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Cost Benefit Analysis Report of the 35 priority actions contributing to Jordan's NDC

Final Report

Report for Jordanian Ministry of Environment

Hima حمى for Environment & Management Consulting لاستشارات البيئة والإدارة

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Contact:

Mahmoud Abu-Ebid, Gemini Building, Fermi Avenue, Harwell, Didcot, OX11 0QR, UK

T: +44 (0) 1235 753 193

E: Mahmoud.Abu-ebid@ricardo.com

Authors:

Ricardo: Carolina de Oliveira, Amber Jenevizian, Clemence Moinier, Cris Caballero, Lara Turtle, Micaela Zabalo, Richard Smithers

Hima: Sana Al-Labadi, Walaa Matalqa,

Approved by:

Mahmoud Abu-Ebid

Signed

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1 Introduction

This report is prepared for Jordan's Ministry of Environment by Ricardo Energy & Environment (Ricardo) and our Jordanian partners, Hima Environment and Management Consulting, as part of the NDC Partnership's Climate Action and Enhancement Package (CAEP) activities in Jordan, for the project "*CAEP Jordan: Nationally Determined Contribution (NDC) costing, cost benefit analysis, and climate finance strategy for 35 priority actions contributing to Jordan's NDC"*. The purpose of this project was to develop a cost-benefit analysis of each priority action followed by provisional identification of funders and development partners that may potentially be interested in supporting the implementation of these actions.

This report presents the cost benefit analysis (CBA) of the actions. Section 2 provides an overview of the methodologies used to develop this report. Section 4 provides an summary of the status, cost and funding requirements, mitigation benefit assessment, and adaptation benefit assessment for each action. Section 5 provides the conclusions and recommendations. Subsequent sections in the Appendices provide detailed information for the Water (Section A1), Agriculture (Section A2), Health (Section A3), Transport (Section A4), and Energy (Section A5) sector actions. Note, as described in Table 4, five of the 35 actions do not require funding (2, 21, 23, 32, 33) so no detailed assessment is presented of them. Finally, a 'Climate Finance Strategy' report was prepared alongside this report, with the outcomes of the funder mapping assessment.

2 Report Methodologies

2.1 Cost, activities, and co-funding data

In order to undertake the CBA, Ricardo and Hima consulted with key national stakeholders across the Water, Agriculture, Health, Transport, and Energy sectors who had specific interests in each of the 35 priority actions contributing to implementation of Jordan's NDC. Through capacity building workshops and one-to-one meetings with these stakeholders between June-December 2020, a data collection template was systematically completed that provided a description of each action, its components activities, associated costs and co-funding. Between January and March 2021, Ricardo verified the costs provided by stakeholders through benchmarking them against the costs of similar actions and activities undertaken elsewhere and, particularly, in neighbouring Palestine, where Ricardo has been responsible for the development of costed NDC implementation plans across seven sectors. Ricardo then performed a desk-based assessment of the climate change mitigation and adaptation benefits, and other co-benefits, of each action (methodology below). With Hima's support, this was validated by the key stakeholders with interests in coordinating their delivery. 5 of the 35 priority actions were excluded from the CBA and funder mapping process for varying reasons.[1]

2.2 Potential Mitigation Benefit Assessment Methodology

Ricardo undertook a desk-based assessment of the potential climate change mitigation benefit of the actions. All actions will result in emissions being generated during their construction and operation. However, some projects will result in emission savings relative to a counterfactual scenario in which the action would not have been implemented. For each action, the following are identified:

Emissions. Also known as 'gross emissions', the major sources of emissions generated throughout the construction and operation phases (or equivalent) of the actions. Emissions have been identified that fall within Scope 1, 2 and 3 categories, where:

- Scope 1 – direct GHG emissions from sources operated by the project (for example, fuel combustion)
- Scope 2 – indirect GHGs associated with energy consumption (for example, electricity, heating, cooling, steam) consumed but not produced by the project
- Scope 3 – all other GHG emissions (for example, business travel)[2].

Note, none of the actions have sufficient data to provide a robust estimate of gross emissions.

Emission savings. The activities within each action which result in an emission savings and why, with reference to the counterfactual scenario, describing workings of any relevant mitigation technologies. Some of the actions have sufficient activity data to provide a rough estimate of the emission savings which may result through the implementation of activities, and where possible this has been provided.

A rating is provided of the **net emissions** of each action, which cancels out emission savings from gross emissions for the action as a whole. The net emissions of each action are rated using the qualitative scale below. The scale of the action in relation to other actions was also considered. In some cases, a range of ratings has been provided because the action owner has not confirmed what measures will be undertaken as part of the action.

[1] Actions have been excluded at the stakeholder's request due to cancellation, no longer requiring funding, or being subsumed into other actions. Full details in Table 4.
[2] IPCC, AR5 Climate Change 2014: Mitigation of Climate Change – Annexe I – Glossary, 2014, Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-i.pdf

Table 1: Definition of mitigation benefits' scores

Score	Explanation
-2	Large increases in GHG emissions
-1	Small increases in GHG emissions
0	No overall changes to GHG emissions
1	Small reductions in GHG emissions
2	Large reductions in GHG emissions

Enabling actions

A number of actions are classified as 'enabling' actions. While they do not directly result in emission savings, if they are implemented, they will enable direct emission savings (mitigation benefits) to be realised. Without them, certain emission savings would not be realisable through future projects. Examples include the creation of green building code legislation: while the action does not directly result in mitigation benefits, it is a key stepping-stone to enabling emission savings in the future, as new builds comply with this legislation. Without the legislation, these mitigation benefits would not be realised. As such, 'enabling actions' are considered to have indirect mitigation benefits, and receive a rating of 1.

2.3 Potential Adaptation Benefit Assessment Methodology

The adaptation benefit assessment comprised the following steps:

1. A review of Jordan's Third National Communication (2014) to identify the sectors most vulnerable to climate change
2. Identification of the key factors affecting the climate sensitivity[3] and adaptive capacity[4] for each of those sectors that influence their vulnerability[5] (see Appendix 1)
3. A qualitative assessment of each action's adaptation benefits in relation to the key factors influencing vulnerability. For each action:
    a. The adaptation benefits of actions were rated in relation to their potential for the sector to reduce Jordan's vulnerability to climate change. Hence, the scale at which potential benefits will be delivered is an important determinant of scores.
    b. The benefits were assessed separately with regard to each of its major component activities
    c. Insufficient details about the action's component activities meant that the assessment provided had to be a theoretical description of how each action might affect the key factors influencing a sector's vulnerability, and why this could lead to an increase or a decrease in vulnerability
    d. Climate projections for Jordan were also considered, where relevant, to identify whether the action's component activities might be effective in increasing adaptive capacity and thereby reducing risk of climate change impacts.
4. For each action, the assessment also considered the measures that might enable or prevent it from achieving the adaptation benefits described, which are presented in the "Adaptation Potential" sections.

[3] Climate sensitivity: "The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change" (IPCC, 2014 and 2018)
[4] Adaptive capacity: "The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC 2014 and 2018))
[5] Vulnerability: "The propensity or predisposition to be adversely affected" (IPCC 2014 and 2018)

5. Based on the assessment described above, final ratings are provided at the action level, according to the definitions in Table 2. Where a single rating is provided for an action, it is **conditional** on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score. Where stakeholders have not confirmed that the measures described under the "Adaptation Potential" section can be implemented, two ratings are provided, one based on the measures being undertaken, the other if they are not considered.

Table 2: Definition of scores of adaptation benefits

Score	Explanation
-2	The action affects key factors that influence a sector's vulnerability in a way that substantially increases it
-1	The action affects key factors that influence a sector's vulnerability in a way that increases it
0	The action has no effect on any key factors that influence a sector's vulnerability
1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability
2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially increase its vulnerability

2.4 Co-benefit assessment methodology

Ricardo has provided a qualitative assessment of the economic, social and environmental benefits associated with each major activity group in each action. These are termed 'co-benefits' because they are not climate-related benefits, such as mitigation and adaptation. This draws on best practice guidance such as *C40's co-benefits of climate action*[6] report, and the judgement of our climate action experts.

[6] C40 Cities, '*Co-benefits of urban climate action: A framework for cities',* September 2016, accessed 03/02/2021 on c40-lse-cobenefits

3 Abbreviations

Table 3 provides the names and abbreviations of all organisations mentioned in this report.

Table 3 – List of organisation's abbreviations

Abbreviations	Organisation
ACC	Agricultural Credit Corporation
ASEZA	Aqaba Special Economic Zone Authority
CBJ	Central Bank of Jordan
CBO	Community-Based Organizations
EDCO	Electricity Distribution Companies
EMRC	Energy and Minerals Regulatory Commission
GAM	Greater Amman Municipality
JCI	Jordan Chamber of Industry
JEF	Jordan Environment Fund
GBC	Jordan Green Building Council
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
JVA	Jordan Valley Authority
LTRC	Land Transport Regulatory Commission
MOA	Ministry of Agriculture
MEMR	Ministry of Energy and Mineral Resources
MoEnv	Ministry of Environment
MOF	Ministry of Finance
MOH	Ministry of Health
MOL	Ministry of Labour
MOPIC	Ministry of Planning and International Cooperation
MOT	Ministry of Transport
MWI	Ministry of Water and Irrigation
NARC	National Agricultural Research Centre
NEPCO	National Electric Power Company
PM	The Prime Ministry
WAJ	Water Authority of Jordan

4 Summary of action assessments

Table 4 provides a summary of the status, funding requirements, cost verification assessment, mitigation benefit assessment, and adaptation benefit assessment for each action. Note, 4 of the actions have a 'no further action' status as they do not require funding.

Table 4 – Summary of action assessments

Action ID	Action name	Lead organisation	Status	Total Cost (USD $)	Funding requirement (USD $)	Potential Mitigation Benefit assessment[7]		Potential Adaptation Benefit assessment[8]	
Water Sector									
1	Wastewater networking (al-Koura district), in addition to lifting stations implementation & wastewater treatment plant for (beit edees, kafr, abeel, kafr ewan, kafr rakeb…)	MWI- JVA-WAJ	Requires funding	57,615,000	52,380,000	-1	2	-1	2
2	Feasibility study to reduce water losses and increase water savings in the northern part of King Abdullah Canal	MWI-WAJ	No further action - already funded						
3	Preparation of detailed designs and rehabilitation of water network in Ardah district/ Balqa Governorate	MWI- JVA	Requires funding	21,220,850	21,216,548	1		-1	2
4	Expansion of Madaba Wastewater Treatment Plant	MWI- JVA	Requires funding	66,169,000	60,154,000	0	2	-1	2

[7] Where two ratings are provided, this indicates the minimum and maximum potential scores, dependent on what measures are finally undertaken. Further, mitigation actions with a double asterisk (**) are **enabling actions** which result in indirect mitigation benefit. See methodology for an explanation.
[8] Where two ratings are provided, this indicates the minimum and maximum potential scores, dependent on what measures are finally undertaken.

Action ID	Action name	Lead organisation	Status	Total Cost (USD $)	Funding requirement (USD $)	Potential Mitigation Benefit assessment[7]	Potential Adaptation Benefit assessment[8]
5	Enhance the Energy Efficiency in the well fields and Pumping Stations	MWI-WAJ/ Ministry of Energy	Requires funding	20,253,000	20,235,900	2	0
6	Establish a financing facility for rainwater harvesting from household roofs to support projects that augment rural and urban water supply	MWI- JVA	Requires funding	4,082,400	4,057,000	1	1
7	Blue Economy Principles for Improved Touristic Competitiveness, Livelihoods of the Fisherman Community, Industrial Development and Monitoring Indicators of Pollution Control and Climate Change in the Jordanian Sector of the Gulf of Aqaba, Red Sea	ASEZA	Requires funding	15,960,080	14,472,780	1	1
Agriculture Sector							
8	Green Works in Agriculture and Forestry - the protection and sustainability of forest wealth	MOA-Ministry of Labour-MOPIC-CBOs	Requires funding	17,725,000	15,987,500	1	1
9	Reduce soil erosion through the management and harvesting of rainwater by small farmers in rural areas of Jordan	MOA, Small Farmers	Requires funding	30,258,400	28,318,421	1	0 1
10	Exploitation of treated water in increasing the vegetated area	MOA	Requires funding	10,335,000	9,567,500	0	1

Action ID	Action name	Lead organisation	Status	Total Cost (USD $)	Funding requirement (USD $)	Potential Mitigation Benefit assessment[7]	Potential Adaptation Benefit assessment[8]
	– land reclamation, agricultural development and water harvesting in Irbid Governorate						
11	Help small farmers and rural families adapt to climate change - Supporting poor families in Ma'an Governorate, improving the income of poor families in the northern Jordan Valley, Irbid Governorate - investment in small ruminants to support poor rural families	MOA/ Small farmers cooperative societies	Requires funding	11,130,000	8,880,000	0	2
12	Develop rangelands for climate change mitigation through social cooperation and water harvesting techniques – water harvesting and improving the income of poor families in Maan and Shobak	MOA	Requires funding	33,329,619	32,739,219	2	1
13	Disseminate climate change adaptation techniques through smart agriculture production	MOA/NARC	Requires funding	2,271,240	2,098,440	2	1
14	Assist the irrigated farms to face the climate change impact through implement adaptation techniques such as use water irrigation efficiency - Assist the impact of climate change on crop production	MOA - Land and Irrigation dept.	Requires funding	247,200	228,980	0	1

Action ID	Action name	Lead organisation	Status	Total Cost (USD $)	Funding requirement (USD $)	Potential Mitigation Benefit assessment[7]	Potential Adaptation Benefit assessment[8]
	and crop water requirements in different bioclimatological regions of Jordan						
15	Climate-related agricultural risk management programs/systems - Agricultural Risk Management Fund - Frost Project	MOA	Requires funding	4,312,750	4,094,500	-1	0
16	Implement climate change proofing for agricultural crops including setting up an integrated Pest management (IPM) System	MOA/Plant Protection Directorate/Pest Control Department	Requires funding	297,150	254,250	0	2
Health Sector							
17	Strengthening surveillance and establishment of highly sensitive alert system by developing health forecast system for any climate sensitive disease through 15 sentinel hospitals and 20 health centres	Ministry of Health	Requires funding	1,835,200	1,801,672	0	2
18	Establishment of Leishmania Unit in the Division of Parasitic and Zoonotic Diseases	Ministry of Health	Requires funding	110,050	100,051	0	1
Transport Sector							
19	Fostering mobility in Amman through a Bus rapid transit (BRT) network	Greater Amman Municipality / MOT	Requires funding	282,309,071	260,159,561	2	1

