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# IMPROVING RURAL LIVELIHOODS AND THE ENVIRONMENT THROUGH THE INTEGRAL UTILIZATION OF RESIDUES OF TREATED WASTE WATER AND ORGANIC SOLID WASTE FOR THE PRODUCTION OF RENEWABLE ENERGY AND COMPOST IN MAFRAQ GOVERNORATE OF JORDAN

July 2020

SDGs:



Countries:

Jordan

Project Code:

TCP/JOR/3602

FAO Contribution:

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Contact Info:

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#### Implementing Partner

Ministry of Agriculture.

#### Beneficiaries

Host communities in the Mafraq governorate and Syrian refugees in the Zaatari camp.

#### Country Programming Framework (CPF) Outputs

Priority 2: Sustainable Development and Use of Natural Resources (i.e. Water, Land, Range and Forests) through Improved Agricultural Research and Extension and Use of Modern Agricultural Bio-technologies and Climate-smart Practices (CPF 2016–2020 ).



## BACKGROUND

As the Syrian crisis continues to escalate, the influx of refugees in neighbouring countries places an growing burden on affected areas. The United Nations High Commissioner for Refugees (UNHCR) determined that Jordan hosts around 620 000 registered refugees, while the Government has estimated that there is a total of 1.4 million refugees in the country. In Mafraq, the refugee population lives in distress, while the broader population is also affected by the refugee influx. In December 2019, there were 75 993 individuals and 17 655 families registered at the Zaatari refugee camp. Stakeholders in the Zaatari community continue to pursue the creation of job opportunities for residents, with a record 13 220 active work permits being reached in October 2019.

Although job opportunities are traditionally dominated by the agriculture sector, the waste sector offers potential for the development of additional “green” jobs. In Jordan, the level of municipal solid waste has grown rapidly over the past two decades, while the influx of refugees has exponentially increased its rate of production. Much of the solid waste produced finds its way to landfills, most of which are classified as unsanitary dump sites. On top of the strain being placed on the waste management system, the influx of refugees has also driven an increased demand for energy. This TCP project was therefore designed to make use of waste in the Zaatari municipality in the creation of sustainable job opportunities that promote compost production for agricultural purposes and the generation of energy.

## IMPACT

The project sought to bolster the local economy and enhance the potential for economic growth in the Mafraq governorate through private sector enterprise development, the enhancement of livelihoods and the creation of environmentally sustainable job opportunities.

## ACHIEVEMENT OF RESULTS

### Output 1: Renewable energy is generated utilizing solid waste from Zaatari municipality and sludge from Zaatari refugee camp

An international consultant performed a technical study pertaining to the establishment of a biogas plant, which led to a tender for its procurement through the United Nations Global Marketplace (UNGM). Following closure of the invitation to bid (ITB), the evaluation team assessed the offers received. Negotiations were undertaken with BEB Bio Energy Berlin, but the negotiated offer still exceeded both the budget available and time constraints of the project.

As the potential budget revision and contract extension were not approved, the EU sought to liaise alternatively with local institutions. An agreement was reached to carry out a downsized pilot activity. The National Energy Research Centre (NERC), a division within the Royal Scientific Society (RSS), was highly receptive to the initiative. A letter of agreement (LoA) was signed between FAO and the NERC detailing the requirements of the NERC to design, supervise and perform a test run of the biogas pilot unit. The NERC submitted a draft proposal for their biogas pilot unit, which could generate 51 kWh of energy per day. Following review and approval by the biogas consultant, the final design was prepared in July 2019.

Biogas consultants were also recruited to design an optimal biogas plant for the Zaatari camp. The plant is expected to utilize all the feedstock available in Zaatari. Notably, the plant design will be used as a starting point in the future EU–German Agency for International Cooperation (GIZ) project, which will involve the Water Authority of Jordan, the United Nations Children's Fund (UNICEF) and the UNHCR. The final proposal was published in an annex of the design report.



