 10 years

Section 2: Current Electricity Sources

5. What is your primary source of electricity?

☐ National Grid ☐ Private Generator ☐ Photovoltaic (PV) System ☐ Other (please specify):

6. Do you use multiple sources of electricity?

☐ Yes (please specify): _____ ☐ No

7. On average, how many hours of electricity do you receive daily?

☐ Less than 6 hours ☐ 6-12 hours ☐ 12-18 hours ☐ More than 18 hours

Section 3: Electricity Demand and Costs

8. What is your daily electricity demand (in kilowatts or amperes)?

9. How would you rate the reliability of your electricity supply?

☐ Very Reliable ☐ Somewhat Reliable ☐ Unreliable

10. How would you describe your electricity costs?

☐ Very Expensive ☐ Expensive ☐ Affordable ☐ Cheap

Section 4: Interest in Photovoltaic (PV) Systems

11. Are you familiar with PV systems?

☐ Yes ☐ No

12. Have you considered adopting a PV system?

☐ Yes ☐ No

13. If not, what are the main reasons? (Check all that apply)

- ☐ High upfront costs ☐ Lack of knowledge ☐ Limited space
☐ Other (please specify): _____

14. If yes, what features are most important to you? (Check all that apply)

- ☐ Cost savings ☐ Reliability ☐ Environmental benefits ☐ Independence from the grid
☐ Other (please specify): _____

Section 5: Green Lending Initiative

15. Are you aware of the green lending initiative by the Iraqi Central Bank?

- ☐ Yes ☐ No

16. Would you be interested in applying for a green loan to adopt a PV system?

- ☐ Yes ☐ No

17. If yes, what loan features are most appealing to you? (Check all that apply)

- ☐ Low interest rates ☐ Flexible repayment terms ☐ No interest (sharia-compliant)
☐ Other (please specify): _____

18. If no, what are the main reasons? (Check all that apply)

- ☐ Lack of trust in financial institutions ☐ Complexity of loan application
☐ Other (please specify): _____

Section 6: Additional Comments

19. Please share any additional comments or suggestions about renewable energy adoption for small businesses: _____

IV. Questionnaire for Financial Institutions (Potential Green Lenders)

1. Institution Overview

- Can you describe your institution's involvement in green finance or RE projects?
- Do you currently offer any green lending products? If yes, please describe their structure (e.g., interest rates, loan terms, eligibility criteria).

2. Experience with RE Financing

- Have you financed PV or other RE projects in the Kurdistan Region? If yes, can you provide examples?
- What has been the response or demand from customers for green finance products related to PV systems?

3. Challenges in Offering Green Finance

- What challenges have you encountered in offering loans for RE projects?
- Are there specific risks or barriers that prevent you from increasing your offerings in the RE sector?

4. Government and Regulatory Support

- Do current government policies and regulations support your institution's efforts to provide green financing?
- What policy changes or incentives would encourage you to expand your green lending portfolio?

5. Future Outlook

- Are there any new green finance products you are considering offering in the future?
- What are your expectations for the growth of the RE market in the Kurdistan Region?

V. Questions for Government Officials

A. For the Board of Investment (BoI)

- **Incentives for PV Investments:** What current incentives or financial mechanisms are in place to encourage private sector investment in RE projects, particularly in solar PV?
- **Attracting Foreign Investments:** How can the government better attract foreign investments into the RE sector, especially for PV companies?
- **Public-Private Partnerships:** What role does the BoI play in facilitating public-private partnerships (PPPs) for RE projects?
- **Investment Barriers:** What are the main challenges or barriers investors face in entering the green energy market, and how can the government mitigate these obstacles?
- **Future Policies:** Are there any upcoming policies aimed at promoting green lending or investment in RE technologies?

B. For the KRG Board of Environmental Protection and Improvement (BEPI)

- **Environmental Benefits of Solar PV:** What initiatives does the board currently have to promote the environmental benefits of solar PV systems to businesses and households?
- **Green Certification:** Does the KRG provide any green certifications or standards that PV companies must meet? If not, are there plans to establish such regulations?
- **Supporting Policies:** What policies are needed to encourage households and businesses to adopt PV systems, and how can the board contribute to these efforts?
- **Environmental Awareness Campaigns:** Are there ongoing or planned campaigns to raise awareness about the environmental impact of adopting solar PV among the public?

