

# Advancing Circularity in Jordan Refugee Camps through Sustainable Wastewater and Sludge Management

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## INTRODUCTION

With less than 100 m<sup>3</sup> of renewable water resources available per inhabitant per year, which is significantly below the global threshold of 500 m<sup>3</sup> per inhabitant, Jordan is the second most water scarce country in the world [1]. Jordan currently hosts around 1.36 million refugees contributing to 15% of Jordan's total population [2], demonstrating increased pressure on the government in terms of water supply and sewerage systems and hence required infrastructure investments.

To address these challenges, policies have been put in place aiming at improved and sustainable management of natural resources and acknowledging the importance of the water, energy, and food Nexus, by promoting circular economy of available resources.

Consequently, Jordan has qualified to receive official development assistance from different international entities to support the government in addressing their response plan to the Syrian crisis. The two refugee camps projects introduced were initiated in cooperation with the German Federal Ministry for Economic Cooperation and Development (BMZ), European Union (EU), and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, to provide Syrian refugee camps with infrastructure for wastewater and sludge treatment. The importance of these projects comes from the fact that sustainable solutions for wastewater and sludge management within the camps is a pivotal step towards enhancing the livelihoods of its residents.

## Azraq Refugee Camp Wastewater Treatment Plant

### Project Objectives

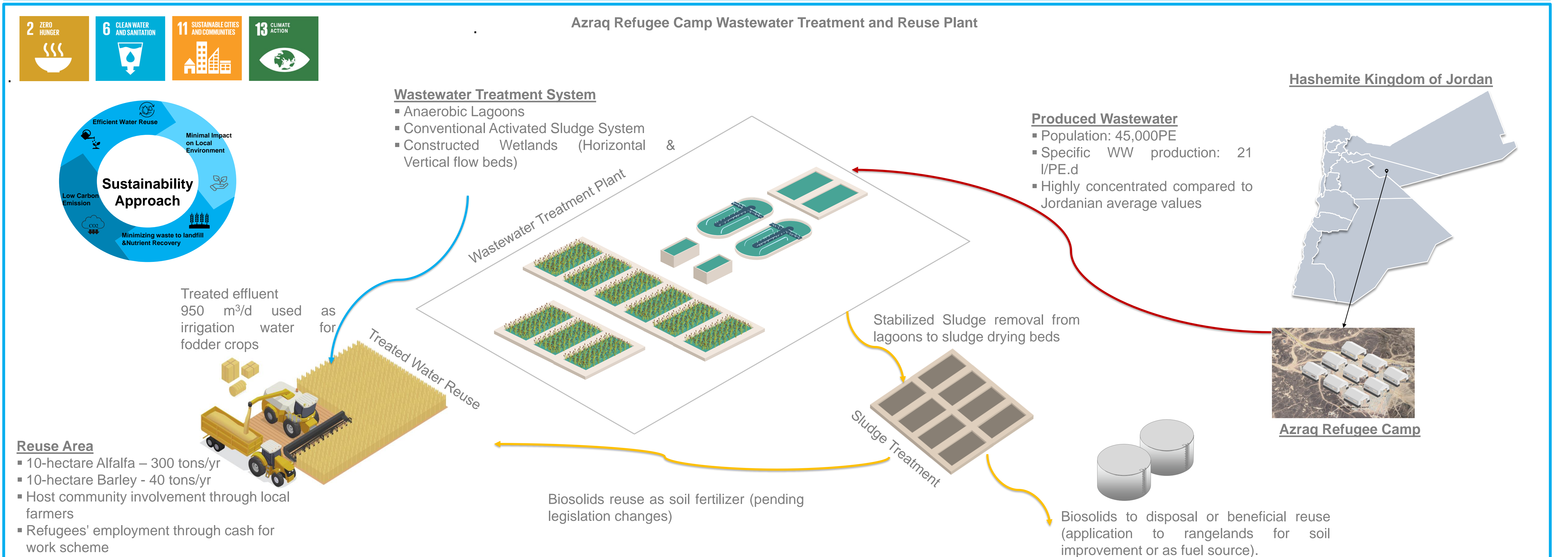
- Considering the need for a dedicated wastewater treatment plant within the camp due to its remote location and the costly practice of currently transporting wastewater outside the camp, it was crucial to consider an ecologically and environmentally sustainable design that ensures optimum resource recovery including water and sludge reuse, and also minimizes the amount of waste generation.
- Transform wastewater treatment plants into resource recovery facilities.
- Enhance sustainable environments in refugee camps to improve refugees' quality of life through effective wastewater management.