### Output 2: Green jobs are created through the construction and operation of a solid waste segregation unit in Zaatari municipality

The design and bill of quantities (BoQ) for the material recovery facility (MRF) were prepared and the required authorizations for its construction were obtained. An ITB was launched in December 2017 and, subsequently, a contract was signed with the Al-Maqsad Contracting Company in February 2018 for construction of the MRF. FAO monitoring was stringent throughout construction, with periodical site meetings taking place. Two amendments were made to allow for the installation of a rainwater harvesting system. FAO assisted in the acquisition of work permits by reaching an agreement to present the contractor as an agent to the Syrian Refugee Affairs Directorate (SRAD). Following site inspection and contract closure in October 2018, sorting tables, various consumables, a high-pressure pump, fire extinguishers and water tanks were procured for the facility. Overall, 44 men were employed for the construction of the MRF, accruing a total of 1 578 workdays. A dump truck was later procured to transport organic waste between the MRF and the composting yard.

Following Oxfam gaining sole responsibility for the oversight of waste management and cleaning at the Zaatari camp, an agreement was reached with FAO for the delivery of solid waste to the MRF. The single-operator approach also facilitated effective investment in cost reduction, waste recovery and waste reuse. Additionally, the MRF was incorporated into Oxfam's waste flow chart. All the sorted waste was weighed, and the recyclable materials were collected by Oxfam for a recycling project, while the organic waste was delivered to the compost yard.

In 2019, FAO and Oxfam met again to reach a delivery agreement. Thanks in part to the establishment of the MRF, Oxfam managed to reduce transport costs through the negotiation of a new agreement with the trucking contractor. Oxfam agreed to deliver 16 tonnes of solid waste to FAO, free of cost, beginning in the first quarter of 2020, which will allow the MRF to run at full capacity. Additionally, the drafting of an agreement to guide the operation and handover of the MRF was undertaken.



A composting expert delivered the first waste management training session. A qualitative assessment of the waste was carried out and the data used to determine the organic waste contaminants. Training guidelines and sorting procedures were developed and displayed in both Arabic and English. FAO and Oxfam cooperated in the delivery of the second sorters training session, which served as a test run for operationalization of the MRF. Oxfam also provided hygiene, waste handling and recyclable material sorting experts for the training. An advertisement for green job opportunities was released with the support of Oxfam. The positions conformed to the Zaatari Cash for Work Standard Operating Procedure (CFW SOPs). Seventy-four applications were received, and all applicants were invited to attend the training. A team comprising the best 20 sorters was established, which remained employed at the MRF.

**Output 3: Compost, compliant with Jordanian standards for application of biosolids, is produced from the sludge and solid waste**

Research into the use of biosolids for the production of compost was conducted together with the National Agriculture Research Centre (NARC). In March 2019, the NARC presented their research findings to stakeholders. The results suggested that the compost being produced met the Jordan Biosolids Standards (JS 1145/2006). In the future, the results need to be presented to the Interministerial Committee on Biosolids, which did not hold regular meetings in 2019.

At the NARC, bioassays were conducted to evaluate the effects of compost produced from biosolids on seed germination and to determine the best compost-to-soil ratio for growing selected plants. The analysis of results was being finalized before their reporting and presentation to stakeholders. Encouragingly, early indications suggested that the compost has no detrimental effects on seed germination or growth rate. Moreover, it improved biomass production and can be safely used to fertilize soil.

Compost was also being produced without biosolids at the Zaatari plant. The first batch was tested at RSS laboratories and found to be safe for use. Subsequently, a new research initiative was undertaken at the NARC Khalidiya Saline Agriculture Research Station, which examined the effects of the compost under saline growth conditions. The findings were highly encouraging and later presented to the committee for regulation.

The construction of the compost yard was contracted to Al-Maqdad Contracting Company. The site inspection and handover were completed in April 2018. The construction employed 21 people for a cumulative 239 workdays. Modern Construction Machinery was contracted to supply a skid-steer loader and also provided training for equipment operators.

