WASH Learning Paper

Installing solar-powered pumps in fragile contexts: Main lessons learned from Concern Worldwide's experience in an IDP camp in Northern Syria.

Context

Northern Syria (NS) remains one of the most complex protracted humanitarian crises. It is characterized by hostilities, natural disasters, epidemics and displacement compounded by the deterioration of socio-economic conditions. In 2023, the population in need of humanitarian assistance reached 15.3 million people[1]. The expanded nature of the ongoing conflict continues to force hundreds of thousands of internally displaced people (IDPs) out of NS, of whom 52% live in camps[2], either informal or official. Simultaneously, the direct impact of conflict on water infrastructure, increasing instability in natural water (rains or river level) is exacerbating the water crises across the whole Syria.

Due to the scarcity of water and the vulnerable situation of IDPs, it is of paramount importance to develop long-term and sustainable solutions to provide water in such context. One of the most standard solutions to move from water trucking to sustainable systems is the implementation of water networks in IDP camps. With an unreliable availability of fuel due to attacks by armed groups, inaccessibility to high-quality standard fuel and that the use of fossil fuels is neither sustainable nor beneficial for the environment, one possibility is solar powered water pumping.

This paper presents the findings of this solution. In 2023, as the main WASH partner for an IDP camp in NS, Concern installed a water network with solar panels.

IDP Camp Overview

Concern has been working at the IDP camp in NS since its establishment, with the number of IDPs increasing year on year due to the ongoing conflict on the northern borders.

Until 2023, water was provided to the residents of the camp through water trucking at distribution points by Concern at regular intervals and funded by the European Union. The primary water source for the system was the Euphrates River. Water tankers would directly extract water from the riverbank, subsequently transporting it to the camp. Prior to distribution, the water underwent a chlorination process. Following a 30-minute contact time to ensure effective disinfection, the treated water was then dispensed at designated distribution points throughout the camp.

Water Trucking Challenges

Water trucking, while a necessary emergency measure in some humanitarian contexts, presents significant challenges including high costs, environmental impact, energy inefficiency, reliability issues, logistical complexities,

[1] Syrian Arab Republic: 2023 Humanitarian Needs Overview (December 2022) OCHA
[2] Syrian Arab Republic: 2023 Humanitarian Needs Overview (December 2022) OCHA

and quality concerns. Therefore, it is necessary to shift towards more sustainable, cost-effective, and reliable water supply solutions such as piped distribution networks and solar-powered systems.

Concern decided to deviate from water trucking and adopt longer-term solutions that would enhance the camp's resilience: solar-powered system connected to a water network system.

Methodology of Implementation

The project implementation took place between July to September 2023, with continuous operations maintenance and field support. A final handing over to the local authority's water department is planned for May 2025.

Technical specifications:

- Water Distribution Network: the system comprises an EPANET designed network of HDPE pipes extending 7 km, covering the entire camp layout and ensuring adequate flow rates and pressures are maintained at all distribution nodes.
- Solar Power System: powered by a 26-kW solar array consisting of 66 photovoltaic panels. An 18.5 kW inverter is utilized to drive a 15-kW submersible pump, ensuring efficient energy conversion and system operation.
- Submersible Pump: The pump operates with a capacity of 65 m^3/h and a head of 50 meters, meeting the water demand and pressure requirements of the system.
- Backup Power Supply: A repurposed generator serves as a backup power source during periods of reduced solar output, such as overcast winter days, ensuring uninterrupted water supply operations.