Action ID	Action name	Lead organisation	Status	Total Cost (USD $)	Funding requirement (USD $)	Potential Mitigation Benefit assessment[7]	Potential Adaptation Benefit assessment[8]	
20	Increased access to public transport services in Irbid and Zarqa cities	MOT	Requires funding	24,241,000	9,231,000	2	-1	1
21	Access to public transport services increased in Jarash	MOT, Jarash Municipality, LTRC	No further action - Covered in action 24					
22	Battery-electric buses deployed for use in public transportation	MOT-LTRC-GAM-MEMR-NEPCO-MoEnv-JEF	Requires funding	421,786,416	383,078,560	2	-1	1
23	Battery-electric vehicles deployed for use in public/government fleets	MOT- MOF - GDF - PM-Jordan custom - JPD - Audit Bureau	Suspended					
24	Intelligent Transport System (ITS)	GAM-MOT-LTRC	Requires funding	78,556,700	78,328,700	1	0	
25	Phase 1: Solar Powered Electric Bus Fleet Pilot in Karak, Ma'an and Tafeilah Governorates	MOT-LTRC-Southern Jordan-Municipalities	Requires funding	70,000	68,733	1**	0	
Energy Sector								
26	Encouraging and supporting local industries to manufacture renewable energy components	JCI	Requires funding	116,900	101,900	0	1	
27	Activating the recently established Renewable	MEMR/ JREEEF	Requires funding	16,099,410	7,303,000	2	1	

Action ID	Action name	Lead organisation	Status	Total Cost (USD $)	Funding requirement (USD $)	Potential Mitigation Benefit assessment[7]	Potential Adaptation Benefit assessment[8]
	Energy and Energy Efficiency Fund (JREEEF)						
28	Encouraging the use of solar energy for water heating	MEMR/JREEEF, local banks, chambers of commerce and industry, local CBOs	Requires funding	177,501	133,839	1**	1
29	Requiring the implementation of green building codes	MEMR/JREEEF, local banks, chambers of commerce and industry, local CBOs, CBOs including Jordan GBC	Requires funding	726,000	660,000	1**	2
30	Requiring all new buildings in the public sector to comply with Leadership in Energy & Environmental Design (LEED) or a local rating system of same principles but market-focused	Jordan GBC	Requires funding	925,750	875,750	1**	1
31	Rationalising energy consumption in all sectors and improving their efficiency and raising awareness about the long-term financial benefits of energy efficiency	MEMR, MEMR/JREEEF, local banks, chambers of commerce and industry, local CBOs, EDCOs, local banks	Requires funding	13,221,078	10,253,524	2	0

Action ID	Action name	Lead organisation	Status	Total Cost (USD $)	Funding requirement (USD $)	Potential Mitigation Benefit assessment[7]	Potential Adaptation Benefit assessment[8]
32	Providing appropriate financial incentives for energy efficiency projects and raising awareness about the incentives provided by the renewable energy and energy conservation law; and providing funding to allow assessing the potential of saving energy, for schools, hospitals and other facilities (hotels, commercial buildings)	MEMR/JREEEF , local banks, chambers of commerce and industry, local CBOs, local ministries, Agricutlure Credit Corporation	No further action – subsumed in 27, 28, 31				
33	Attracting private sector investment to the energy sector	Energy and Minerals Regulatory Commission (EMRC)	No further action - cancelled				
34	Expanding the use of solar cooling in commercial and industrial facilities	JCI	Requires funding	296,000	196,000	1	1
35	Hydro pumped storage	Ministry of Energy , private sector, NEPCO	Requires funding	233,497,300	219,993,000	1	-1

5 Conclusions and Recommendations

This project marks an important step along the long journey toward the implementation of Jordan's priority actions contributing to the delivery of international comments identified in its NDC. This report provides a high-level CBA of each of the priority actions, based on provisional descriptions of their component activities, costs and funding requirements, and indicative climate change adaptation and mitigation assessments. The information is more complete for some actions than others, depending on the extent of stakeholder input, degree to which the actions have previously been considered, and availability of data. Nevertheless, with regard to all actions that have been assessed, we recommend that the resultant information and stakeholder engagement provides good foundations on which to continue to make progress. It is important to note that the purpose of this project was to develop a CBA of each action not to prioritise the actions in relation to each other, as all have already been identified as national priorities. Instead, we recommend that the CBAs should be used to inform the development of implementation plans, concept notes and provision of funding.

The accompanying Climate Finance Strategy Report provides provisional indications from each of the funders and development partners of which of the priority actions they might potentially be interested in supporting. The Strategy Report reveals that there are potentially a significant number of organisations that may be able to support Jordan in implementing these actions.

Regarding next steps, it is recommended that the lead organisations for each action:

1. Take ownership for the progression of their actions.
2. Liaise with lead organisations for other related actions within and across sectors with a view to potentially clustering actions, as the basis for developing implementation plans that are attractive to the scope and scale of funders and development partner interests.
3. Follow the appropriate communication channels and engage in further conversation with potential funders and development partners regarding provision of financial support to develop an implementation plan for their action, in isolation or in combination with a cluster of actions.
4. Develop the implementation plan, including the following sections:
    - Relevance to GCF Country Programme
    - Reasons for prioritisation, for example:
        - Government support
        - Adaptation benefits
        - Mitigation benefits
        - Capacity available
        - Technology available
    - Gender mainstreaming
    - Target(s) and description of activities and sub-activities
    - Timeframes
    - Indicative costs
    - Existing funding and likely sources of funding
    - Institutional arrangements
    - Policy recommendations
    - Challenges for implementation
5. Discuss and agree with supporting organisations how the implementation plan can be developed subsequently into a concept note to secure funding for implementation.

A1 Appendices - Water Sector Actions contributing to the Jordanian NDC

A1.1 Action 1: Wastewater Treatment Network

Wastewater networking (al-Koura district), in addition to lifting stations implementation & wastewater treatment plant for (beit edees, kafr, abeel, kafr ewan, kafr rakeb and Jdetta…)

Lead Organisation	MWI- JVA-WAJ
Lead Organisation contact	Eng. Wafa Shehadah wafa_shehadeh@mwi.gov.jo

Project description

The project intends to set up a wastewater treatment network and sites in the al-Koura district of Jordan in North-East Jordan, which includes the city Der Abi Saeed.

A1.1.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Construction of a wastewater treatment plant and lifting stations (7) to serve the Koura district areas (Beit Edees, Kafr, Abeel, Kafr Ewan, Kafr Rakeb and Jdetta) with sanitation. The number of expected beneficiaries is 46,000, and the number of expected home connections is (7500).	Consultation and planning	No. of connections	7,500	2020 - 2025	Consulting engineers, planning licenses, building materials, labour, etc	2,050	15,375,000
2. Supply of a main, subsidiary and carrier sanitation lines to serve the Jedita area with sanitation, the expected number of beneficiaries is 20,000, and the expected number of household connections is 2000.	Consultation and planning	No. of connections	2,000	2020 - 2025	Consulting engineers, planning licenses, building materials, labour, etc	5,280	10,560,000
3. Supply of a main, subsidiary and carrier sanitation lines to serve the Kafr Abeel area with sanitation, the expected number of beneficiaries is 10,000, and the expected number of household connections is 2000.	Consultation and planning	No. of connections	2,000	2020 - 2025	Consulting engineers, planning licenses, building materials, labour, etc	5,280	10,560,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
4. Supply of a main, subsidiary and carrier sanitation lines to serve the Kafr Ewan area with sanitation, the expected number of beneficiaries is 10,000, and the expected number of household connections is 2000.	Consultation and planning	No. of connections	2,000	2020 - 2025	Consulting engineers, planning licenses, building materials, labour, etc	5,280	10,560,000
5. Supply of a main, subsidiary and carrier sanitation lines to serve the Kafr Rakeb area with sanitation, the expected number of beneficiaries is 10,000, and the expected number of household connections is 1500.	Consultation and planning	No. of connections	1,500	2020 - 2025	Consulting engineers, planning licenses, building materials, labour, etc	7,040	10,560,000
Total Cost							**57,615,000**

A1.1.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Consultation and planning	-	-	1,395,000	-	1,395,000	-	-		13,980,000
Consultation and planning	-	-	960,000	-	960,000	-	-		9,600,000
Consultation and planning	-	-	960,000	-	960,000	-	-		9,600,000
Consultation and planning	-	-	960,000	-	960,000	-	-		9,600,000
Consultation and planning	-	-	960,000	-	960,000	-	-		9,600,000
Total Funding Requirement									**52,380,000**

A1.1.3 Potential Mitigation benefit assessment

Major activity: Construction of a wastewater treatment plant, lifting stations and sanitation lines

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[9]. Emissions generation will also be dependent on the duration of construction, which is thought to last for 1-5 years. Scope 3 emissions from transport to and from the building site.

Operation emissions

Scope 1 emissions from wastewater once constructed. Some CH_4 can be emitted from WWTP from settling basins and other anaerobic pockets. May also emit CH_4 generated in upstream sewer networks during turbulent and/or aerobic treatment processes. Sludge disposal (e.g. landfill, use in agriculture, incineration) may also be responsible for CH_4 emissions. Collection of wastewater in underground sewers are not a significant source of CH_4 emissions[10]. Significant CH_4 emissions from wastewater treatment (WWT) only arise from the anaerobic part of the process and is very much dependent on the temperature at which anaerobic digestion takes place[11].

N_2O as an intermediate product from the degradation of nitrogen components in the wastewater depending on the efficiency of the WWTP in removing this during the secondary and tertiary treatment stage.

Scope 2 CO_2 emissions from the consumption of electricity in the treatment process. It is assumed that the WWTP will be in operation for 10-40 years, so emissions will continue to be released over this timeframe.

Emission savings

It is assumed that without a WWTP wastewater would be discharged to cesspits in soil or aquatic environments, either permanently or temporarily before being transported to an alternative WWTP. In the case of permanent discharge, this action would result in CH_4 emission savings[12] as nutrient oversupply in aquatic environments/soil will increase CH_4 emissions. In the case of temporary discharge before transporting to an alternative WWTP, this action results in savings of CH_4 as before, in addition to savings of transport and energy emissions (CO_2) to treat the water at the alternative WWTP.

There is the potential for significant emission savings if proper technology for recovering gases is implemented in the WWTP. Flaring the CH_4 converts this to CO_2 and H_2O, which has a significantly lower global warming potential, equivalent to emission savings. This process generates significant amount of heat which can be captured and used as an energy source, which would generate even further emission reductions as it displaces the need for alternative energy sources.

Mitigation benefit assessment for whole action

Given the uncertainty in whether there will be the recovery of biogas, this action has a range of potential scores:

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[9] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[10] https://www.eib.org/attachments/strategies/eib_project_carbon_footprint_methodologies_en.pdf
[11] IPCC 2019 Refinement: 'Temperature affects wastewater treatment processes, in particular decentralised systems where no external supplemental heat is provided (uncontrolled temperature) and anaerobic digestion for which the optimal temperature is 30–38°C. At lower temperatures, the rate of anaerobic digestion decreases and CH_4 production becomes unlikely below 12°C'.
[12] IPCC 2019 Refinement: Wastewater https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/5_Volume5/19R_V5_6_Ch06_Wastewater.pdf

-1	Small increases in GHG emissions – if no biogas is recovered
0	No overall changes to GHG emissions – if biogas is recovered and flared
1	Small reductions in GHG emissions – if biogas is recovered and flared
2	Large reductions in GHG emissions – if biogas is recovered and used as energy source

A1.1.4 Potential Adaptation benefit assessment

Major activity: Construction of a wastewater treatment plant, lifting stations and sanitation lines

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

While in operation, the wastewater treatment network has the potential to:

- Reduce water scarcity through an increase in the supply of water resources
- Enable water providers to respond to growing demand for water resources
- Enable stable long-term access to clean water for agricultural activities, sanitation, and in households, even in situations of drought and/or reduced rainfall.

The action may also improve the health of ecosystems by preventing wastewater from being released into freshwater and/or groundwater bodies, and into the soil.

Adaptation potential

To achieve the adaptation benefits while in operation and prevent damages to the ecosystem, construction of the plant should be guided by a social and environmental impact assessment to ensure that materials and building processes adequately prevent physical damages caused by climate change or extreme weather events. The assessment should consider the range of possible future climate scenarios and their impact on the infrastructure, water and waste sector, and recommend building practices accordingly (location, material, etc). Without such an assessment, physical damages may occur and lead to water and soil pollution (causing contamination of drinking water, agricultural products, etc) and reduced water supply.

To ensure that the adaptation benefits are retained in the long term, regular maintenance and monitoring activities should be carried out. In the absence of proper maintenance and monitoring of the built infrastructure, the wastewater treatment network is at risk of malfunctioning or failing. This may negatively affect all sectors supplied by the network, such as health, agriculture, water and biodiversity sectors, due to soil contamination or water contamination.

It is also essential to establish financial mechanisms that can cover potential expenses incurred to adapt the network to climate risks and/or to ensure that assets and communities are insured in case of impacts.

Adaptation benefit assessment for whole action

Stakeholders have not confirmed that the measures described under the "Adaptation Potential" section can be implemented, two ratings are provided, one based on the measures being undertaken, the other if they are not considered.

-1	The action affects key factors that influence a sector's vulnerability in a way that increases it – if conditions on adaptation potential are not met preventing disbenefits to the ecosystem and community.
2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially

	increase its vulnerability – if a social and environmental impact assessment is conducted, regular maintenance and monitoring activities are in place and financial mechanisms are established.