**Output 4: Unskilled workers from Zaatari municipality and refugee camp are trained and employed in construction, operation and management of the solid waste segregation unit, biogas plant, and the composting plant through one existing cooperative society**

In total, 105 people were employed as construction workers, including 80 Jordanians and 25 refugees. Another 89 refugees participated in training activities, with 30 gaining employment in green jobs created through the project.

**IMPLEMENTATION OF WORK PLAN**

Project activities were carried out within the approved budget, with a no-cost extension and budget revision being approved to facilitate the continuation of these efforts. Risks were monitored throughout the project cycle and relevant mitigation measures were employed as required. The major risk identified was the controversial nature of using biosolids in Jordan, which could have led to the project interventions not being adopted. As such, a concerted effort was made to fully comply with Jordanian regulations and standards, as well as to involve national institutions.

As the project operated within a humanitarian relief site, several context-specific actions needed to be considered. Active participation was required in working groups and task forces, particularly those involved in hygiene and waste disposal operations. This allowed project efforts to become better integrated into daily operations. On-site coordination, however, remained challenging due to the differing priorities of working groups. Additionally, specific employment arrangements had to be followed. Reliable partners were identified to facilitate this process for internal workers, while the attainment of entry permits for external workers led to delays. Finally, the procurement of a small biogas pilot plant proved difficult as established suppliers recognized the limited profitability of such a project. Local institutions were engaged instead.

## FOLLOW-UP FOR GOVERNMENT ATTENTION

It is recommended that efforts to support the harmonization of standards for the use of biosolids in Jordan with international best practices is continued. Ultimately, this will help alleviate the economic and environmental strain placed on Jordan by the requirement to dispose of large quantities of biosolids. In addition, the Government should ensure that the plan to construct and make the pilot biogas plant operational are put into action. Finally, it is recommended that the Government continue to explore the potential of private sector investment in waste management. This could allow for better use of waste materials in the production of compost, the use of compost in agriculture, including saline agricultural activities, and energy production.

## SUSTAINABILITY

### 1. Capacity development

The development of institutional and human capacities was central to the success of the project and will ensure a continued flow of benefits in the future. In particular, the provision of training to beneficiaries will support the ongoing operation of the facilities that were established. The project also fostered collaboration between multiple actors in the Zaatari camp, each with its own set of objectives. In particular, having project efforts brought to the attention of working groups and task forces in the camp encouraged stakeholders to adopt a broader view of waste management.

### 2. Gender equality

The project promoted gender balance and aimed to enhance the role of women in relevant activities.

### 3. Environmental sustainability

The project directly addressed environmental sustainability through the introduction of new methodologies and technologies for the operation of the segregation and composting facilities and the biogas plant.

### 4. Human Rights-based Approach (HRBA) – in particular Right to Food and Decent Work

The project did not primarily target the advancement of human rights; however, it did focus on the creation of jobs (including those for refugees) and the development of the local economy. Workers were also paid according to the CFW SOPs.



### 5. Technological sustainability

The handover process was designed in a manner that potential biogas operators will receive relevant training and that Oxfam, who are expected to oversee the operation of the MRF and compost yard, have the required expertise to do so.

### 6. Economic sustainability

Efforts were undertaken to ensure the continued operation of the biogas plant and the segregation and composting facilities beyond project closure. Future operators will possess sufficient resources to continue the work started under the project, while the local community is expected to continue benefitting from the interventions. Notably, ongoing waste transport costs were reduced.