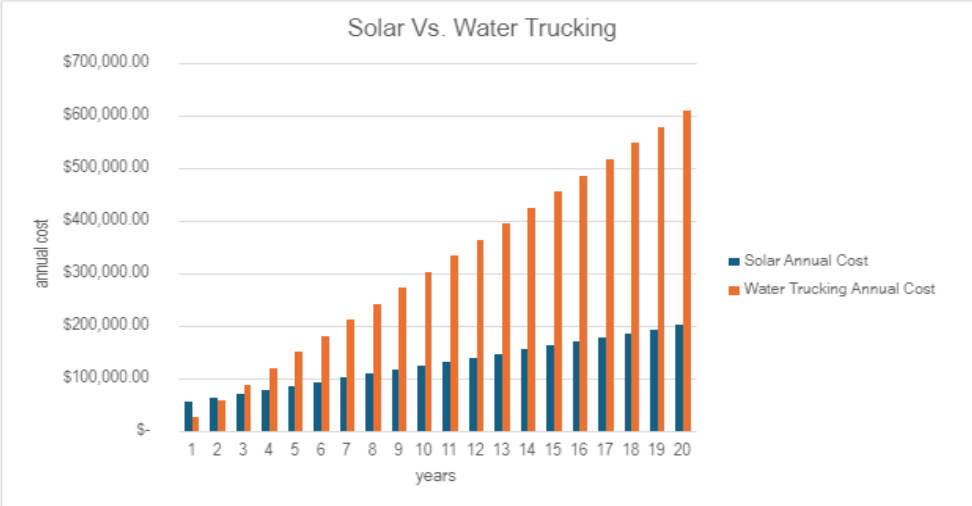
Results

The main positive outcomes identified are the following:

- Cost-effectiveness: water trucking is no longer necessary, with complete dependence on the solar-power system, providing enough water for the entire camp.
- A reliable water system: the installation of a water pipe system avoids the hazards associated with the condition of the roads used by the water trucks.
- Environmental Benefits: the initiative minimizes reliance on non-renewable resources; the solar panel lifespan is 15 years.
- Water leakage reduction: direct connection to the water pipe system eliminates the previous loss of water observed during the water transfer to trucks.

European Union

- Improved health risks: a reduction in stagnant water, with a positive impact on the hygiene situation, reducing the risk of water and victor borne diseases[3].



Main challenges:

- Capital price: there is a high initial cost for installing solar-power system which was not easy to fund.
- Procurement challenges and technical limitations: we faced low capacity of local market suppliers to find the 25-50 HZ pumps' motor, even in the broader region with only 50-60 HZ available.
- Vandalism due to lack of ownership (not specific to solar-powered systems): frequent damages are done to the communal tanks, float valves. There are also illegal connections and thefts. In general, operation and maintenance can be difficult due to a lack of commitment from local authorities for anything linked to IDP camps.
- Disaster risk: we had an unexpected episode of flooding between May and July 2023 which caused the entire system to flood. As a result, we needed to put the water source intake pipe directly into the lake using boats. The boats allowed us to adapt to the level variations of the Euphrates River.
- Seasonal disruptions: during wintertime in NS, cloudy days are frequent which of course implied to use fuel-powered generators as a back-up.
- Operations and maintenance require more technical skill than that of water trucking. For the first 6 months the system was operated directly by Concern Engineers with individuals from the camp hired and trained on the solar systems, network, valves flow, chlorination and reporting.

Conclusion

Concern is working with partners to outline plans for ongoing maintenance and community-led initiatives to ensure sustainability of the system. Having worked with the water department for the past 7 years, we are confident in their capacity to run the water stations, with essential support and training provided prior to handover in May 2025. An important lesson learned from this project is the importance of regular follow-up and monitoring to adapt the system

[3] The NS Health Cluster reported 69 cases of AWD in 2022, 3 cases in 2023 and no cases in 2024.

to changing circumstances and needs. Following the handover, Concern will continue to monitor the water quality and support the water department where necessary.

Testimonial

Living in the IDP camp with their families since the camp's establishment, 6 workers maintain the camp's solar-powered water pump network alongside 2 workers who oversee the maintenance and operation of the water supply system, they explained the impact the pumps has had on all those living in such a fragile context.

"*The quality and quantity of water that we are now able to access has improved dramatically; the project has provided us with a stable water source for the future. Previously the women had to collect water from the river whilst they left their children in the tents. Not only was this unsafe for the children but the water was dirty, and it was not uncommon to become sick. The only other alternative we had was water from water trucking. Although this was clean, we had to stand in line for long periods of time and it just wasn't a sustainable solution.*"