### Project Background

- Azraq Refugee Camp is located around 100 km east of the Jordanian capital Amman and occupies an area of approximately 14.7 km<sup>2</sup>.
- The Camp is currently hosting around 39,060 refugees with 10,953 shelters and a maximum physical capacity of 53,000 refugees.
- The average specific wastewater generation was 20.6 L/cap/day.
- Currently, shelters are connected to a holding tank, with a total of 3500 holding tanks installed throughout the refugee camp which then is emptied through private contractor into a transfer station located northeast of the camp and then disposed offsite.

### Process Design

- Wastewater treatment Capacity:** 45,000 PE with a specific wastewater production of 21 l/PE/d was used, resulting in a wastewater flowrate of 950 m<sup>3</sup>/d.
- Wastewater treatment process:** Azraq wastewater treatment plant has combined both conventional and nature-based solution in order to: (1) accommodate for the highly concentrated wastewater. (2) meet the stringent effluent requirements set by the JS893/2021 for irrigation crops. (3) consider as much nature-based processes as possible to reduce operational costs due to limited budget. The selected treatment includes Anaerobic lagoons, Conventional Activated Sludge System and Constructed Wetlands (Horizontal and Vertical)
- Effluent standards:** Treated water will meet the Jordanian Standards JS 893/2021, for Class C for the purpose of reuse for Field crops and forest trees.