## DOCUMENTS AND OUTREACH PRODUCTS

- ❑ Final Report on Compost Research. NARC and FAO. Amman, August 2019. 65 pp.
- ❑ Zaatari Waste Water Treatment Plant Bio Solids Results. NCARE. Amman, 23 August 2016. 4 pp.
- ❑ Fence design. FAO Jordan. Amman, 29 November 2017. 1 pp.
- ❑ Office design. FAO Jordan. Amman, 29 November 2017. 1 pp.
- ❑ Ablution block. FAO Jordan. Amman, 29 November 2017. 1 pp.
- ❑ MRF design. FAO Jordan. Amman, 29 November 2017. 2 pp.
- ❑ Compost yard design. FAO Jordan. Amman, 29 November 2017. 2 pp



## ACHIEVEMENT OF RESULTS - LOGICAL FRAMEWORK

<b>Expected Impact</b>	<b>To contribute to enhanced economic growth potential of the local economy of Mafraq Governorate through private sector enterprise development, improved livelihoods and promotion of environmental sustainability and green jobs opportunities</b>		
<b>Outcome</b>	Improved livelihoods with increased green job opportunities for the most vulnerable within the host communities and enhanced environmental conditions in Mafraq Governorate through integral utilization of residues of treated wastewater and biosolids in generating renewable energy and compost		
	<b>Indicators</b>	<ol style="list-style-type: none"> <li>At least 70 vulnerable households benefit from regular income of labour from the biogas plant, the solid waste separation and the compost plants by the end of the action.</li> <li>USD 190 000 generated from 1 650 000 kWh of electricity produced yearly through the utilization of solid and liquid waste by the end of action.</li> <li>Net annual savings of USD 45 000 made by the reduction in the quantity of sludge and organic solid waste disposed to Mafraq and Al Akeeder landfills by end of project.</li> <li>5.5 tonnes(MT) of compost produced daily and used for soil conditioning, rangeland and forest restoration from 2nd year of the action.</li> <li>Greenhouse gases emissions reduced by 10.1 tonnes of CO2 equivalent units daily by 20th month of the action.</li> </ol>	
	<b>Baseline</b>		
	<b>End Target</b>		
	<b>Comments and follow-up action to be taken</b>		
<b>Output 1</b>	<b>Renewable energy is generated utilizing solid waste from Zaatari municipality and sludge from Zaatari refugee camp</b>		
	<b>Indicators</b>	<b>Target</b>	<b>Achieved</b>
	51 kWh of electricity produced daily by the biogas plant by the end of the project.		Partially
<b>Baseline</b>	All the objectively verifiable indicators (OVIs) are benchmarked against the establishment of a pilot biogas production plant. Achievement of the OVIs is anticipated by the EU following completion of the intervention.		
<b>Comments</b>	The observed reduction in solid waste was attributable to composting activity alone – around 3 000 kg of waste per day. This reduced total waste delivery to landfills by 40 percent. It is anticipated that with the full capacity of the MRF, the total waste generated in the camp will be reduced by 21 percent. In 2019, 765 488 kg of waste was sorted. The organic fraction accounted for 286 801 kg, representing 37.5 percent of the total waste. In addition, there were 17 253 kg of recyclable/reusable materials, which were given to Oxfam for processing, while the remaining 461 434 kg went to the landfill.		
<b>Activity 1.1</b>	<b>Reconfirm feasibility of plant to the competent authority and obtain the required clearances and authorizations</b>		
	<b>Achieved</b>	Partially	
	<b>Comments</b>	<p>In 2018, FAO launched a tender for the procurement of a biogas plant through the UNGM procurement platform. The one valid offer received exceeded the available budget and proposed implementation period. FAO and the EU met to discuss a possible budget revision and a contract extension. These were not approved.</p> <p>The EU sought to liaise with local institutions in order to overcome the challenges in procurement. An agreement was reached to involve a national organization for the implementation of a downsized pilot activity. In March 2019, FAO and the EU approached the NERC, which later submitted a draft proposal for the biogas pilot unit. The feed material that can be used in the downsized plant includes 8 cubic m of preliminary sludge and 25 kg dry organic waste. This would generate 26 cubic m of biogas per day. The amount of energy that can be generated from this is 51 kWh per day.</p>	