C. For the Ministry of Labour and Social Affairs (MoLSA)

- **Job Creation through PV Adoption:** How does the ministry view the potential for job creation in the PV sector, and what programs are in place to support skill development in RE industries?
- **Supporting Low-Income Households:** What financial support or incentives are available to assist low-income households in purchasing and installing PV panels?
- **Social Protection and Green Jobs:** Are there initiatives to retrain workers from traditional energy sectors to green jobs, particularly in PV technology?
- **Public Awareness:** How does the ministry educate the public about the benefits of solar PV adoption and access to green finance?
- **Collaborative Efforts:** How does MoLSA collaborate with other ministries or financial institutions to provide social protections for those adopting renewable technologies?

Appendix C Interviews with Hotel Managers and Household Heads

As part of the research, interviews were conducted with several hotel managers and household heads to gain a deeper understanding of the challenges they face in adopting PV systems and the types of financing they prefer. These interviews revealed notable differences in electricity needs, financing challenges, and preferences between the two groups, i.e, the households and the hotels, shaped by both economic and cultural factors.

Hotel Managers' Perspectives

A key finding from the interviews with hotel managers is that most hotels in the region are operated by contractors who rent the buildings rather than owning them. This arrangement creates significant challenges when it comes to securing financing, particularly for green loans. Since the contractors managing the hotels do not own the properties, they face difficulties proving creditworthiness, which makes banks hesitant to offer loans for PV systems. This credit history issue is a major obstacle to PV adoption in the hotel sector, despite the apparent interest in RE solutions.

In terms of energy needs, hotel managers explained that their properties require a substantial amount of power, with the average hotel needing at least 250Ah per hour. This large electricity demand necessitates the installation of advanced PV and storage systems, which come with high upfront costs of nearly 50.000 to 60.000 USD. These systems would need to be capable of powering all hotel operations, including lighting, HVAC systems, kitchens, and other essential services, which run continuously throughout the day and night.

Despite the high cost, hotel managers expressed a willingness to invest in such systems, if they have access to long-term financing. Many managers indicated that they do not mind paying interest fees on loans, as long as the repayment terms are spread over several years. They see PV systems as a way to significantly reduce their long-term operating costs, particularly expenses related to private generators and electricity purchased from the national grid. In their view, the money saved on conventional energy sources would more than cover the monthly installments on a loan for PV installation. Managers believe that switching to solar energy would not only reduce operational costs but also improve the sustainability of their hotels, which is becoming an important factor in attracting environmentally conscious tourists.

These hoteliers are aware that PV systems represent a long-term investment, and while the initial costs may be high, the potential savings and energy independence make the investment worthwhile. However, the biggest barrier remains the difficulty in obtaining financing due to their status as non-property owners, which limits their ability to access credit.

Appendix D Interviews with the KRG Board of Investment (BoI)

This section provides a detailed analysis of the responses provided by the BoI officials to a series of questions regarding incentives, challenges, and future policies for promoting renewable energy investments, specifically PV projects. The responses cover key areas such as current incentives, foreign investment attraction, public-private partnerships, investment barriers, and future policies in the green energy sector.

1. Responses to the Interview Questions

a. Incentives for PV Investments

The response from the BoI indicated that while the Ministry of Electricity does not currently have specific incentives tailored exclusively for PV investments, there are general investment incentives available for those seeking to invest in the Kurdistan Region. These include benefits provided under the BoI license incentives, as well as long-term contracts with the Ministry of Electricity, particularly 25-year Power Purchase Agreements (PPA).

These agreements ensure stable returns over a long period, thus offering a degree of security to investors in renewable energy. However, the absence of tailored incentives for the PV sector may limit its growth potential. Investors may find it challenging to differentiate the financial advantages of solar energy projects from other sectors, potentially slowing the uptake of solar technologies.

b. Attracting Foreign Investments

The KRG's strategy for attracting foreign investments in renewable energy, including PV projects, relies on the work of the Foreign Direct Investment (FDI) unit operating under the brand "Invest Kurdistan." This initiative seeks to promote the region's investment potential through modern marketing methods such as social media campaigns and professionally prepared pitch decks. Additionally, the government participates in international delegations and events, showcasing the Kurdistan Region as a favorable destination for renewable energy investments. The proactive marketing approach is essential for creating visibility and interest among international investors. However, the effectiveness of these strategies could depend on the region's overall infrastructure and policy framework, which would need to be more supportive of renewable energy to convert interest into actual investments.

c. Public-Private Partnerships (PPPs)

The BoI acts as a facilitator in public-private partnerships (PPPs), particularly for energy projects. In most cases, contracts are drafted between investors and the Ministry of Electricity (MoE), with the BoI stepping in when required by the investors. The role of

Bol in these partnerships appears to be more supportive than directive, as it does not take the lead in structuring the partnerships but rather facilitates them when requested. This approach allows flexibility for investors to propose their projects, but it may lack a coordinated effort or streamlined process for initiating PPPs in the renewable energy sector. A more robust and clearer framework for PPPs could further encourage investment in the PV sector, especially from foreign firms looking for long-term collaboration with the government.

d. Investment Barriers

Several critical barriers to investment in the green energy sector were highlighted as follows:

Land acquisition poses a significant challenge, with most available lands being under the control of the Ministry of Agriculture. This complicates efforts by investors to secure suitable locations for PV installations, adding time and complexity to the investment process.

The lack of a robust banking system that meets international standards hinders financial transactions, with investors often having to resort to cash payments, which adds operational inefficiencies and risks.

The regulatory environment for PV projects is underdeveloped. The Ministry of Electricity still applies traditional electricity regulations to PV projects, which may not adequately address the specific needs of solar energy projects. This lack of dedicated regulatory frameworks for renewable energy projects is a significant barrier that could deter potential investors.

e. Future Policies

The Bol was not able to provide specific information regarding future policies aimed at promoting renewable energy investment, as the Ministry of Electricity had not yet shared its updated master plan. A formal request for this information has been made, but at the time of the interview, there was no clear visibility on upcoming regulations or policies that could support green lending or other financial mechanisms designed to promote renewable energy technologies. The lack of immediate clarity on future policy directions creates uncertainty for investors, who may be hesitant to commit to large-scale projects without assurances of supportive regulatory frameworks or financial incentives.

2. Analysis and Implications

The responses from the Bol indicate that while there are efforts to attract investment in the PV sector, significant gaps remain in both financial and regulatory support. The absence of specific incentives for PV projects means that investors might not see sufficient financial advantages in entering the sector, especially when compared to more developed renewable energy markets elsewhere. Additionally, the issues surrounding land acquisition and banking infrastructure create logistical and financial hurdles that

could dissuade both domestic and international investors from pursuing opportunities in the Kurdistan Region.

The government's reliance on long-term Purchase Power Agreements (PPAs) and general investment incentives is a positive step, but it may not be enough to drive substantial growth in the renewable energy sector. More comprehensive measures, such as targeted tax breaks, subsidies, and a dedicated regulatory framework for PV projects, are needed to address the specific challenges of the industry.

Furthermore, the absence of a strong, investor-friendly banking system adds unnecessary complexity and risk to renewable energy investments, particularly in a capital-intensive industry like PV installations. International investors, who are accustomed to smooth and secure financial transactions, may find the current system too cumbersome or risky to engage with. Addressing these systemic financial challenges is crucial if the KRG hopes to attract significant foreign direct investment in the PV sector.

On the policy side, the lack of clarity on future regulations is particularly concerning. Without clear guidance from the Ministry of Electricity on how the PV sector will be regulated or incentivised in the future, investors may remain hesitant to commit. The uncertainty around future policies means that even those interested in the region may delay their entry until more concrete information is available.

3. Conclusion

While the Kurdistan Region has the potential to grow its renewable energy sector, especially in solar PV, the current investment climate presents several challenges. The lack of tailored incentives, difficulties in land acquisition, an underdeveloped banking system, and the absence of a dedicated regulatory framework for PV projects all create barriers to entry for investors.

On the positive side, initiatives like "Invest Kurdistan" and the availability of long-term PPAs provide some foundation for attracting investment. However, to fully realise the potential of the PV sector, the KRG needs to adopt more comprehensive financial mechanisms, improve regulatory clarity, and enhance the region's financial infrastructure to support both local and international investors in this critical industry.

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