A1.1.5 Co-benefits assessment

Economic	**Social**	**Environmental**
Cost savings with wastewater treatment	Health impacts from less contamination of water and fewer disease outbreaks	Reduced pollution
Potential revenue streams from by-product processing	Improved access to clean water	Reduced aquifer depletion
Reduced economic impacts of water variability	Reduced droughts and water shortages	Reduced reliance on groundwater resources
Long term local job creation	Increased water security	

A1.2 Action 3: Rehabilitation of Wastewater Network

Preparation of detailed designs and rehabilitation of water network in Ardah district/ Balqa Governorate

Lead Organisation	MWI- WAJ
Lead Organisation contact	Eng. Rami Abu Rwaq / WAJ Rami_Aburwaq@mwi.gov.jo

Project description

Preparation of detailed designs and rehabilitation of water network in Ardah district/ Balqa Governorate.

A1.2.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Preparation of feasibility study of Water Network in Ardah District	Collect, Review and Analyse All Available Data about Existing & Future Water Resources	Kilometres	200	2020 - 2025	Consultants Field Visits Transportation Data Collection Hydrological Studies	1,000	200,000
	Assess Pump Stations & Recommend Improvements	No. of stations	5	2020 - 2025	Consultants Field Visits Transportation Surveying Works	2,550	12,750
	Review & Update Water Hydraulic Model	Kilometres	200	2020 - 2025	Hydraulic Analysis Consultations	1,000	200,000
	Prioritization & Cost Estimate and Submission of Final Feasibility Study Report	No. of months	12	2020 - 2025	Consultations Staff Documents	9,000	108,000
2. Environmental Impact Assessment	Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements	Consultations	1	2020 - 2025	Consultants, Field Visits, Air Quality Measurements, Reporting and Printing	70,000	70,000
3. Detailed Design & Tender Documents Preparation	Pre-Qualification Process	Consultations	1	2020 - 2025	Consultations	10,100	10,100
	Detailed Design and Tender Design Documents	No. of months	12	2020 - 2025	Topo Surveys Soil Investigations Land Acquisition Printing and Reporting	10,000	120,000
4. Rehabilitation of Water Networks in Ardah District	Rehabilitation and Construction of Networks	Kilometres	200	2020 - 2025	Construction Materials, Transportation, Field Offices Supervision	102,500	20,500,000
Total Cost							**21,220,850**

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity

A1.2.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Collect, Review and analyse All Available Data about Existing & Future Water Resources	-	-	355	-	355	-	-		199,645
Assess Pump Stations & Recommend Improvements	-	-	266	-	266	-	-		12,484
Review & Update Water Hydraulic Model	-	-	532	-	532	-	-		199,468
Prioritization & Cost Estimate and Submission of Final Feasibility Study Report	-	-	532	-	532	-	-		107,468
Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements	-	-	355	-	355	-	-		69,645
Pre-Qualification Process	-	-	133	-	133	-	-		9,967

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Detailed Design and Tender Design Documents	-	-	532	-	532	-	-		119,468
Rehabilitation and Construction of Networks	-	-	1,597	-	1,597	-	-		20,498,403
Total Funding Requirement									**21,216,548**

A1.2.3 Potential Mitigation benefit assessment

Major activity 1 – Rehabilitation of water networks in Ardah District

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[13]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. The scale of emissions release will be lower due to the nature of this activity as the water networks will be retrofit rather than built from scratch. Scope 3 emissions will occur from transport to and from the construction site.

Operation emissions

Assuming that electricity consumption to pump water through the network is taken from the grid, scope 2 emissions will occur over the life cycle of wastewater networks, which is typically 100+ years[14]. Scope 3 emissions will also occur from transport to and from the plant to complete maintenance.

Emission savings

Some, as the rehabilitation of the water networks should increase energy efficiency.

Mitigation benefit assessment for whole action

1	Small reductions in GHG emissions

A1.2.4 Potential Adaptation benefit assessment

Major activity 1: Rehabilitation of water networks in Ardah District

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

While in operation, the water network has the potential to:

- Reduce water scarcity through an increase in the supply of water resources
- Enable water providers to respond to growing demand for water resources
- Enable stable long-term access to clean water for agricultural activities, sanitation, and in households, even in situations of drought and/or reduced rainfall.

Major activity 2: Preparatory works prior to the rehabilitation of the networks[15]

The preparatory works may provide necessary information to ensure that planning and management practices allow for a minimum of inefficiencies and losses of water resources. It may also provide recommendation to minimise the network's vulnerability to future climate hazards and potential negative impact on the ecosystem (i.e. by recommending resistant material, shielded geographical location, etc).

[13] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[14] https://www.sciencedirect.com/science/article/abs/pii/S1462075899000023#:~:text=Typically%2C%20water%20mains%20in%20fully,from%20100%20to%20200%20yr.
[15] ie. the impact assessment, the assessment of pump stations and recommend improvements, the review & update of the water hydraulic model and the collect, review and analysis of all available data about existing and future water resources

This would benefit all sectors supplied by the network as well as surrounding ecosystems, by ensuring that the supply infrastructure is resilient to climate hazards and, hence, prevent potential leaks and/or shortages.

Adaptation potential

To achieve the adaptation benefits while in operation and prevent damages to the ecosystem, rehabilitation of water networks should be guided by a social and environmental impact assessment to ensure that materials and building processes adequately prevent physical damages caused by climate change or extreme weather events. The assessment should consider the range of possible future climate scenarios and their impact on the infrastructure, water and waste sector. Without such an assessment, physical damages may occur and lead to water and soil pollution (causing contamination of drinking water, agricultural products, etc) and reduced water supply.

To ensure that the adaptation benefits are sustained long term, regular maintenance and monitoring activities should be carried out. In the absence of proper maintenance and monitoring of the built infrastructure, the water network is at risk of malfunctioning or failing. This may negatively affect all sectors supplied by the network, such as health, agriculture, water and biodiversity sectors, due to soil contamination or water contamination.

It is also essential to establish financial mechanisms that can cover potential expenses incurred to adapt the network to climate risks and/or to ensure that assets and communities are insured in case of impacts.

Adaptation benefit assessment for whole action

Stakeholders have not confirmed that the measures described under the "Adaptation Potential" section can be implemented, two ratings are provided, one based on the measures being undertaken, the other if they are not considered.

-1	The action affects key factors that influence a sector's vulnerability in a way that increases it – if conditions on adaptation potential are not met preventing disbenefits to the ecosystem and community.
2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially increase its vulnerability – if a social and environmental impact assessment is conducted, regular maintenance and monitoring activities are in place and financial mechanisms are established.

A1.2.5 Co-benefits assessment

Economic	Social	Environmental
Cost savings with wastewater treatment	Health impacts from less contamination of water and fewer disease outbreaks	Reduced pollution
Potential revenue streams from by-product processing	Improved access to clean water	Reduced aquifer depletion
Reduced economic impacts of water variability	Reduced droughts and water shortages	Reduced reliance on groundwater resources
Long term local job creation	Increased water security	

A1.3 Action 4: Madaba Wastewater Treatment Plant

Expansion of Madaba Wastewater Treatment Plant

Lead Organisation	MWI- WAJ
Lead Organisation contact	Eynas Allouban Eynas_Alloubani@mwi.gov.jo

Project description

Madaba is a city south west of Amman near the Jordan Valley with a population of approximately 60,000. The project intends to expand the capacity of the wastewater treatment plant currently serving the town of Madaba. The project includes a feasibility study as well as other pre-construction studies and the development/expansion of the site.

A1.3.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Detailed designs for the Expansion of Madaba WWTP	Feasibility Study	No. of studies	1	2020 - 2025	Collect, review and analyse all available data about existing & future design	15,000	15,000
	Preliminary (Basis of) Design Report	Consultations	1	2020 - 2025	Consultation and deign	55,000	55,000
	Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements	Consultations	1	2020 - 2025	Consultants, Field Visits, Air Quality Measurements, Reporting and Printing	77,000	77,000
2. Tender documents and Pre-Contract services for the expansion of Madaba WWTP	Pre-qualification process, detailed design and tender design documents	Consultations	1	2020 - 2025	Consultation, topographical surveys, soil investigations, land acquisition, printing and reporting	22,000	22,000
3. Rehabilitation and expansion of the WWTP[16]	Rehabilitation and Construction	Consultations	1	2020 - 2025	Construction materials, labours, engineers, transportation, field visits and supervision	66,000,000	66,000,000
Grand Total Cost							**66,169,000**

[16] The current capacity of Madaba WWTP is 7600m3/day and it will be expanded to a capacity of 16000m3/day

A1.3.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Feasibility Study	-	-	1,000	-	1,000	-	-		14,000
Preliminary (Basis of) Design Report	-	-	5,000	-	5,000	-	-		50,000
Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements	-	-	7,000	-	7,000	-	-		70,000
Pre-qualification process, detailed design and tender design documents	-	-	2,000	-	2,000	-	-		20,000
Rehabilitation and Construction	-	-	6,000,000	-	6,000,000	-	-		60,000,000
Total Funding Requirement									**60,154,000**

A1.3.3 Potential Mitigation benefit assessment

Major activity – Rehabilitation and expansion of the WWTP

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[17]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions will occur from transport to and from the construction site.

Operation emissions

Scope 1 emissions from wastewater once constructed - CH_4 from degradation of organic material in the wastewater under anaerobic conditions. Significant CH_4 emissions from wastewater treatment (WWT) only arise from the anaerobic part of the process. Sludge disposal (e.g. landfill, use in agriculture, incineration) may be also responsible for CH_4 emissions. Collection of wastewater in underground sewers are not a significant source of CH_4 emissions[18]. N_2O emissions are also a possibility as an intermediate product from the degradation of nitrogen components in the wastewater.

Scope 2 emissions will occur from the consumption of electricity in the treatment process over a long time period. The life cycle of wastewater networks is typically 100+ years[19].

Emission savings

The rehabilitation and expansion of the WWTP will increase the volume of treated water. It is assumed that without this increase, wastewater would be discharged to cesspits in soil or aquatic environments, either permanently or temporarily before being transported to an alternative WWTP. In the case of permanent discharge, this action would result in CH_4 emission savings[20] as nutrient oversupply in aquatic environments/soil will increase CH_4 emissions. In the case of temporary discharge before transporting to an alternative WWTP, this action results in savings of CH_4 as before, in addition to savings of transport and energy emissions (CO_2) to treat the water at the alternative WWTP.

There is the potential for significant emission savings if proper technology for recovering gases is implemented in the WWTP. Flaring the CH_4 converts this to CO_2 and H_2O, which has a significantly lower global warming potential, equivalent to emission savings. This process generates significant amount of heat which can be captured and used as an energy source, which would generate even further emission reductions as it displaces the need for alternative energy sources.

Further savings result from the rehabilitation of the plant which should increase energy efficiency of existing operations.

Mitigation benefit assessment for whole action:

Given the uncertainty in whether there will be the recovery of biogas, this action has a range of potential scores:

0	No overall changes to GHG emissions – if biogas is recovered and flared
1	Small reductions in GHG emissions – if biogas is recovered and flared

[17] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[18] https://www.eib.org/attachments/strategies/eib_project_carbon_footprint_methodologies_en.pdf
[19] https://www.sciencedirect.com/science/article/abs/pii/S1462075899000023#:~:text=Typically%2C%20water%20mains%20in%20fully,from%20100%20to%20200%20yr.
[20] IPCC 2019 Refinement: Wastewater https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/5_Volume5/19R_V5_6_Ch06_Wastewater.pdf

2	Large reductions in GHG emissions – if biogas is recovered and used as energy source

A1.3.4 Potential Adaptation benefit assessment

Major activity 1: Rehabilitation and expansion of the WWTP

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

While in operation, the wastewater treatment network has the potential to:

- Reduce water scarcity through an increase in the supply of water resources
- Enable water providers to respond to growing demand for water resources
- Enable stable long-term access to clean water for agricultural activities, sanitation, and in households, even in situations of drought and/or reduced rainfall.

The action may also improve the health of ecosystems by preventing wastewater from being released into freshwater and/or groundwater bodies, and into the soil.

Major activity 2: Preparatory works prior to the rehabilitation and expansion of the WWTP [21]

The preparatory works may provide the necessary information to ensure that planning and management practices minimise inefficiencies and losses of water resources. It may also provide recommendations to minimise the plant's vulnerability to future climate hazards and potential negative impact on the ecosystem (i.e. by recommending resistant material, shielded geographical location, etc).

This would benefit all sectors supplied by the network as well as surrounding ecosystems, by ensuring that the water treatment and supply infrastructure is resilient to climate hazards and, hence, prevent potential leaks and/or shortages.

Adaptation potential

To achieve the adaptation benefits while in operation and prevent damages to the ecosystem, construction of the plant should be guided by a social and environmental impact assessment to ensure that materials and building processes adequately prevent physical damages caused by climate change or extreme weather events. The assessment should consider the range of possible future climate scenarios and their impact on the infrastructure, water and waste sector, and recommend building practices accordingly (location, material, etc). Without such an assessment, physical damages may occur and lead to water and soil pollution (causing contamination of drinking water, agricultural products, etc) and reduced water supply.

To ensure that the adaptation benefits are sustained long term, regular maintenance and monitoring activities should be carried out. In the absence of proper maintenance and monitoring of the built infrastructure, the wastewater treatment network is at risk of malfunctioning or failing. This may negatively affect all sectors supplied by the network, such as health, agriculture, water and biodiversity sectors, due to soil contamination or water contamination.

It is also essential to establish financial mechanisms that can cover potential expenses incurred to adapt the network to climate risks and/or to ensure that assets and communities are insured in case of impacts.

Adaptation benefit assessment for whole action

[21] ie. the impact assessment, the feasibility study

Stakeholders have not confirmed that the measures described under the "Adaptation Potential" section can be implemented, two ratings are provided, one based on the measures being undertaken, the other if they are not considered.

-1	The action affects key factors that influence a sector's vulnerability in a way that increases it – if conditions on adaptation potential are not met preventing disbenefits to the ecosystem and community.
2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially increase its vulnerability – if a social and environmental impact assessment is conducted, regular maintenance and monitoring activities are in place and financial mechanisms are established.

A1.3.5 Co-benefits assessment

Economic	**Social**	**Environmental**
Cost savings with wastewater treatment	Health impacts from less contamination of water and fewer disease outbreaks	Reduced pollution
Potential revenue streams from by-product processing	Improved access to clean water	Reduced aquifer depletion
Reduced economic impacts of water variability	Reduced droughts and water shortages	Reduced reliance on groundwater resources
Long term local job creation	Increased water security	

A1.4 Action 5: Efficiency Improvements in Well Fields and Pumping Stations

Enhance the Energy Efficiency in the well fields and Pumping Stations

Lead Organisation	MWI-WAJ/ Ministry of Energy
Lead Organisation contact	Eng. Jeries Mukattash Jeries_Mukattash@mwi.gov.jo

Project description

The project involves improving energy efficiency and reducing GHG emissions associated with well fields and pumping stations, including measures such as replacing control panels and pumps and pipes and valves.

A1.4.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Perform Hydraulic Modelling for the Water Supply Systems	Training on the Modelling Software	No. of trainees	100	2020-2025	trainers, venue, catering, training material, computers, software, etc	530	53,000
	Replace Pipes	Km	8000	2020-2025	construction materials, labours, engineers, pipes, etc	400	3,200,000
	Replace Valves	No. of valves	5000	2020-2025	construction materials, labours, engineers, valves, etc	500	2,500,000
2. Replacing Control Panels	Studying the Suitable Type of Control Panel	No. of studies	1000	2020-2025	consultants, field visits, data collection and analysis, printing and consultants	2,000	2,000,000
	Installing the new panels	No. of panels	1000	2020-2025	construction, engineers, labours, panels, construction materials, etc	3,000	3,000,000
3. Replacing Pumps	Maintaining Pumps	No. of pumps	1000	2020 - 2025	engineers, pumps, spare parts, field visits, transportation, etc	5,000	5,000,000
	Install New Pumps	No. of pumps	500	2020 - 2025	engineers, pumps, spare parts, field visits, transportation, etc	9,000	4,500,000
Total cost							**20,253,000**

A1.4.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Training on the Modelling Software	-	-	2,700	-	2,700	-	-		50,300
Replace Pipes	-	-	2,400	-	2,400	-	-		3,197,600
Replace Valves	-	-	2,400	-	2,400	-	-		2,497,600
Studying the Suitable Type of Control Panel	-	-	2,400	-	2,400	-	-		1,997,600
Installing the new panels	-	-	2,400	-	2,400	-	-		2,997,600
Maintaining Pumps	-	-	2,400	-	2,400	-	-		4,997,600
Install New Pumps	-	-	2,400	-	2,400	-	-		4,497,600
Total Funding Requirement									**20,235,900**

A1.4.3 Potential Mitigation benefit assessment

Major activity 1 - Perform Hydraulic Modelling for the Water Supply Systems: Replace pipes, valves and control panels

Construction emissions

Scope 3 emissions from transport to and from the site over the expected installation period of 1-5 years. As there is no major construction taking place, there is likely to be no emissions from actual pipe replacement.

Operation emissions

Scope 1 emissions will arise if electricity is generated on site. Scope 2 emissions will occur from electricity use from the grid to pump water at well fields over the operational period of 10-40 years. Scope 3 transport emissions from field visits.

Emission savings

Yes, due to increased efficiency of water supply systems.

Major activity 2 – Maintaining and installing new pumps

Construction emissions

Scope 2 emissions from construction and installation of new pumps. Emissions are likely to include those from: demolition and site preparation, transport, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[22]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions from transport to and from the construction site will also occur.

Operation emissions

Scope 1 emissions will arise if electricity is generated on site over operational period, which is expected to be 10-40 years. Scope 3 transport emissions from field visits.

Emission savings

Yes, due to proposed interventions to improve energy efficiency in water supply systems through energy efficiency measures.

Grid emission factor is estimated at 0.646 tonnes CO_2/MWh and estimated energy saving is 50 GWh. This offers a potential CO_2 saving of 32,000 tonnes/annum. No data has been provided on the type of energy efficiency measures proposed so no estimates can be made.

Mitigation benefit assessment for whole action

2	Large reductions in GHG emissions

A1.4.4 Potential Adaptation benefit assessment

Major activity 1: Perform hydraulic modelling of the water supply systems

Hydraulic modelling allows simulation of water flow, water pressure and water quality of the system under different conditions, including varying levels of rainfall, etc. Hence, these studies may provide the necessary information to ensure that:

[22] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

- The system is set up to minimise inefficiencies and losses of water resources
- Sufficient water is provided to the network users
- Network users are supplied with good quality water.

Major activity 2: Maintaining and installing new pumps

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

While in operation, the new pumps have the potential to:

- Reduce water scarcity through an increase in the supply of water resources
- Enable water providers to respond to growing demand for water resources
- Enable stable long-term access to clean water for agricultural activities, sanitation, and in households, even in situations of drought and/or reduced rainfall.

Adaptation potential

In several locations in Jordan, overall precipitation levels are decreasing. The water deficit has been addressed through the unsustainable practice of overdrawing highland aquifers, resulting in lowered water tables and declining water quality (Third National Communication, 2014)[23].

Hence, to prevent adaptation disbenefits, it is essential that the hydraulic modelling software accounts for all future precipitation and rainfall scenarios, so that groundwater resources' supplies are not overestimated. Additional feasibility studies should also consider projections on the level of demand from water resources from other sectors, to limit the potential negative impact of pumping on water availability. It may be more relevant to relocate wells and pumping stations where precipitation is expected to increase rather than decrease, or to discontinue the activity altogether.

Moreover, to ensure that the adaptation benefits are retained in the long term, regular maintenance and monitoring activities should be carried out, both to ensure the networks' infrastructure quality as well as monitor changes in groundwater levels.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

0	The action has no effect on any key factors that influence a sector's vulnerability

A1.4.5 Co-benefits assessment

Economic	Social	Environmental
Cost savings for households and industry	Increased water security	Improved air quality

[23] https://unfccc.int/resource/docs/natc/jornc3.pdf

A1.5 Action 6: Rainwater Harvesting

Establish a financing facility for rainwater harvesting from household roofs to support projects that augment rural and urban water supply

Lead Organisation	MWI- JVA
Lead Organisation contact	Mr. Omar Salameh Omar_Salameh@mwi.gov.jo 798503736

Project description

The action is to establish a finance project that can finance the installation of rainwater harvesting systems on houses in central (Amman and Madaba) and southern (Maan , Al Karak, Wadi Mousa and Al Tafilah) Jordan. The project aims to install 1,600 RWH systems in the next two years. These will be retrofitted onto existing houses and installed in new builds, wherever there is available the space for the reservoir and the building owner approves.

A1.5.1 Breakdown of action and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Construction of reservoirs in the middle governorates	Capacity building on how to calculate the reservoirs' volume based on the rainfall for municipalities staff	No of Trainings courses	8	2020 - 2025	Training material, catering, training venue, trainer, transportation	450	3,600
	Awareness for the public community	No. of awareness campaigns	4	2020 - 2025	Organising awareness events, training material, catering, brochures, awareness venue, event planner, production of videos	5,000	20,000
	Design and Construction of the reservoirs (rainwater harvesting tanks)	No. of reservoir (tanks)	800	2020 - 2025	Material, consultants, contractors	2,500	2,000,000
2. Construction of reservoirs in the southern governorates	Capacity building on how to calculate the reservoirs' volume based on the rainfall for municipalities staff	No. Training courses	4	2020 - 2025	Training material, catering, training venue, trainer, transportation	450	1,800
	Awareness for the public community	No. awareness campaigns	4	2020 – 2025	Organising awareness events, training material, catering, brochures, awareness venue, event planner, production of videos	5,000	20,000
	Construction of the reservoirs	No. of reservoirs (Tanks)	800	2020 - 2025	Material, consultants, contractors	2,500	2,000,000
Adaptation Potential, Impact Assessment study	Study and design the reservoir according to the	No. of reservoirs (Tanks)	1,600	2020-2025	Consultants	4.375	7000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	arear of the building and the annual rain rating						
3. Reviewing, developing and activating the legislations related to the national building codes.	New legislation	Consultations	1	2020 - 2025	Consultation, meetings, expert advisor on legislations and legal expert	30,000	30,000
Total Cost							**4,082,400**

A1.5.2 National contribution and funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Capacity building on how to calculate the reservoirs' volume based on the rainfall for municipalities staff	-	-	200	-	200	-	-		3,400
Awareness for the public community	-	-	5,000	-	5,000	-	-		15,000
Design and Construction of the reservoirs (rainwater harvesting tanks)	-	-	-	-		-	-		2,000,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Capacity building on how to calculate the reservoirs' volume based on the rainfall for municipalities staff	-	-	200	-	200	-	-		1,600
Awareness for the public community	-	-	5,000	-	5,000	-	-		15,000
Construction of the reservoirs	-	-	-	-		-	-		2,000,000
Study and design the reservoir according to the arear of the building and the annual rain rating									7,000
New legislation	-	-	15,000	-	15,000	-	-		15,000
Total Funding Requirement									**4,057,000**

A1.5.3 Potential Mitigation benefit assessment

Major activity 1: Construction of reservoirs in the middle and southern governorates

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[24]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions from transport to and from the construction site.

Operation emissions

Recent studies have indicated that when comparing RWH systems to using a mains supply, RWH systems can be up to three times more energy intensive, dependent on factors such as rainwater demand, building type, RWH design[25]. These scope 2 emissions from electricity would occur over the operational time of 10-40 years.

Emission savings

There is the potential for small-scale domestic greywater harvesting retrofits to have a GHG saving due to the displacement of current energy and resource intensive activities associated with supplying domestic water, in both urban and rural settings. Since mains water supply is intermittent and poor quality in Jordan, there is significant reliance on bottled and tankard supplied water, with associated industrial and transport emissions, which would be displaced due to this action. Regarding whether it may displace use of mains supply, this is uncertain. In rural settings, this could allow for additional irrigation capacity, not reducing mains supply use. Overall, and emission savings are anticipated.

Mitigation benefit assessment for whole action

1	Small reductions in GHG emissions

A1.5.4 Potential Adaptation benefit assessment

Major activity 1: Construction of reservoirs for rainwater harvesting

Qualitative adaptation assessment

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

While in operation, reservoirs have the potential to:

- Reduce water scarcity through an increase in the supply of water resources
- Enable water providers to respond to growing demand for water resources
- Enable stable long-term access to clean water for agricultural activities, sanitation and in households, even in situations of drought and/or reduced rainfall.

Major activity 2: Capacity building for municipalities staff and awareness raising for the public community

[24] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

[25] Vieira, A.S. Beal, C.D. Ghisi, E. Stewart, R.A. (2014) Energy intensity of rainwater harvesting systems: A review. Renewable and Sustainable Energy Reviews, Volume 34, June 2014, Pages 225-242, ISSN 1364-0321, http://dx.doi.org/10.1016/j.rser.2014.03.012.

Capacity building activities may sensitise the public to water scarcity challenges and encourage efficient water consumption (i.e. prevent waste). It may also increase the knowledge and skills available to build, maintain and use alternative solutions for water supply. Overall, this may ensure that public services and households can retain access to water resources in situations of droughts, as well as prevent unnecessary pressure on the traditional supply network.

Adaptation potential

Benefits are subject to stable levels of rainfall, which vary by region. Under RCP8.5, decreased precipitation levels are likely for most of the country by 2050. Increased precipitation is only projected in the northern highlands of Irbid and highlands of Tafeeleh and Karak up to 2050. After 2050, precipitation is projected to shift towards the Southern Badia, where increased precipitation is predicted to extend along the southeast frontier up to 2100.

Given the locations identified (middle governorates and southern governorates) and considering the activities' timeframe (2020 – 2025), the above-mentioned benefits may not be realised.

Moreover, to achieve adaptation benefits, an impact assessment should be conducted for each region where reservoirs are proposed to consider their potential impact on the physical infrastructure in the context of all possible future climate scenarios. It is also essential to establish financial mechanisms that can cover potential expenses incurred to adapt the network to climate risks and/or to ensure that assets and communities are insured in case of impacts.

Finally, capacity building and awareness-raising activities should incorporate maintenance of the reservoirs and distribution network to prevent degradation of the infrastructure and/or to ensure that no contaminated water is consumed.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and prevents damage that would otherwise increase its vulnerability

A1.5.5 Co-benefits assessment

Economic	Social	Environmental
Cost savings for households	Improved access to clean water	Reduced aquifer depletion
Reduced economic impacts of water variability	Increased water security	
Short term local job creation	Reduced water shortages	

A1.6 Action 7: Promoting tourism, green industry and monitoring climate change in Aqaba

Blue Economy Principles for Improved Touristic Competitiveness, Livelihoods of the Fisherman Community, Industrial Development and Monitoring Indicators of Pollution Control and Climate Change in the Jordanian Sector of the Gulf of Aqaba, Red Sea

Lead Organisation	ASEZA
Lead Organisation contact	Dr. Aiman Soleiman Asoleiman@aseza.jo

Project description

The project seeks to make improvements to the Gulf of Aqaba and Aqaba Special Economic Zone through an increase in 'green tourism'[26], improving the livelihoods of the fishing community, industrial improvements, green transportation and better monitoring of marine and climate indicators.

[26] Green tourism is tourism that adopts water use and energy efficiency and also minimal waste production and efficient waste management.

A1.6.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Aqaba Competitiveness as a Tourist Attraction and Livelihoods of the Local Communities	Alternative Livelihoods for Fishermen	No. of projects	50	2020 - 2025	Development of small and medium enterprises engaging traditional fishermen	60,000.00	3,000,000
	Providing training and facilities for processing of the fish catch to improve its value and marketability	No. of trainees	200	2020 - 2025	Trainers, coordinators, venue, catering, training materials, etc...	5,000.00	1,000,000
	Providing training, facilities and equipment to generate non extractive value from fishing	No. of trainees	200	2020 - 2025	Trainers, coordinators, venue, catering, training materials and equipment	5,500.00	1,100,000
2. Preparing environmental impact assessment, climate change indicators studies	Perform studies according to the MoEnv. Requirements	No. of studies	2	2020 - 2025	Consultants, Field Visits, Air Quality Measurements, Reporting and Printing	40,150	80,300
3. Enhanced Industrial Development	Improve Industrial Energy Efficiency and Use of Renewable Energy Sources	No. of facilities	5	2020 - 2025	Installation of new units of renewable energy generation and retrofitting of energy saving units.	550,000.00	2,750,000
	Foster Efficient Wastewater Treatment Using high efficiency proven Technology for Effective Exploitation of Space and Water Reuse	No. of plants	1	2020 - 2025	Introduction of well proven space, time, energy, recovery, quality and operational efficient technology for effective exploitation of space in	3,300,000.00	3,300,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
					wastewater treatment and treated water reuse		
	Introduce Innovative Desalination Technologies	No. of desalination units	1	2020 - 2025	Desalination unit, installation, engineers and transportation	4,400,000.00	4,400,000
4. Improved Monitoring for Climate Change Indicators and Pollution Control	Improving Data Management and Accessibility by Incorporating all Coastal Monitoring Activities in One Web Base Accessible National Monitoring Program	No. of consultants	2	2020 - 2025	Consultation, and web base designing fees	55,000.00	110,000
	Provide Sufficient Training on Measurement of Climate Change Indicators such as Alkalinity and High Resolution pH	No. of laboratories	3	2020 - 2025	Providing training and equipment at 3-laboratories on measuring climate change indicators	36,630	109,890
	Enhance Monitoring Concerning Pollution Indicators from Desalination and Wastewater Treatment	No. of laboratories	3	2020 - 2025	Providing training and equipment at 3-laboratories on measuring indicators concerning wastewater treatment and desalination	36,630	109,890
Total Cost							**15,960,080**

A1.6.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Alternative Livelihoods for Fishermen	-	-	300,000	-	300,000	-			2,700,000
Providing training and facilities for processing of the fish catch to improve its value and marketability	-	-	100,000	-	100,000	-			900,000
Providing training, facilities and equipment to generate non extractive value from fishing	-	-	100,000	-	100,000	-			1,000,000
Perform studies according to the MoEnv. Requirements	-	-	7,300	-	7,300	-			73,000
Improve Industrial Energy Efficiency and Use of Renewable Energy Sources	-	-	250,000	-	250,000	-			2,500,000
Foster Wastewater Treatment Using Innovative Technology for More Effective Exploitation of Space and Reuse	-	-	300,000	-	300,000	-			3,000,000
Introduce Innovative Desalination Technologies	-	-	400,000	-	400,000	-			4,000,000
Improving Data Management and Accessibility by Incorporating all Coastal Monitoring Activities in One Web	-	-	10,000	-	10,000	-			100,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Base Accessible National Monitoring Program									
Provide Sufficient Training on Measurement of Climate Change Indicators such as Alkalinity and High Resolution pH	-	-	10,000	-	10,000	-			99,890
Enhance Monitoring Concerning Pollution Indicators from Desalination and Wastewater Treatment	-	-	10,000	-	10,000	-			99,890
Total Funding Requirement									**14,472,780**

A1.6.3 Potential Mitigation benefit assessment

Major activity 1 – Providing alternative livelihoods to fisherman

Construction emissions

There is no construction and therefore no emissions expected with this activity.

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

There are no emissions savings, and therefore no mitigation benefit to be expected from this activity.

Major activity 2 – Enhancing industrial development through renewable energy and energy efficiency in industry

Construction emissions

Emissions generation will be dependent on the type and duration of construction, which is thought to last for up to 5 years. No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[27]. The scale of emissions release will be lower due to the nature of this activity as this is a retrofit rather than a new build project. Scope 3 emissions from transport to and from the site.

Operation emissions

The industrial installations that will be running off renewable energy will have no operational emissions. The industrial buildings installing energy efficiency emissions will still produce scope 1 and 2 emissions but on a smaller scale than without the measures in place.

Emission savings

Emissions savings from the enhancement of industrial development over an operational timescale of 10-40 years will be dependent on how quickly the renewable energy sources will be implemented, and whether it will negate all scope 1 emissions that would be produced as a result of industrial development. Likewise, emissions savings from energy efficiency measures will be dependent on the extent to which they are implemented within the building. There is potential for emissions savings through the use of renewable energy and energy efficiency schemes for the retrofit of existing buildings. Therefore, there will be a mitigation benefit compared to the current scenario.

Major activity 3 - Wastewater treatment

Construction emissions

If a new WWTP is be constructed, there will be emissions impacts associated with this activity. Emissions generation will be dependent on the type and duration of construction, which is thought to last for up to 5 years. No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding,

[27] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

wielding etc) installation activities, building completion and finishing[28]. Scope 3 emissions from transport to and from the site. Alternatively, if the existing WWTP is retrofitted, similar emissions would be released from construction but on a smaller scale and shorter timeline.

Operation emissions.

Scope 2 emissions will occur from energy generation over the life cycle of wastewater networks, which is typically 100+ years[29].

Emission savings

If a new WWTP is built, there will be emissions savings through the potential displacement of an older inefficient WWTP which can be decommissioned; however, if the proposed WWTP it is simply additional not displacing any existing WWTP, there are no direct emission savings, although the project would promote the use of more efficient technologies in Jordan. This stimulus to the technology market may facilitate the creation of more in the future, so there are indirect savings in the future. Alternatively, if the existing WWTP is retrofitted, increased activity emissions could be offset by possible energy efficiency improvements.

Major activity 4 - Desalination practices

Construction emissions

Based on the assumption that a new desalination plant will be constructed, there will be emissions impacts associated with this activity. Emissions generation will be dependent on the type and duration of construction, which is thought to last for up to 5 years. No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[30]. Scope 3 emissions from transport to and from the construction site.

Operation emissions

Scope 2 emissions will occur from energy generation over the life cycle of the plant, up to 40 years.

Emissions saving

There will be emissions savings through the potential displacement of an older inefficient desalination plant which can be decommissioned; however, if the proposed desalination plant is additional and not displacing any existing desalination plants, there are no direct emission savings, although the project would promote the use of more energy efficient and innovative technologies[31] in Jordan. This stimulus to the technology market may facilitate the creation of more in the future, so there are indirect savings in the future.

Major activity 5 – Improvements in monitoring for climate change indicators and pollution control

Construction emissions

There is no construction and therefore no emissions expected with this activity.

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[28] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

[29] https://www.sciencedirect.com/science/article/abs/pii/S1462075899000023#:~:text=Typically%2C%20water%20mains%20in%20fully,from%20100%20to%20200%20yr.

[30] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

31 The technology which aims to be implemented uses half of the extracted cooling water for desalination, saving in energy and in reducing the brine's impact by dilution, as the desalination brine is mixed with the other half of the cooling water before it goes back to the sea. This can repeated for other industries using cooling water. The The technology is innovative because it is energy efficient and uses minimal added chemicals in terms of antifouling, antiscalants and anticorrosion.

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

There are no emissions savings, and therefore no mitigation benefit to be expected from this activity.

Mitigation benefit assessment for whole action

1	Small reductions in GHG emissions

A1.6.4 Potential Adaptation benefit assessment

Major activity 1 – Providing alternative livelihoods to fishermen

The activity provides fishermen with alternative sources of income, so that a potential depletion of fishing resources due to climate change may be less damaging to their livelihoods.

The activity also encourages the development of non-extractive fishing activities, hence, reducing the intensity of extractive practices and potentially removing additional pressures on sensitive coastal and marine habitats and species.

Major activity 2 – Enhancing industrial development through renewable energy and energy efficiency in industry

Using renewable energy use can help to reduce dependency on fuel. This contributes to reducing the impact that potential disruption on oil supply may have on Jordan's economy as a result of climate change hazards. In addition, enabling energy efficiency in the industry can also reduce demand pressure on energy supply, reducing demand for energy to be imported from traditional sources and, hence, encouraging the use of renewable energy as main source.

Major activity 3 - Wastewater treatment

Wastewater treatment may contribute to:

- Reducing water scarcity through an increase in the supply of water resources
- Enabling water providers to respond to growing demand for water resources
- Enabling stable long-term access to clean water for agricultural activities, sanitation and in households, even in situations of drought and/or reduced rainfall.

Overall, these activities may allow for improvements in sanitation services and increases in water provision. This would improve health but also support tourism expansion and provide alternative sources of income, reducing pressure on ecosystems. The benefits are expected to be higher if a new wastewater treatment plant is built, compared to an alternative scenario where it is retrofitted to an existing plant.

If the wastewater plant is energy efficient, this would reduce demand pressure on energy supply reducing the demand for energy to be imported from traditional sources and, hence, enable the use of renewable energy as the main source.

Major activity 4 - Desalination practices

A desalination unit may contribute to:

- Reducing water scarcity through an increase in the supply of water resources
- Enabling water providers to respond to growing demand for water resources
- Enabling stable long-term access to clean water for agricultural activities, sanitation and in households, even in situations of drought and/or reduced rainfall.

Overall, these activities may allow for improvements in sanitation services and increases in water provision. This would improve health but also support tourism expansion and provide alternative

sources of income, reducing pressure on ecosystems. The benefits are expected to be higher if a new desalination unit is built, compared to an alternative scenario where it is retrofitted to an existing desalination unit.

If the desalination unit is energy efficient, this would reduce demand pressure on energy supply reducing the demand for energy to be imported from traditional sources and, hence, enabling the use of renewable energy as the main source.

Major activity 5 – Improvements in monitoring for climate change indicators and pollution control

Providing a system to monitor, prevent and react to potential ecosystem degradation may ensure that the marine and coastal ecosystems remain productive and provide key ecosystem services (e.g. fish for consumption, coral reefs providing a buffer from storm and waves, etc)

Adaptation potential

There is a high risk that developing tourism in Aqaba and enhancing its industrial development will lead to a greater concentration of activity and associated pollution. This could further increase the climate of sensitivity marine and coastal ecosystems . Degradation and/or higher sensitivity of these systems may have damaging effects on economic activity in Aqaba and the livelihoods of inhabitants, as fishing and tourism would see their resources and/or their value decrease, and natural buffers would no longer function to protect coastal infrastructure from physical damages.

To achieve adaptation benefits, it is key to develop a specific vulnerability and risk assessment and incorporate its results to the city's development plan. The development of the city's economic activity should be constantly accompanied by environmental impact assessments, themselves incorporating the results of the vulnerability and risk assessments and considering all future likely scenarios. Indicators for monitoring climate change need to be defined in a way that monitors the climate sensitivity of key assets and ecosystems to ensure that they are not compromised by short- and medium-term industrial development and that their long-term resilience is sustained.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A1.6.5 Co-benefits assessment

Activities	Economic	Social	Environmental
Providing alternative livelihoods to fisherman	Increased revenue to fisherman	Increased food security	Reduce pressure on natural fisheries
	Economic benefits of eco/low-impact tourism sector		
Industrial development through renewable energy	Increased energy security	Health impacts from improved air quality	Improved air quality
	Long term local employment		
Industrial development through energy efficiency	Increased energy security	Health impacts from improved air quality	Improved air quality
	Cost savings		

Industrial development through Water treatment / desalination	Cost savings with wastewater treatment	Increased water security	Reduced pollution
	Long term local employment	Health impacts from less contamination of water and fewer disease outbreaks	
CC monitoring	Long term local employment	Health impacts from improved air quality and reduced pollution	Reduced pollution
			Improved air quality

A2 Appendices - Agriculture Sector Actions contributing to the Jordanian NDC

A2.1 Action 8: Rehabilitation and Cultivation of Forestry Land

Green works in agriculture and forestry – the protection and sustainability of forest wealth

Lead Organisation	MOA-Ministry of Labour-MOPIC-CBOs
Lead Organisation contact	Dr. Mahmood Rabeia mahmoud.rabei@moa.gov.jo mahmoodrabei@gmail.com

Project description

The main aim of this project is to restore and increase Jordan's forest area. It will involve cultivating new forest land as well as rehabilitating and maintaining existing forest land. Facilities within forest gardens will also be rehabilitated. Further, it will also involve training for government to apply evidence-informed decision making, based on assessment of the decision-making process, private sector and civil society inclusion, data availability and usage. This project is to be carried out over three years.

A2.1.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Cultivation of about 10,000 dunums of forest lands.	Cultivation	Dunum	10,000	2020 - 2025	Cultivation	385	3,850,000
2. Maintenance and rehabilitation of about 20 % of the existing forests.	Maintenance activities	Dunum	10,000	2020 - 2025	Rehabilitation	200	2,000,000
3. Rehabilitation of 11 forest nurseries to produce 5 million seedlings.	Rehabilitation	Dunum	11	2020 - 2025	Rehabilitation	500,000	5,500,000
4. Rehabilitation of forest gardens and their facilities (cottages, restaurants, playgrounds, etc...) and national parks.	Rehabilitation	Dunum	10	2020 - 2025	Rehabilitation	500,000	5,000,000
5. Training of the Ministry of Agriculture staff.	Training courses	No. of staff	250	2020 - 2025	Training material, trainers, catering, venue, etc…	500	125,000
6. Training of local communities neighbouring forests (5,000 people) on handicrafts	Training courses	No. of trainees	5,000	2020 - 2025	Training material, trainers, catering, venue, etc…	250	1,250,000
Total Cost							**17,725,000**

A2.1.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Cultivation	-	-	350,000	-	350,000	-	-		3,500,000
Maintenance activities	-	-	200,000	-	200,000	-	-		1,800,000
Rehabilitation	-	-	550,000	-	550,000	-	-		4,950,000
Rehabilitation	-	-	500,000	-	500,000	-	-		4,500,000
Training courses	-	-	12,500	-	12,500	-	-		112,500
Training courses	-	-	125,000	-	125,000	-	-		1,125,000
Total Funding Requirement									**15,987,500**

A2.1.3 Potential Mitigation benefit assessment

Major activity 1 – Cultivation, maintenance and rehabilitation of forests

Construction emissions

Minor CO_2 emissions released from the cultivation of soil. Scope 2 emissions will also be emitted as a result of transport by arborists to and from the sites over 3 years.

Operation emissions

None, as the new plants will act as a sink to CO_2 emissions.

Emission savings

Yes, as it will act to increase the carbon pool over a long timeframe.

Mitigation benefit assessment for whole action:

1	Small reductions in GHG emissions

A2.1.4 Potential Adaptation benefit assessment

Major activity 1 – Cultivation, maintenance, and rehabilitation of forests

Forests provide key ecosystem services regarding water supply and quality through natural collection, storage, filtration and delivery (including recharging groundwater bodies). They maintain soil quality and improve soil stability, reducing. Forests also provide natural habitats, necessary sustain biodiversity.

Hence, this activity may contribute to improving soil quality and soil stability (necessary for agricultural production and infrastructure), water supply and water quality (necessary for agricultural production, sanitation, or household consumption) and provide additional space for species to develop and/or to migrate.

Major activity 2 – Trainings

Depending on the content of the trainings provided, this activity may improve management and governance of water resources and agricultural practices in ways that prevent the use of potentially damaging practices. It may also contribute to increasing public awareness of forests' benefits and the importance of conservation, again potentially preventing damaging practices and encouraging restoration.

Adaptation potential

The above adaptation benefits may only be realised if forests are appropriate to the location. This is a function of the tree crops used, their complementarity, etc. Preliminary studies should be undertaken to ensure the best tree species and location are picked to deliver these benefits.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A2.1.5 Co-benefits assessment

Economic	Social	Environmental
Long term local job creation	Health impacts from improved air quality	Maintained and increased biodiversity and ecosystem services
		Increased cultural habitats and recreational areas
		Improved air quality

A2.2 Action 9: Rainwater Harvesting amongst Small Farmers

Reduce soil erosion through the management and harvesting of rainwater by small farmers in rural areas of Jordan

Lead Organisation	MOA, Small Farmers
Lead Organisation contact	Eng. Khalid Alheesa khalidalheesa@yahoo.com

Project description

The Ministry of Agriculture has proposed this action. Its main aim is to increase the productivity of farmers' lands by decreasing soil erosion, increasing rainwater management and water-use efficiency. Infrastructure will be built to prevent soil erosion, and water harvesting techniques implemented to increase the amount of water available to farmers. Drip irrigation techniques will be incorporated for water-use efficiency. Farmers will also be provided with training on each of stages of implementation. The project will be implemented over a period of 5 years in the five governorates with the highest annual rainfall (ca. 300mm).

A2.2.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Component No. 1 (stone barriers construction on the farmers' fields)	Preparation of a mechanism to include farmers in the project in terms of regulations, submission application, announcement and farmers registration.	No. of farmers	10,000	2020-2025	Preparing application, check farmers' applications, and announcement	1.7	17,000
	Training of the MoA staff on how to apply the project mechanism	No. of staff	200	2020 - 2025	Trainers, coordinators, venue, catering, training materials, etc	71	14,200
	Field visit to the farmers' lands	No. of farmers	10,000	2020 - 2025	Transportation and fuels	1.7	17,000
	Construction of stone barriers	Dunum	50,000	2020 - 2025	Construction materials, labours, engineers, etc	80	4,000,000
2. Component No. 2 (Cisterns construction on the farmers' fields)	Preparation of a mechanism to include farmers in the project in terms of regulations, submission application, announcement and farmers registration.	No. of farmers	10,000	2020 - 2025	Preparing application, check farmers' applications, and announcement	1.7	17,000
	Training of the MoA staff on how to apply the project mechanism	No. of staff	200	2020 - 2025	Trainers, coordinators, venue, catering, training materials, etc	71	14,200
	Field visit to the farmers' lands	No. of farmers	10,000	2020 - 2025	Transportation and fuels	1.7	17,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
	Construction of cisterns	No. of farmers	10,000	2020 - 2025	Construction materials, labours, engineers, etc	2,253	22,530,000
3. Component No. 3 (drip irrigation and fencing)	Drip irrigation and Fencing about 10,000 farms (50,000 dunum)	No. of farmers	10,000	2020-2025	purchasing of drip irrigation systems, engineers, field visits, transportation, etc	352	3,520,000
4. Component No. 4(Capacity Building for farmers)	Training farmers on stone barrier construction methods	No. of farmers	1,000	2020 - 2025	Trainers, coordinators, venue, catering, transportation, training materials, etc	28	28,000
	Construction techniques for cistern as well as channels and collection pits leading to cistern	No. of farmers	1,000	2020 - 2025	Trainers, coordinators, venue, catering, transportation, training materials, etc	28	28,000
	Land usage planning with contour plans, location of cistern to allow for gravitational irrigation, location and densification of tree planting, location of stone barriers, the usage of Cactus trees as a fence around the farm	No. of farmers	1,000	2020 - 2025	Trainers, coordinators, venue, catering, transportation, training materials, etc	28	28,000
	Training on irrigation milestones and quantity per watering milestone depending on plant type and land types	No. of farmers	1,000	2020 - 2025	Trainers, coordinators, venue, catering, transportation, training materials, etc	28	28,000
Total Cost							**30,258,400**

A2.2.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Preparation of a mechanism to include farmers in the project in terms of regulations, submission application, announcement and farmers registration.	-	-	17,000	-	17,000	-	-		0
Training of the MoA staff on how to apply the project mechanism	-	-	14,20	-	1,420	-	-		12,780
Field visit to the farmers' lands	-	-	17,000	-	17,000	-	-		0
Construction of stone barriers	-	450,704	17,000	-	467,704	-	-		3,532,296
Preparation of a mechanism to include farmers in the project in terms of regulations, submission application, announcement and farmers registration.	-	-	17,000	-	17,000	-	-		0

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Training of the MoA staff on how to apply the project mechanism	-	-	1,420	-	1,420	-	-		12,780
Field visit to the farmers' lands	-	-	17,000	-	17,000	-	-		0
Construction of cisterns	-	450,704	17,605	-	468,309	300,000	-	300,000	21,761,691
Drip irrigation and Fencing about 10,000 farms (50,000 dunum)	-	450,704	70,422	-	521,126	-	-		2,998,874
Training farmers on stone barrier construction methods	-	14,084	13,916	-	28,000	-	-		0
Construction techniques for cistern as well as channels and collection pits leading to cistern	-	14,084	13,916	-	28,000	-	-		0
Land usage planning with contour plans, location of cistern to allow for gravitational irrigation, location and densification of tree planting, location of stone barriers, the usage of Cactus trees	-	14,084	13,916	-	28,000	-	-		0

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
as a fence around the farm									
Training on irrigation milestones and quantity per watering milestone depending on plant type and land types	-	14,084	13,916	-	28,000	-	-		0
Total Funding Requirement									**28,318,421**

A2.2.3 Potential Mitigation benefit assessment

Major Activity 1 - Stone barriers, cistern and drip irrigation and fencing construction on the farmers' fields

Construction emissions

Potential for minor scope 1 CO_2 emissions released from cultivating soil during construction. Scope 2 emissions from plumbing and other construction over 1-5 years (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, cistern completion and finishing. Scope 3 emissions from transport to and from the fields.

Operation emissions

Irrigation can, in some cases, change soil moisture and release scope 1 CO_2 and N_2O. Scope 2 emissions as a result of electricity consumption from the pumping of water from the cistern over the operational period of 10-40 years.

Emission savings

Yes, as this action will increase rainwater management and water use efficiency, therefore reducing the amount of electricity used to pump water to farmers' fields.

Major Activity 2 – Capacity building for farmers

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

Potential for minor scope 2 emissions reductions through more informed farmers making better choices on energy usage.

Mitigation benefit assessment for whole action:

1	Small reductions in GHG emissions

A2.2.4 Potential Adaptation benefit assessment

Major Activity 1 - Stone barriers, cistern and drip irrigation and fencing construction on the farmers' fields

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

Construction of stone barriers slows water runoff, so that it can be absorbed by the soil and spread evenly over the land. Cisterns enable collection and retention of water for future use in case it becomes scarce, and drip irrigation ensures efficient water use by limiting the risk of evaporation.

Hence, once in operation, these constructions may help ensure sufficient water availability for agricultural production to counter the impacts of droughts on the sector and ensure stable production.

However, fencing may lead to negative effects on soil quality. If the cattle movements are too restricted, it may lead to eutrophication of soils and groundwater.

Major Activity 2 – Capacity building for farmers

Depending on the training provided, the activity may lead to improvements in water management, water and soil conservation, and agricultural practices. This would help ensure that water is efficiently used, so that resources remain available in dry periods. This training would also ensure that current use of the soil does not compromise future yields through harmful cultivation practices.

Trainings may also serve to increase farmers' awareness of ecosystems' value for agricultural production, hence, reducing the likelihood that these are damaged in the future and maintaining the key ecosystem benefits necessary for agricultural production.

Adaptation potential

The benefits identified above can be realised if preliminary studies are conducted to ensure that the location and material is chosen specifically to withstand the impact of any potential climate hazards.

However, benefits remain subject to stable levels of rainfall, which vary by region. Under RCP8.5, a decrease in precipitation is likely for most of the country by 2050. Increased precipitation is only projected in the northern highlands of Irbid and highlands of Tafeeleh and Karak up to 2050. After 2050, precipitation is projected to shift towards the Southern Badia, where increased precipitation is projected to extend along the southeast frontier up to 2100.

Adaptation benefit assessment for whole action

Stakeholders have not confirmed that the measures described under the "Adaptation Potential" section can be implemented, two ratings are provided, one based on the measures being undertaken, the other if they are not considered.

0	The action has no effect on any key factors that influence a sector's vulnerability – if condition on adaptation potential is not met.
1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability – if preliminary studies are conducted.

A2.2.5 Co-benefits assessment

Economic	Social	Environmental
Long term local job creation	Increased security of water supply	Reduced aquifer depletion
Increased revenue generation and cost savings for farmers		
Possible reduction in food price volatility	Increased food security	
Increased land productivity		

A2.3 Action 10: Utilisation of Treated Water in Vegetation

Exploitation of treated water in increasing the vegetated area – land reclamation, agricultural development and water harvesting in Irbid Governorate

Lead Organisation	MOA
Lead Organisation contact	Eng. Areej Arabiyat (Head of Documentation and Technical Support Section) aarabiyat@yahoo.com 0770493210

Project description

The aim of this project is to make use of treated water to produce industrial wood in the areas surrounding the wastewater treatment plant in Irbid. This will involve rehabilitation of the land, maintenance of irrigation networks, as well as raising awareness and providing training to surrounding communities in order to be able to use the wood to make handicrafts etc.

A2.3.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Rehabilitation of 25,000 dunums of treasury lands surrounding the wastewater treatment plants.	Reclamation and rehabilitation	Dunum	25,000	2020-2025	Cleaning, improving soil condition and adding new plants.	130	3,250,000
2. Maintenance of irrigation networks and restricted-cultivation systems to produce industrial wood.	Maintenance activities	Dunum	25,000	2020 - 2025	Engineers, field visits, spare parts, transportation, etc…	275	6,875,000
3. Raising awareness of the neighbouring communities.	Courses in treated wastewater specifications courses in treated wastewater usages and benefits	No. of trainees	500	2020 - 2025	Training material, trainers, catering, venue, etc…	200	100,000
4. Carrying out economic activities for associations and individuals to train them on handicrafts from produced wood.	Cost benefit analysis course, handcraft practical courses and work shops	No. of trainees	500	2020-2025	Training material, trainers, catering, venue, etc…	220	110,000
Total Cost							**10,335,000**

A2.3.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Reclamation and rehabilitation	-	-	125,000	-	125,000	-	-		3,125,000
Maintenance activities	-	-	625,000	-	625,000	-	-		6,250,000
Courses in treated wastewater specifications courses in treated wastewater usages and benefits	-	-	7,500	-	7,500	-	-		92,500
Cost benefit analysis course, handcraft practical courses and work shops	-	-	10,000	-	10,000	-	-		100,000
Total Funding Requirement									**9,567,500**

A2.3.3 Potential Mitigation benefit assessment

Major Activity 1 – Rehabilitation of treasury lands and restricted-cultivation systems to produce industrial wood

Construction emissions

Potential for minor scope 1 CO_2 emissions released from cultivating soil during land rehabilitation. Scope 3 emissions from transport to and from the field site.

Operation emissions

The rehabilitation of 25,000 dunums of treasury lands will act to reduce emissions by increasing the carbon pool. However, the cultivation of these plants for industrial wood production will act to increase emissions by reducing the carbon pool.

Emission savings

The planting of trees to produce industrial wood will have no emission savings effect, as they will not be in place for long enough to have a significant impact on emissions and will release CO_2 back into the atmosphere on cultivation.

Major activity 2 – Maintenance of irrigation networks

Operation emissions

Irrigation can, in some cases, change soil moisture and release minor scope 1 CO_2 and N_2O emissions. There will also be scope 3 emissions from engineers travelling to and from the site to maintain the irrigation networks.

Emission savings

Irrigation networks using treated water will consume less energy than what would be needed to irrigate with clean water, so there is potential for energy savings here.

Major activity 3 – Awareness raising and capacity building

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

Potential for minor scope 2 emission savings through farmers making more informed choices on energy use.

Mitigation benefit assessment for whole action:

0	No overall changes to GHG emissions

A2.3.4 Potential Adaptation benefit assessment

Major Activity 1 – Rehabilitation of treasury lands

Rehabilitation of the vegetation through use of treated wastewater may provide positive benefits to soil quality, without putting increased pressure on use of groundwater resources. Growth of plants for industrial wood consumption can stabilise soils and thereby maintain agriculture and biodiversity. Restoring the land to produce industrial wood may help to reduce existing pressure on native forests

that are currently subject to deforestation, hence, protecting biodiversity habitats and retaining key forest ecosystem services.

Major activity 2 – Maintenance of the network

Maintenance activity could prevent contamination of the water and soil, and thereby avoid damage to health, ecosystems, biodiversity, water bodies and agriculture. The irrigation network from the wastewater treatment plant may sustain supply of clean water to agricultural land, including in times of droughts, hence, ensuring stable production.

Major activity 3 – Awareness raising and capacity building

Courses on "treated wastewater specifications" and on "wastewater usage and benefit" may improve water management and conservation by the community and prevent water waste. Depending on the content of the training, it may also prevent damage to health by improving public understanding of wastewater use and risks of contamination.

Adaptation potential

As described for Major activities 1, 2 and 3.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A2.3.5 Co-benefits assessment

Activities	Economic	Social	Environmental
Land rehabilitation	Long term local job creation	Health impacts from improved air quality	Maintained and increased biodiversity and ecosystem services
			Improved air quality
Wastewater usage	Cost savings with wastewater treatment	Increased water security	Reduced aquifer depletion
	Reduced economic impacts of water variability	Reduced droughts and water shortages	
Economic project	Increased revenue generation for low income groups		
	Long term local job creation		

A2.4 Action 11: Climate Change Adaptation of Farmers and Rural Families

Help small farmers and rural families adapt to climate change – supporting poor families in Ma'an Governorate, improving the income of poor families in the northern Jordan Valley, Irbid Governorate – investment in small ruminants to support poor rural families

Lead Organisation	MOA/ Small farmers cooperative societies
Lead Organisation contact	Eng. Lama Shmaylh Lama.shmaylh@live.com 0772103588

Project description

This project involves helping small farmers and rural families in Ma'an, Irbid, Jordan Valley to adapt to climate change by providing technical assistance and capacity building.

A2.4.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Distribution of income-generating projects to alleviate poverty and increasing the income of poor rural families	Distribution of income-generation project such as three heads of sheep, one head of cows, or protected cultivation houses with seedlings of medicinal and aromatic plants, or the establishment of a grey water unit with the cultivation of land with clover	No. of projects	4,500	2020 - 2025	Bidding for sheep and greenhouses purchasing	2,000	9,000,000
2. Capacity building of rural women to increase economic income	Agricultural and non-agricultural capacity building courses targeting rural women	No. of training courses	150	2020 - 2025	Catering, trainers for, training materials, hall fare	1,500	225,000
	Capacity building courses	No. of capacity buildings courses	150	2020 - 2025	Catering, trainers for, training materials, hall fare	1,500	225,000
	Project	No. of Projects	300	2020 - 2025	Sheep and cattle purchase bids	2,000	600,000
3. Marketing for rural women products in the exhibitions and the markets.	Establish rural markets in all governorate during product seasons	No. of rural markets	54	2020 - 2025	Logistics services, equipment for rural markets, and shopping sites rents	15,000	810,000
	Exhibitions	No. of exhibitions	9	2020 - 2025	Exhibitions sites rents, cameras, shopping bags, brochures, etc...	30,000	270,000
Total Cost							**11,130,000**

A2.4.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Distribution of income-generation project such as three heads of sheep, one head of cows, or protected cultivation houses with seedlings of medicinal and aromatic plants, or the establishment of a grey water unit with the cultivation of land with clover	-	-	2,000,000	-	2,000,000	-	-		7,000,000
Agricultural and non-agricultural capacity building courses targeting rural women	-	-	50,000	-	50,000	-	-		175,000
Capacity building courses	-	-	50,000	-	50,000	-	-		175,000
Project	-	-	50,000	-	50,000	-	-		550,000
Establish rural markets in all governorate during product seasons	-	-	60,000	-	60,000	-	-		750,000
Exhibitions	-	-	40,000	-	40,000	-	-		230,000
Total Funding Requirement									**8,880,000**

A2.4.3 Potential Mitigation benefit assessment

There are little to no emissions or emission savings expected from the activities within this action.

Mitigation benefit assessment for whole action:

0	No overall changes to GHG emissions

A2.4.4 Potential Adaptation benefit assessment

Major activity 1: Distribution of income-generating projects and marketing of rural women products

Income generation through these activities may improve farmers' abilities to overcome climate change or extreme weather events (e.g. by increasing their ability to access health services, and food in times when land is unproductive, etc).

It may also improve farmers' abilities to adapt to long-term changes in climate by improving their access to technologies, products and crops that allow them to adapt their farming practices to new climate conditions and maintain their productivity etc.

Major activity 2: Capacity building for rural women (agriculture and non-agriculture training)

Capacity building activities regarding agricultural practices may improve efficiency in water use for agricultural production, hence, reducing pressure on water resources and potentially increasing water availability to households. Training on agricultural practices may also improve soil management and crop growing practices, thereby safeguarding ecosystems from long-term damage.

Capacity building activities regarding non-agricultural practices may help support additional income generation and, hence, yield the same benefits as described under Major activity 1.

Adaptation potential

Adaptation potential will vary depending on the relevance and the components of the income-generating projects and on the content of the trainings. Income-generating projects should be developed and allocated based on an assessment of their ecosystem services, potential vulnerabilities, and the enabling environment, to ensure that cattle, crops and water can be used efficiently and that they do not damage ecosystems (e.g. maintaining sufficient soil nutrients and space for cattle to avoid soil contamination, have low risk of damage and contamination to the grey water unit, etc).

To improve long-term climate resilience, trainings should also include awareness-raising activities on the benefits of protecting and restoring ecosystems. The content of the training should also focus on how farmers and women may adjust their practices and/or change their activities to (1) overcome potential climate impacts and (2) limit their own ecosystem impacts to avoid increasing future risks of climate impacts.

Adaptation benefit assessment for the whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially increase its vulnerability

A2.4.5 Co-benefits assessment

Activities	Economic	Social	Environmental
Investment in ruminants	Revenue generation for low income groups	Increased food security	
Medicinal plants	Revenue generation for low income groups		
Land cultivation	Long term local job creation	Health impacts from improved air quality	Maintained and increased biodiversity
			Improved air quality
Marketing rural womens' products	Long term local job creation		
	Revenue generation for low income groups		

A2.5 Action 12: Rangeland Development

Develop rangelands for climate change mitigation through social cooperation and water harvesting techniques – water harvesting and improving the income of poor families in Maan and Shobak

Lead Organisation	MOA
Lead Organisation contact	Eng. Mohammad Al Adwan m.adwan@yahoo.com Eng. Rana Abu Saada ranaabusaada.moa@gmail.com

Project description

This action which involves the rehabilitation of two existing rangeland sites. Key activities include technical studies to determine location and site characteristics, followed by land preparation and establishment of irrigation systems. This will increase farmers' incomes, while reducing their operational costs through rainwater management and harvesting, as well as increase the area of rural green space. This action will be carried out over a three-year period in Maan and Shobak.

A2.5.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Technical studies for 2 new reserve sites	Pre-identification site (setting special criteria for site selection)	No. of sites	2	2020 - 2025	Sites documents, remote sensing image and analysis, soil map, cadastral map, field visit & land use /cover map	1,000	2,000
	Conducting baseline socioeconomic need assessment studies and evaluation.	No. of sites	2	2020 - 2025	Meeting with local community, design questionnaire and pre-test, data collection, data entry and analysis & reporting.	2,500	5,000
	Establishing or encourage of agricultural and range cooperatives.	No. of sites	2	2020 - 2025	Meeting with community & establishment cooperation (objectives, roll).	1,000	2,000
	Hydrological study.	No. of studies	2	2020 - 2025	Data and literature review collection, as (precipitation, runoff coefficient, other study at the area)	2,500	5,000
	Biophysical characterization.	No. of studies	2	2020 - 2025	Soil properties, soil sample and soil analysis (physical and chemical analysis), land use/ cover study & profile description and soil analysis	2,500	5,000
	Topographic study (300 ha).	Hectare	300	2020 - 2025	Station staff & GIS and mapping staff	10,000	3,000,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
		No. of staff	4	2020 - 2025	Staff fees and transportation	2,000	8,000
		No. of Station Labour	8	2020 - 2025	Staff fees and transportation	500	4,000
		No. of GIS & mapping staff	2	2020 - 2025	Staff fees and transportation	325	650
2. Rehabilitation and supervision of 2 existing reserve (including water spreading and contour bunds).	Hydrology & vegetation cover studies	No. of reserves	2	2020 - 2025	Maintenance of existing water harvesting structure	16000	32,000
	Land preparation to be implementation.	Contour line on ground, vallerani machine (fuel), labour & transportation. (No. of reserves)	2	2020 - 2025	Contour line on ground, vallerani machine (fuel), labour & transportation	60,000	120,000
	Replanting	Hectare	600	2020 - 2025	Crop selection & seedlings, planting the crops, labours, follow up & monitoring and evaluation	50,000	30,000,000
3. Management and maintenance of reserves	Community youth rangers for 3 years for 2 reserves	No. of rangers	8	2020 - 2025	Rangers fees	4,404	105,969

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	For rehabilitation existing water harvesting techniques.	No. of WH structures	2	2020 - 2025	Rehabilitation, staff, labours, transportation, etc…	15,000	30,000
4. Training	20 training courses for local community	No. of training courses	20	2020 - 2025	Training materials, venue, catering, trainer(s), etc…	500	10,000
Total Cost							**33,329,619**

A2.5.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Pre-identification site. (Setting special criteria for site selection)	-	-	200	-	200	-	-		1,800
Conducting baseline socioeconomic need assessment studies and evaluation.	-	-	500	-	500	-	-		4,500
Establishing or encourage of agricultural & range cooperatives.	-	-	200	-	200	-	-		1,800
Hydrological Study.	-	-	500	-	500	-	-		4,500

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Biophysical characterization.	-	-	-	-	0	-	-		5,000
Topographic study (300 ha).	-	-	2,000	-	2,000	-	-		2,998,000
	-	-	-	-	0	-	-		8,000
	-	-	-	-	0	-	-		4,000
	-	-	-	-	0	-	-		650
Hydrology & vegetation cover studies	-	-	-	-	0	-	-		32,000
Land preparation to be implementation.	-	-	-	-	0	-	-		120,000
Replanting	-	587,000	-	-	587,000	-	-		29,413,000
Community youth rangers for 3 years for 2 reserves	-	-	-	-	0	-	-		105,969
For rehabilitation existing water harvesting techniques.	-	-	-	-	0	-	-		30,000
20 training courses for local community	-	-	-	-	0	-	-		10,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Total Funding Requirement									**32,739,219**

A2.5.3 Potential Mitigation benefit assessment

Major Activity 1 – Rehabilitation and maintenance of reserves

Construction emissions

Minor scope 3 emissions from transport to and from the reserves during rehabilitation over 3 years.

Operation emissions

Minor scope 2 emissions from visits to the fields to manage and maintain the reserves over 10-40 years. Large potential for emissions reduction as a result of the rehabilitation of reserves acting as a sink to carbon and increasing the carbon pool.

Emission savings

There is a large mitigation potential from the rehabilitation and maintenance of rangeland by increasing carbon sequestration.

Major activity 2 – Training and management and maintenance of reserves

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant. In terms of the maintenance of reserves, and assuming this takes place over a longer timescale of 1-5 years, there will be further scope 3 emissions from transport to and from the reserves for maintenance.

Emission savings

Potential for minor scope 2 emission savings through farmers making more informed choices on energy use.

Mitigation benefit assessment for whole action:

2	Large reductions in GHG emissions

Quantitative mitigation benefit assessment

Insufficient data to provide an estimate on potential emissions savings.

A2.5.4 Potential Adaptation benefit assessment

Major activity 1 – Rehabilitation and maintenance of reserves

Ecosystem services provided by rangeland include groundwater recharge, water purification, and freshwater provision, which can be used for household consumption and irrigation. Thus, rangelands may reduce demand pressure on water services and increase availability of water for agriculture and household consumption, notably through the irrigation system.

Rangelands also support erosion control and soil nutrient cycle, which overall improves the quality of the soil and its water retention ability. This may support sustainable agricultural production by alleviating climate impacts (such as droughts) on the soils and maintaining sustainable crop growth.

Major activity 2 – Training and management and maintenance of reserves

Rangelands are fragile ecosystems that require careful management to ensure the benefits are sustained. Training rangers in the sustainable management and maintenance of the reserves will ensure that the benefits described in Major activity 1 can be sustained.

Adaptation potential

Adaptation benefits may vary depending on the species planted and the use of the rangeland. This should be carefully assessed during the preliminary technical studies.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A2.5.5 Co-benefits assessment

Activities	Economic	Social	Environmental
Rangeland development		Health impacts from improved air quality	Maintained and increased biodiversity and cultural habitats
			Improved air quality
Rainwater harvesting/management	Long term local job creation	Increased security of water supply	Reduced aquifer depletion
	Reduced operational cost		
Increase green space	Short term local job creation		Maintained and increased biodiversity and ecosystem services
			Increased cultural habitats and recreational areas

A2.6 Action 13: Climate-Smart Agriculture

Disseminate climate change adaptation techniques through smart agriculture production

Lead Organisation	MOA/NARC
Lead Organisation contact	Eng. Mustafa Al Otoom myfather1927@gmail.com 0799485557

Project description

This project involves increasing climate adaptation in agriculture by making use of climate-smart agricultural (CSA) production and techniques, including fertilisation and irrigation systems, hydroponics, as well as ensuring farmers are well trained to gain the necessary knowledge and skills related to the CSA production methods.