Activity 1.2	Prepare documents, launch an international tender and engage an engineering company for the construction of the plant	
	Achieved	Partially
	Comments	<p>A technical study related to the biogas component of the project was commissioned. The International Consultant prepared reports, which allowed for the successful launch of the ITB notice (2018/CSAPC/FNJOR/100231). Site visits were organized for companies that showed an interest. An evaluation team was formed, comprising the project manager and two biogas engineering consultants, which was further supported by two FAO staff. The team evaluated the offers received.</p> <p>FAO entered into negotiations with BEB Bio Energy Berlin to determine if it was possible to reduce both the implementation period and quoted prices. As at December 2018, the offer with negotiated amendments stood at USD 1 274 925. A no-cost extension was requested to account for the delivery time.</p> <p>An LoA was signed in May 2019 between FAO and the NERC regarding the design, supervision and test running of the pilot unit. The NERC submitted their first draft of the design report in May 2019, which was then sent to the biogas consultant for comments and approval. The final design was completed in July 2019. The ITB was circulated to vendors through the UNGM. Concurrently, the project engaged biogas consultants to design a plant that could utilize all the feedstock available in Zaatari. The plant design was to be used in the future EU–GIZ project, serving as a starting point for stakeholders, particularly the Water Authority of Jordan, UNICEF, UNHCR and GIZ. The proposal was published in the Design Report (Annex 6) titled “Technical Support – Full Size Zaatari Biogas Plant to Generate Electricity.”</p>
Activity 1.3	Construct and assemble a biogas plant at Zaatari wastewater treatment facility under supervision and certification of a sector engineer/supervisor	
	Achieved	No
	Comments	
Activity 1.4	Conduct test runs and on satisfactory functionality connect the biogas plant to the national electric grid	
	Achieved	No
	Comments	
Activity 1.5	Formulate a management plan to ensure the biogas plant function according to required standards	
	Achieved	No
	Comments	
Activity 1.6	On induction of trained staff, commission the biogas reactor and electricity generating equipment	
	Achieved	No
	Comments	

<b>Output 2</b>	Green jobs are created through the construction and operation of a solid waste segregation unit in Zaatari municipality		
	Indicators	Target	Achieved
	Employed labourers (20 percent female and 80 percent male) for solid waste separation by the 27th month of the action (as per ILO standards).		Partially
<b>Baseline</b>			
<b>Comments</b>	In total, 30 people were employed (12 males and 18 females).		
<b>Activity 2.1</b>	Design plant for the separation of organic and inorganic solid waste		
	Achieved	Yes	
	Comments	The design and BoQ for a 16-tonne per day MRF were developed.	
<b>Activity 2.2</b>	Obtain the required authorizations for the construction of the solid waste separation plant and construct according to approved designs		
	Achieved	Yes	
	Comments	<p>ITB-LOP-JOR-EU-2018-034 was launched on 31 December 2017. Twenty-three companies were invited. Seven bids were received, of which six were valid. A contract (FAOJO/GCP/JOR/017/EC/CON01/18) was signed with Al-Maqsd Contracting Company in February 2018. Contract monitoring by FAO was stringent and periodical site meetings were held to discuss progress and make qualitative observations. Minor changes were discussed, which necessitated contract amendments in April and September 2018. These amendments allowed for the installation of a rainwater harvesting system.</p> <p>The contractor struggled with the requirements for working inside the camp. However, to reduce the strain on time and resources, an agreement was reached for FAO to present the contractor as an agent to the SRAD, allowing the contractor to make requests for and collect permits directly.</p> <p>The contract closure, site inspection and handover were completed in October 2018. The construction directly employed 44 men for 1 578 workdays. Six tailor-made stainless-steel sorting tables, complete with a leachate collection bin, were procured from Jordan Catering Company. The tables can hold 1 cubic m of waste. Other consumable materials (gloves, boots, masks, aprons etc) were tested for effectiveness before being approved for purchase. A high-pressure pump, fire extinguishers and water tanks were also procured. Finally, a dump-truck was procured, which was to be used primarily to ferry organic waste between the MRF and the composting yard.</p>	
<b>Activity 2.3</b>	Sign an agreement with the organization charged with waste collection to dispose some of the solid waste of Zaatari camp at the separation plant		
	Achieved	Partially	
	Comments	<p>In August 2018, UNICEF announced the shift from a multi-operator (i.e. Oxfam, Acted and JEN) platform to a single operator run activity, with Oxfam taking charge of all camp cleaning and waste trucking management. This ultimately benefitted the processes involved in integrated waste management, facilitating a more transparent and accountable operation and allowing for effective investment in cost reduction, waste recovery and waste reuse.</p> <p>FAO and Oxfam held meetings to discuss the pilot project. The two teams packaged the second sorters training session, which also served as a test run of the MRF, and collaborated for the purposes of observation and documentation. Oxfam provided hygiene, waste handling and recyclable material sorting experts for the training. Additionally, Oxfam updated the waste flow chart so that it included the MRF.</p> <p>During 18 September–1 October 2018, Oxfam arranged for the provision of 29.5 tonnes of waste. Despite facing contracting issues, Oxfam devised a plan to provide the MRF with 3 tonnes of waste daily.</p> <p>At the MRF, all sorted waste was weighed. Recyclable materials were collected by Oxfam for their recycling project, organic waste was sent to the compost yard and the remainder was directed to landfills.</p> <p>In 2019, a delivery agreement was reached. It was initially suggested that the project share the cost of waste delivery to the MRF. A major effect of the establishment of the MRF, however, was a reduction in transport costs from the camp to the landfill. Oxfam revealed that the new agreement reached with the trucking contractor included lower costs. Costs were initially reduced to JOD 132 per month and later reduced further to JOD 102.96. Oxfam agreed to deliver 16 tonnes of solid waste to FAO, free of cost, beginning in the first quarter of 2020. This will allow the MRF to run at full capacity. The drafting of an agreement to guide the operation and eventual handover of the initiative was undertaken.</p>	



Activity 2.4	Obtain the necessary certification of the functionality of the plant	
	Achieved	No
	Comments	
Activity 2.5	Formulate and implement the separation plant operational procedures	
	Achieved	Yes
	Comments	A composting expert/waste management trainer was recruited. A qualitative analysis of the waste was performed, and the data collected was used to deduce the common organic waste contaminants in Zaatari. This information was then used to develop training guidelines and sorting procedures (in both Arabic and English). The guidelines were printed and remained at the MRF for future reference. Additionally, recommended actions were developed for when contaminants are found.
Activity 2.6	Employ all necessary labour from the Zaatari natives and from the camp	
	Achieved	Partially
	Comments	<p>In May 2018, the identification of potential MRF workers commenced through a sorters training at the Zaatari waste transfer station. Twenty-four female and 30 male refugees attended. In September 2018, the second sorters training session was conducted – the first at the MRF. In agreement with the Zaatari CFW SOPs and with the support of Oxfam and the basic needs and livelihoods working group, the project advertised for training participants. An allowance rate of JOD 1 per hour plus JOD 1 for transportation was indicated. Seventy-four applications were received, and all applicants were invited to participate in the training. In May 2018, 54 people were trained (30 males, 24 females). In September–October 2018, 35 people were trained (16 males, 19 females). A team of twenty sorters was selected to continue working at the MRF. The 20 individuals selected (8 males and 12 females) showed a willingness to learn, which was reflected in their sorting rate. The workers remained under a training package. In addition, three gatekeepers/groundsmen were employed.</p> <p>The research component of the project was implemented in conjunction with the NARC. On 19 March 2019, the NARC presented their research findings to stakeholders. The event was attended by the FAO Representative to Jordan and the Director of the NARC. The results indicated that the compost produced met the Jordan Biosolids Standards (JS 1145/2006). The results needed to be presented to the Interministerial Committee on Biosolids. However, the committee did not hold regular meetings in 2019. Meetings were scheduled to restart in October 2019 under chairmanship of the Ministry of Water and Irrigation.</p> <p>The composting of organic waste (without biosolids) commenced at the Zaatari plant. The first batch produced was tested at RSS laboratories and determined to be safe for use. Consequently, a new research activity was initiated, which was hosted at the NARC Khalidiya Saline Agriculture Research Station. The findings were incorporated into the presentations delivered to the committee for regulation. Additionally, research on the use of compost from municipal waste in forestry activities was commissioned to the NARC and the outcomes are expected in May 2020.</p>

<b>Output 3</b>	Compost, compliant with Jordanian standards for application of bio-solids, is produced from the sludge and solid waste		
	Indicators	Target	Achieved
	<ul style="list-style-type: none"> <li>– 150 tonnes of compost produced by the plant monthly.</li> <li>– 150 tonnes of compost utilized by the public sector for research and rangeland and forest restoration.</li> <li>– One presentation to stakeholders on research results on biosolid waste-based compost use in Jordan.</li> </ul>		Partially
<b>Baseline</b>			
<b>Comments</b>	By month 47, 45 tonnes of compost had been produced but no compost had been used by the public sector. A presentation to stakeholders on the use of biosolid waste-based compost was delivered.		
<b>Activity 3.1</b>	Design a plant for the stabilization of biogas residuals in compliance with Jordanian standards of biosolid		
	Achieved	Partially	
	Comments	<p>Qualitative analysis of the organic waste used for aerobic composting was performed. The compost was delivered to the NARC station in Baqa for pot testing. Bioassays were conducted to evaluate the effect of compost on seed germination and to determine the best compost-to-soil ratio for growing selected plants. Experiments were conducted using various plants, including Mediterranean saltbush, Christ's thorn jujube, tamarisk, safflower, barley, bitter vetch, sorghum and millet.</p> <p>The analysis of results was being finalized before their reporting and presentation to stakeholders. The compost demonstrated no detrimental effects on seed germination or growth rate. Additionally, it improved biomass production and was determined to be safe for use as a fertilizer.</p> <p>The MRF facility became operational in September 2018. Sorted organic solid waste was laid out in the compost yard for drying. Large pieces were manually cut using a shovel. The material was left in the sun for two weeks before being transferred into windrows. The windrows were then covered with a plastic sheet to increase the temperature and start the composting process. The temperature was determined to rise above 50°C within three days. This guaranteed suitable conditions for composting, as well as for the elimination of harmful bacteria and plant seeds.</p>	
<b>Activity 3.2</b>	Obtain the required authorizations for the construction of the stabilization plant		
	Achieved	Partially	
	Comments	The approval from the Ministry of Planning and International Cooperation (MoPIC) in November 2016 was preceded by a no-objection confirmation from line ministries. Therefore, efforts were carried out according to the way they had been approved.	
<b>Activity 3.3</b>	Construct a stabilization plant for the production of compost		
	Achieved	Partially	
	Comments	<p>ITB-LPO-JOR-EU-2018-035 was launched in December 2017. From the 20 companies invited, three valid bids were received for construction of the composting yard. HASCON ultimately withdrew their offer because of ongoing commitments that would have hampered their delivery. The ITB was therefore re-tendered (ITB-LPO-JOR-EU-2018-039) in February 2018. A contract was signed with Al-Maqdad Contracting Company. The contract was revised twice with additional funds being allocated both times. The contract closed at USD 77 330. A site inspection and handover were carried out in April 2018. The construction of the compost yard employed 21 people for a cumulative 239 workdays. Due to the nature of work, only men were employed.</p> <p>Following an ITB, Modern Construction Machinery was contracted to supply a skid loader in July 2018. The skid loader was procured for multiple purposes, including the loading and moving of organic waste to the biogas digester and composting yard and for turning over the windrows. The supply contract included training for equipment operators.</p>	
<b>Activity 3.4</b>	Obtain the necessary certification of the functionality of the plant		
	Achieved	Partially	
	Comments	The certification and authorization for the full use of the yard will be based on the provision of clearance to produce and use compost from the organic fraction of municipal waste.	
<b>Activity 3.5</b>	Formulate and implement the stabilization plant operational procedures		
	Achieved	No	
	Comments		

<b>Output 4</b>	Unskilled workers from Zaatari municipality and refugee camp are trained and employed in construction, operation and management of the solid waste segregation unit, biogas plant, and the composting plant through one existing cooperative society		
	Indicators	Target	Achieved
	<ul style="list-style-type: none"> <li>– Employees (20 percent female and 80 percent male) performing skilled and unskilled labour for the construction of the biogas, solid waste separation and compost plants.</li> <li>– Individuals trained for employment and labourers employed (20 percent female and 80 percent male) at the biogas, solid waste separation and compost plants.</li> </ul>		Partially
<b>Baseline</b>			
<b>Comments</b>	In total, 105 (104 men and one woman) construction workers were employed, of which 80 were Jordanian and 25 were refugees. Eighty-nine refugees (46 men, 43 women) received training and 30 green jobs were created at the facilities (for 12 male and 18 female refugees). Five other jobs were created at the facilities (for three refugees and two Jordanians).		
<b>Activity 4.1</b>	Conduct a capacity assessment of cooperative societies/NGOs and identify one that can operate the biogas, compost and separation plants		
	Achieved	Partially	
	Comments	Although Oxfam was a highly suitable candidate, they were hesitant to serve as the partner for operating the facilities. Thus, FAO continued to operate the plant during the project. In 2019, the GIZ and the EU were engaged to assist in the development of a concept note for future efforts concerned with the establishment of a biogas plant at the Zaatari camp. The new GIZ–EU project will ensure the continuity of efforts undertaken during the project, with the GIZ operating the biogas plant and Oxfam overseeing the compost and separation plants. FAO is expected to formalize the handover in the first quarter 2020.	
<b>Activity 4.2</b>	Formulate a business plan for the CS indicating the number of employees, the different functions of the employees, the required training for each function and the tentative costs and profits of the operations		
	Achieved	Partially	
	Comments	Although this activity began alongside the training for sorters, it was suspended until the full operational capacity of the sorting plant could be reached.	
<b>Activity 4.3</b>	Provide the necessary start up support to the cooperative’s specialized groups in form of technical assistance, management and technical training		
	Achieved		
	Comments	A Jordanian engineer was recruited to train refugees on waste sorting and composting and to serve as the plant manager. The training of sorters and compost handlers was the first component of securing green job opportunities. Since the CFW SOPs did not cover training rates, an agreement was reached for non-skilled labour rates to be applied. An internal CFW training advertisement template was used to ensure that personal data was collected and that individuals were not already hired by another organization. Oxfam distributed the advertisement and further supported the initiative by performing the primary cross-checking of names to ensure eligibility. Data were then matched to the information in the Refugee Assistance Information System, which allowed all payments to be made under a centralized platform within the Common Distribution Centre.	
<b>Activity 4.4</b>	Supervise the functionality of the three specialized groups of the cooperative ensuring that the biogas and separation plants are functioning according to standards set by the operational guidelines		
	Achieved	No	
	Comments		
<b>Activity 4.5</b>	Create awareness of available compost and its impact on livelihoods and especially the environment as a means of commercialization beyond government structures to attract investment via corporate social responsibilities (CSR) in private firms		
	Achieved	No	
	Comments		

**Partnerships and Outreach**

For more information, please contact: [Reporting@fao.org](mailto:Reporting@fao.org)

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