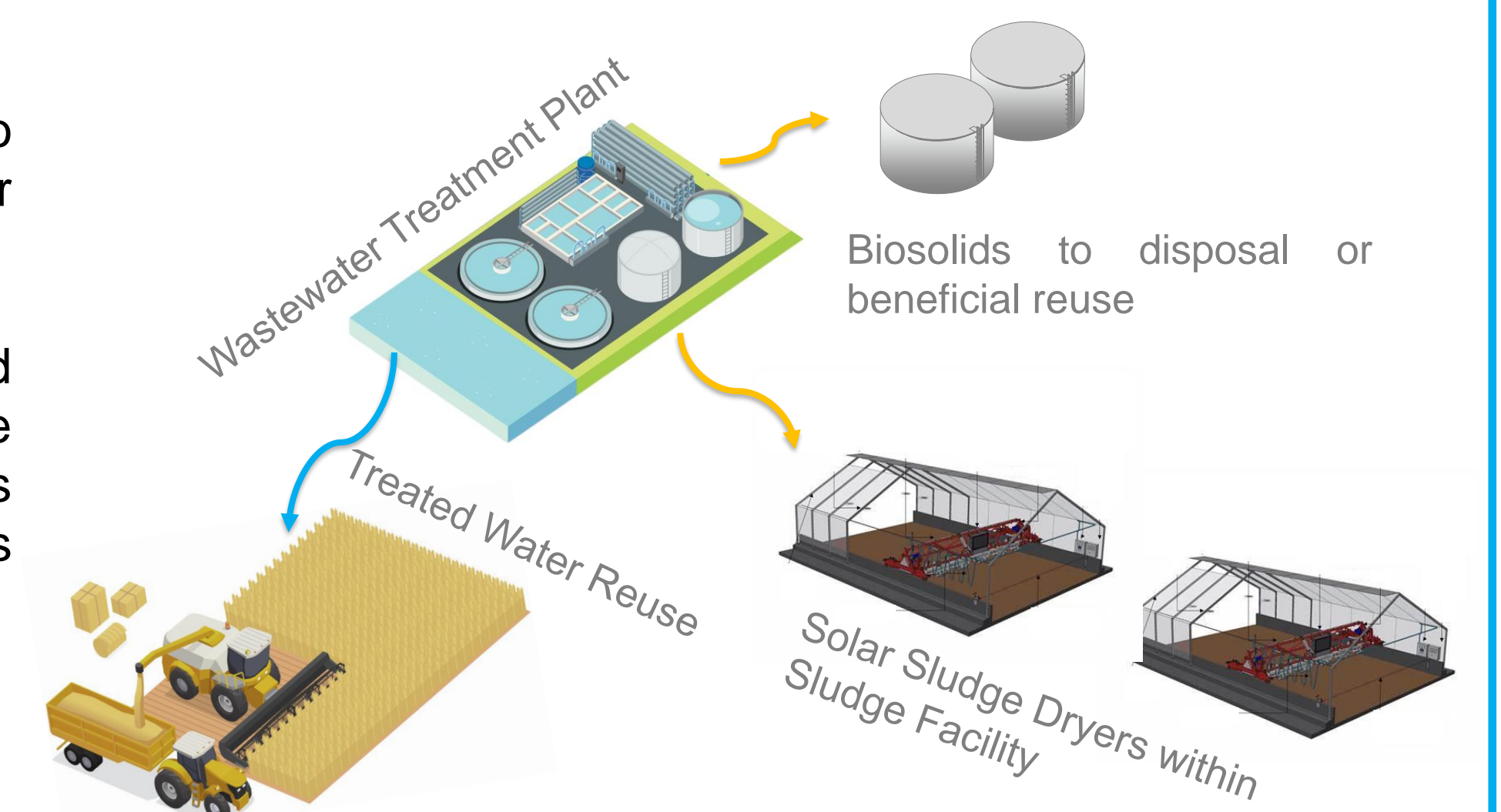
## Sludge Management in Za'atari Refugee Camp

### Project Background and Objectives

- Za'atari Refugee Camp is the largest refugee camp in the country, with more than 82,000 refugees.
- The camp has a sewage network, and the wastewater is transferred to the Za'atari refugee camp wastewater treatment plant (3000 m<sup>3</sup>/d). The treated effluent of the WWTP is used for agriculture, while the sludge is transferred to Al Ekaider wastewater treatment plant.
- In order to close the cycle in terms of efficient resource recovery, the project, under the program "waste to positive energy", aimed for providing a sludge management facility in Za'atari Refugee Camps.

### Project Brief

- The sludge facility in Za'atari Refugee Camp is designed to include gravity thickening, mechanical dewatering, and solar greenhouse sludge drying with a capacity of 224 m<sup>3</sup>/d.
- This project is intended to reduce the amount of sludge produced with dry solid content of minimum 85% DS that allows the application of biosolids as fertilizers. The significance of this project lies within the fact that greenhouse solar dryers is considered a pilot.



## Projects' Impact

Maximizing resource efficiency and minimizing waste by closing the cycle of wastewater treatment utilizing treated water for irrigation and sludge as fertilizer

Mitigating environmental pollution and reducing the strain on natural ecosystems, promoting a healthier environment for both human and ecological communities.

Aligning with the principles of circular economy by applying an integrated approach while resources are kept in use for as long as possible, contributing to a more sustainable ecosystem.

An innovative business model that engages local farmers and refugees in a cash-for-work program, promoting economic empowerment, social inclusion, job creation, and reducing inequalities.

Fostering multi-stakeholder collaborations and building resilient infrastructure.

### References:

- [1] Jordan - Environment and water sector. (n.d.). International Trade Administration | Trade.gov.
- [2] Jordan Response Plan for the Syria Crisis 2020-2022 - Jordan
- [3] UNHCR. (2021). Jordan: Azraq Camp Facts-Sheet. The UN Refugee Agency

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Silver Sponsorship:

