A Sustainable Energy Solution for Domiz 1 Refugee Settlement
Feasibility Study: Summary of Technical, Economic and Social Feasibility Study

Project Partners	United Nations High Commissioner for Refugees, atmosfair gGmbH, American University of Kurdistan, Selco Foundation
Sector	Environment/Human Health/Sustainable Energy/Skills, Development and Education/Inclusive Economics/ Strengthening Governance
Objectives	To provide the residents of Domiz 1 and the local population with training and job opportunities, a clean and reliable source of energy, a community income and improved human health and environment.
Beneficiaries	The refugee population in Domiz 1 of c.a. 30,800.
SDGs	SDG 7: Affordable and clean energy SDG 8: Decent work and economic growth SDG 13: Climate action

Background

The Domiz 1 refugee camp was established in April 2012 to host Syrian refugees in the Duhok province of the Kurdistan Region of Iraq (KRI). With approximately 30,800 inhabitants, it is one of the largest refugee camps in the region. Unlike many temporary refugee settlements in conflict situations, Domiz 1 has developed into an established settlement with the inhabitants residing in brick houses with running water, sewage connection and separate kitchens. Owing to ethnic and cultural similarities, the inhabitants of the camp have largely been welcomed by the host population, with many camp residents working in the nearby city of Duhok.

Summary of the Problem

Currently, all houses in Domiz 1 camp are connected to the national grid, with electricity provided free of cost by the Ministry of Electricity. However, similar to the rest of the KRI, the camp suffers frequent blackouts. This poses severe challenges to living conditions, particularly in the winter and summer when electrical devices are employed to deal with temperatures ranging from -2 to 9°C from December to February and reaching 40 to 45 °C from June-September.

Refugees in the camp can purchase additional electricity through privately-operated community diesel generators. These are connected to households through a parallel grid and the supply is lower so that many appliances can't run on the back-up system. In February 2022, households paid on average USD 36 per month for energy from the diesel generators amounting to 11% of household expenditure. Emissions from the generators pollute the air, ground and water in the camp, causing damage to human health and the environment. In addition, poor safety standards have led to a number of electrical fires in the settlement.

Feasibility Study

The technical, economic and social feasibility study was conducted from January-March 2022 coordinated by the American University Kurdistan and atmosfair gGmbH alongside colleagues from the UNHCR and with support from Selco Foundation. The findings build upon those of a previous study by UNHCR and IRENA conducted in September 2019 as well as the installation by atmosfair of a similar PV system at the Mam Rashan IDP camp in the Duhok region. The study involved discussions with local officials and on-site staff as well as in-person interviews with camp residents, the data was collected through the KoBo toolbox.

Activities include:

- Training of junior field researchers and carrying out face-to-face interviews with 44 daily operation facilities (100% of total), 47 shops (8% of total) and 324 households (6% of total). Households and shops were selected using systematic sampling to ensure the sample was representative of the twelve districts in the camp.
- Installation of three electrical meters on “Feeder-Level” - a cable that supplies up to 50 households with a capacity of 6A (1.3 kW) per household - allowing the measurement of real time energy consumption. In this way, 83 households were monitored from January 20th to March 13th in the Farasheen district of the camp.
- Analysis and development of eight scenarios centered around the installation of a PV power plant to ascertain their technical and economical feasibility including determining sufficient supply of electricity, requirements of the grid, grant/equity ratio, monthly household fee and CO2 savings.

Sustainable Energy Solutions

The feasibility study examined eight different scenarios to ascertain which scenario would be most favorable in providing an uninterrupted supply of electricity for the camp, while lowering the cost for households. The four most suitable options are summarized below.

	Public Grid Parallel				
	Always On			Night Schedule	
	A1	A2	A2b	B1	B2
PV-System Capacity (MW)	16.6	6.9	6.9	11.5	6.9
Battery-System Capacity (MW)	-	-	-	6.0	4.0
Supply by Grid (MWh)	15,699	18,918	18,918	12,032	12,032
Supply by Diesel (MWh)	-	-	-	3,633	2,570
Supply by PV/ESS (MWh)	14,035	10,816	10,816	14,184	9,996
Possible Feed-IN (MWh)	17,251	2,130	2,130	-	-
CO2 savings (t/a)	10,502	10,502	10,502	6,869	7,932
Total Investment (USD)	16,135,000	7,890,000	7,890,000	17,140,941	11,496,706
Grant	11,000,000	2,500,000	-	13,500,000	8,000,000
Equity	5,135,000	5,390,000	7,890,000	3,640,941	3,496,706
Monthly Basic Fee (USD per household per month)	15	15	20	25	25

The most cost effective and climate friendly scenario would be the connection of the PV power plant to the national grid without a back-up system (scenario A1 and A2). This would require the public grid to be constantly available to ensure residents had uninterrupted access to electricity. During initial conversations with the utility provider they demonstrated this would be both technically and administratively possible. However, final clarification is required as to whether 100% grid availability is politically acceptable, physically possible and can be guaranteed. Specifically, it will be important to ascertain the likelihood of power failures which under this scenario would leave the camp without a back-up system.

Scenario A1 would be of particular interest to the utility provider, as the PV system would produce an overcapacity of electricity above that required by Domiz 1. This surplus electricity can then feed-in to the public grid, which would result in more electricity going into the grid than the utility currently supplies to the camp. This means the PV system would not only enable a 24/7 electricity supply within the camp, but would also increase the available electricity across the public grid. This additional electricity could be used to supply other refugee camps in the area like the nearby Domiz 2.

Scenario A2 is also highly interesting from an economical point of view, particularly as it could be financed purely through equity/loans without the necessity of a grant (this scenario A2b would see the household fee rise to USD 20 per month). This demonstrates the commercial viability of PV systems in the KRI even in the most vulnerable populations. However, A2+A2b both rely upon the utility provider supplying more electricity to the camp than they currently are. These scenarios are therefore only possible with strong political support. A further option could be raising the basic fee paid by households or charging for the additional amount of electricity provided. There is room within the current pricing for both options though these would have to be explored further.

If the utility provider is unable to guarantee constant electricity from the grid then B1-B2 also offer viable alternatives by including a battery/diesel back-up ensuring a 24/7 electricity supply to camp residents. These would both require a change in the electricity schedule to supply energy at night, would have less carbon emission savings and require considerable grants to be economically feasible.

Installation

The available land within the camp is flat and unshaded and requires limited earthworks making it highly suitable for the installation of a PV-power plant. The site has easy access and there is sufficient labor available for construction and maintenance of the plant.

The possible areas are in the northwest and in the south of the camp. The available space is adequate for the installation of a maximum of 16.6 MW as envisioned under scenario A1.

Community Fund

A key part of the proposed model is the creation of a community fund to provide financing for projects within the camp and a potential source of financing for residents. The fund will be financed initially through a proportion of the income from the sale of electricity during the period of equity repayments. Once the equity is repaid the fund will subsequently be financed through the positive project cash flow. The fund can potentially be used to support camp residents and the wide local community through providing access to low cost credit, local capacity building including training, catalyzing innovation and livelihood promotion. In particular the fund would target energy efficiency drives through subsidizing more efficient devices and providing funds for insulation.

Contribution to Sustainable Development Goals (SDGs)

The project makes a number of direct contributions towards achieving the UN SDGs including:

- Target 7.1 "By 2030, ensure universal access to affordable, reliable and modern energy services."
- Target 8.5 "By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value."
- Target 13.2 "Integrate climate change measures into national policies, strategies and planning" and 13.B "Promote mechanisms for raising capacity for effective climate change-related planning."

Recommendations

To build upon the feasibility study and ensure the successful implementation of the project the project team recommends the following steps:

- Continue consultations with local, national and international stakeholders to determine which scenario is the most viable before producing a condensed project proposal to present to funders.
- Work with local NGOs to explore the governance structure of the future community fund and research potential projects/mechanisms that could be financed through the fund, especially in the area of energy efficiency.
- Develop a rigorous training concept for residents who will be involved in the installation of the PV system as well as outreach resources for residents clearly explaining the changes and also promoting energy efficiency.
- Outline a plan for the long term operation of the plant that includes a well-trained O&M team on site and regular monitoring by atmosfair.
- Initiate consultations with government and local PV businesses on legislative/guidelines for the integration of PV without storage into the national grid.
- Explore how to enable companies in the KRI to access innovative finance mechanisms like Carbon Credits and crowd funding.
- Identify further projects in refugee camps in the region that could be developed.

Contact

For more information on the project please contact:
Nele Erdmann, Senior Project Manager, atmosfair gGmbH, erdmann@atmosfair.de;
Jack R. Williams, Adjunct Professor, American University of Kurdistan, jack.williams@auk.edu.krd