A2.6.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Environmental Impact Assessment	Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements	Consultations	1	2020 - 2025	Consultants, Field Visits, Air Quality Measurements, Reporting and Printing	47,300	47,300
2. Irrigation networks installation and installing a solar power source to the system	Preparing the land for cultivation	hectare	30	2020 - 2025	Cadastral survey, test lab, land levelling and ploughing	3,000	90,000
	Installing of the network irrigation	hectare	30	2020 - 2025	Irrigation networks made of polyethylene, Smart devices (irrigation hydrant valve, timer), salonid valve, automatic filter, tank	8,900	267,000
	Installing a solar power source to the system	Number of solar energy units	12	2020 - 2025	Solar energy units (water pump, inverter pv solar panels, cable)	21,750	261,000
3. Constructing greenhouses for hydroponic systems and installing a solar power source to the system	Constructing greenhouse poly carbonate	Number of green houses	20	2020 - 2025	Preparing land, green house poly carbonate, cooling and heating system, tanks automatic filter, Uvsetrilization device	31,000	620,000
	Constructing hydroponic system in the green house	Number of hydroponic systems	20	2020 - 2025	Smart device (fertilization machine calibrates the fertilizer by softwar programs), hydroponic system such as (NFT,Dutch Bucket,Deep water..	28,100	562,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
	Installing a solar power source to the system	Number of solar power system	20	2020 - 2025	Solar energy units(water pump, inverter pv solar panels, cable	14,100	282,000
4. Capacity building for farmers, MoA staff and NARC staff	Training courses on cropwat, aqua crop software's, using of smart devices and crops management (IPM, Fertilizing plant for 25 participants)	Number of training courses	3	2020 - 2025	Hall fare, logistic services, trainers, trainees, computer, training materials,…	15,000	45,000
	Field visits to similar projects for 25 participants	Number of field visits	4	2020 - 2025	transportation, trainers, trainees, logistics service	800	3,200
	Two-workshops for presenting results of hydroponic project and irrigation network project	Number of workshops	2	2020 - 2025	hall fare, expert, data show, logistic services, participants	5,000	10,000
5. Maintenance activities for irrigation network, hydroponic systems, and solar energy units	Maintenance of irrigation network	LS	30	2020 - 2025	Works, Technicians, Spare Parts	1,570	47,100
	Maintenance of hydroponic systems	LS	20	2020 - 2025	Works, Technicians, Spare Parts, Fertilizer Solutions, Acids, Plant, Pesticides	1,000	20,000
	Maintenance of solar energy units	LS	32	2020 - 2025	Technicians, Spare Parts	520	16,640
Total Cost							**2,271,240**

A2.6.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Perform Environmental & Social Impact Assessment	-	-	4,300	-	4,300	-	-		43,000
Preparing the land for cultivation	-	-	80,000	-	80,000	-	-		10,000
Installing of the network irrigation	26,208	-	4,200	-	30,408	-	-		236,592
Installing a solar power source to the system	-	-	4,200	-	4,200	-	-		256,800
Constructing greenhouse poly carbonate	15,500	-	10,000	-	25,500	-	-		594,500
Constructing hydroponic system in the green house	8,292	-	1,900	-	10,192	-	-		551,808
Installing a solar power source to the system	-	-	1,900	-	1,900	-	-		280,100
Training courses on cropwat, aqua crop software, using of smart devices and crops management (IPM, Fertilizing plant for 25 participants)	-	-	8,000	-	8,000	-	-		37,000
Field visits to similar projects for 25 participants	-	-	1,000	-	1,000	-	-		2,200

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Two-workshops for presenting results of hydroponic project and irrigation network project	-	-	1,000	-	1,000	-	-		9,000
Maintenance of irrigation network	-	-	2,100	-	2,100	-	-		45,000
Maintenance of hydroponic systems	-	-	2,100	-	2,100	-	-		17,900
Maintenance of solar energy units	-	-	2,100	-	2,100	-	-		14,540
Total Funding Requirement									**2,098,440**

A2.6.3 Potential Mitigation benefit assessment

Major Activity 1 – Irrigation networks installation, constructing green house for the hydroponic system, maintenance activities and installing a solar power source to the system

Construction emissions

No direct scope 1 sources of GHG emissions from construction although there is some potential for minor CO_2 emissions released from the cultivation of soil during land levelling and ploughing. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[32]. Emissions generation will also be dependent on the duration of construction, which is thought to last 1-5 years. Scope 3 emissions from transport to and from the site.

Operation emissions

No scope 1 or 2 emissions if powered entirely by solar. Minor scope 3 emissions from transport to maintain the solar energy units over their operational time of 10-40 years.

Emission savings

The use of solar power for the system will replace the need for on-site diesel generation, which will result in mitigation of Scope 1 emissions. Further, the usage of the fully automated hydroponic technology means less fertiliser (and no chemical weed or pest control substances) will be used, resulting in further mitigation of Scope 1 emissions. Finally, full automation will increase the efficiency of the system, reducing the need for e.g. maintenance by staff and replacement of faulty parts. This reduces on site energy consumption and transport emissions.

Major Activity 2 – Capacity building for farmers, MoA staff and NARC staff

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

Potential for minor scope 2 emissions reductions through more informed farmers making better choices on energy usage.

Mitigation benefit assessment for whole action:

2	Large reductions in GHG emissions

A2.6.4 Potential Adaptation benefit assessment

Major activity 1 – Irrigation networks installation and installing a solar power source to the system

This project will implement fully automated irrigation systems which are 90% more efficient than traditional methods, and drip irrigation technology. Further, the water will be sourced from wastewater treatment plants. Overall, crop production will increase 3-10 times and be produced twice as fast.

Installing irrigation systems for cultivation of agricultural lands can ensure sustainable supply of water to the soil, maintaining crop growth despite climate impacts. This automated system ensures

[32] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

particularly efficient water distribution, reducing water waste and, hence, reducing demand pressure on limited water resources, which is further enhanced by the use of wastewater.

The increased crop production can compensate for reductions due to climate impacts elsewhere in Jordan.

Installing solar power will help to ensure that potential disruption to Jordan's fuel imports, as a result of climate hazards, do not impact on agricultural production.

Major activity 2 – Constructing greenhouses for hydroponic systems and installing associated solar power sources

Use of hydroponic systems help circumvent climate impacts on soil quality, which may otherwise prevent agricultural production. Moreover, hydroponic farming requires less water than traditional agriculture, hence, decreasing demand pressure on water resources and maintaining water availability for other activities.

Overall, crop production will increase 3-10 times and be produced twice as fast. The increased crop production can compensate for reductions due to climate impacts elsewhere in Jordan.

As for irrigation networks, installing solar power will help to ensure that potential disruption to Jordan's fuel imports, as a result of climate hazards, do not impact on agricultural production .

Major activity 3 – Capacity building for farmers, MoA staff and NARC staff

Training courses on software and smart devices may allow for resource-efficient and timely crop management, improving farmers' decision-making about when to cultivate, sow and harvest and increasing resource-use efficiency. As a result, it could contribute to reducing pressure on water and soils caused by agricultural practices and ensure that agricultural yields could be sustained by adjusting to new climate patterns (such as changes in seasonal patterns).

Major Activity 4 – Maintenance activities for irrigation network, hydroponic systems, and solar energy units

Maintenance activities ensure that the above benefits can be sustained

Adaptation potential

The sustainability of the system is significantly improved by sourcing water from wastewater treatment plants. This replaces the need for freshwater resources or rainwater-harvesting cisterns, which are reliant on rainfall or groundwater. These are highly dependent on climate hazards and currently decreasing.

To prevent future damage to the infrastructure, an impact assessment should account for future climate projections, to ensure that materials and building processes are adequate to prevent physical damage caused by climate change or extreme weather events (such as floods, droughts etc). Otherwise, physical damage may occur and lead to water waste and/or crop losses.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A2.6.5 Co-benefits assessment

Activities	Economic	Social	Environmental

Irrigation networks, hydroponic systems	Long term local job creation	Increased water security	Reduced aquifer depletion
Solar power	Increased energy security	Health impacts from improved air quality	Improved air quality
	Long term local employment		
Agriculture	Possible reduction in food price volatility	Increased food security	Maintained and increased biodiversity
	Increased revenue generation for farmers		

A2.7 Action 14: Climate Change Adaptation for Irrigated Farms

Assist irrigated farms to face climate impacts through implementing adaptation techniques, such as water irrigation efficiency – Reduce the impact of climate change on crop production and crop water requirements in different bioclimatological regions of Jordan

Lead Organisation	MOA - Land and Irrigation dept.
Lead Organisation contact	Eng. Emad Al Qudah alqudahemad@gmail.com emad.moa.jo@gmail.com 0799041696

Project description

This action aims to assist crop production by irrigated farms that are facing future climate impacts. This will be achieved through the use of AquaCrop software, data collection and assessment in order to determine potential impacts of climate change on water productivity, followed by knowledge dissemination on adaptation techniques, such as increasing the efficiency of water usage in irrigation systems.

A2.7.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Data collection to be used in AquaCrop software.	Climatic data collection (Tmax, Tmin, Rainfall) for 12 stations.	Number of Weather Stations	12	2020 - 2025	Historical Metrological Daily data for ten years to be collected from JMD	4,000	48,000
	Field data collection (Crops, Soil and field management)	Number of field visits	36	2020 - 2025	Transportation, fuels and technician fees allowances	200	7,200
2. Analysis of soil samples	Take of soil samples from each location and send them to the lab (chemical and physical analysis)	Number of soil samples	12	2020 - 2025	Lab test	1,000	12,000
3. Estimation of expected changes of relative yield loss and water productivity	Capacity building on the use of AquaCrop software and Remote sensing to determine land use/cover.	Number of training courses	3	2020 - 2025	Training hall, logistic services, Trainees fees allowances for 20 trainees… Consultation (national &/or international) Two engineers will carry out the practical part of the training (cost 1500 USD)	10,000	30,000
	Running of AquaCrop and remote sensing software by using collected data at different water inputs	Number of runs	24	2020 - 2025	Experts (national &/or international) - One international expert (cost 400USD) - Four national experts (from ministry of agriculture/ Jordan) (cost 1600 USD)	2,000	48,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
	Estimate the potential impacts of climate change on water productivity (WP) by using of RICCAR data.	Number of reports	24	2020 - 2025	Publications and maps printing - 2 international experts (costs 1000USD) - 4 national experts (from ministry of agriculture/ Jordan) (costs 2000USD)	3,000	72,000
4. Present the results through a national report and illustrative maps.	Printing and publication	Number of Publications and Maps	1000	2020 - 2025		30	30,000
Total Cost							**247,200**

A2.7.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Climatic data collection (Tmax, Tmin, Rainfall) for 12 stations.	-	-	-	-		-	-		48,000
Field data collection (Crops, Soil and field management)	-	-	720	-	720	-	-		6,480
Take of soil samples from each location and send them to the lab (chemical and physical analysis)	-	-	500	-	500	-	-		11,500
Capacity building on the use of AquaCrop software and Remote sensing to determine land use/cover.	-	-	5,000	-	5,000	-	-		25,000
Running of AquaCrop and remote sensing software by using collected data at different water inputs	-	-	-	-		-	-		48,000
Estimate the potential impacts of climate change on water productivity (WP) by using of RICCAR data.	-	-	12,000	-	12,000	-	-		60,000
Printing and publication	-	-	-	-		-	-		30,000
Total Funding Requirement									**228,980**

A2.7.3 Potential Mitigation benefit assessment

Major activity 1: data collection, analysis of soil samples and estimation of expected changes of relative yield loss and water productivity

Operation emissions

Minor scope 2 emissions for electricity usage in laboratories and minor scope 3 emissions for transport to collect data. This would be over a short timescale so can be classed as insignificant.

Emission savings

None

Major activity 2: National report and illustrative maps of results

As above.

Mitigation benefit assessment for whole action:

0	No overall changes to GHG emissions

A2.7.4 Potential Adaptation benefit assessment

Major activity 1: data collection, analysis of soil samples and estimation of expected changes of relative yield loss and water productivity

The activity may improve knowledge of climate impacts on soil. This could enable better planning to adjust to the changing climate (such as changing cropping season, crop types, etc), as well as support the development of new farming practices and tools that could be used to overcome the impacts of climate change.

Major activity 2: National report and illustrative maps of results

Presenting the results in a report and through maps may help to raise awareness on resource scarcity, as well as increase knowledge about yield and water projections. This may increase the readers' ability to adapt their practices through knowledge sharing and, hence, contribute to increasing the water and agricultural sector's overall capacity to adapt to the changing climate.

Adaptation potential

As described above.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A2.7.5 Co-benefits assessment

Economic	Social	Environmental
Possible reduction in food price volatility	Increased food security	Reduced aquifer depletion
Short term local job creation	Increased security of water supply	
Reduced economic impacts of water variability		

A2.8 Action 15: Frost Project

Climate-related agricultural risk management programs/systems - Agricultural Risk Management Fund - Frost Project

Lead Organisation	MOA .
Lead Organisation contact	Dr. Naser Dwaikat Naser.mufleeh@yahoo.com 0795666089

Project description

This action has been proposed by the Ministry of Agriculture. It involves developing the Frost Project to help support climate-related agricultural risk management. It will reduce the risks related to frost thereby increasing overall production of farmers crops. Key activities involve investing in necessary equipment, such as frost fans, followed by ensuring farmers receive adequate training on frost prediction and management. This project is to be carried out over a three year period in Jordan Valley.

A2.8.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Use of technology which reduces the effects of frost	Frost Fans	No. of fans	15	2020-2025	Fans, installation, labours and transportation	142,450	2,136,750
	Use of smart devices (Smart Phone)	No. of smart devices	1500	2020 - 2025	Alarms costs, smart devices, labours and transportation	775	1,162,500
	Air monitoring stations	No. of air monitoring stations	10	2020 - 2025	Air monitoring stations, installations, air quality experts and transportation	78,100	781,000
2. Training Plant production farmers about how to reduce the risk of frost	Courses about predict frost	No. of farmers	500	2020-2025	Trainers, coordinators, venue, catering, training materials, etc...	155	77,500
	Courses about management of frost on protected and exposed vegetables	No. of farmers	500	2020 - 2025	Trainers, coordinators, venue, catering, training materials, etc...	155	77,500
	Courses about management of frost on fruit trees	No. of farmers	500	2020 - 2025	Trainers, coordinators, venue, catering, training materials, etc...	155	77,500
Total Cost							**4,312,750**

A2.8.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Frost Fans	-	-	21,100	-	21,100	-	-		2,115,650
Use of smart devices (Smart Phone)	-	-	105,000	-	105,000	-	-		1,057,500
Air monitoring stations	-	-	71,000	-	71,000	-	-		710,000
Courses about predict frost	-	-	7,050	-	7,050	-	-		70,450
Courses about management of frost on protected and exposed vegetables	-	-	7,050	-	7,050	-	-		70,450
Courses about management of frost on fruit trees	-	-	7,050	-	7,050	-	-		70,450
Total Funding Requirement									**4,094,500**

A2.8.3 Potential Mitigation benefit assessment

Major Activity 1 – Use of technology which reduce the effects of frost

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from electrical installation activities, building completion and finishing[33]. Emissions generation will also be dependent on the duration of construction, which is expected to be 5 years. Scope 3 emissions from transport to and from the field site.

Operation emissions

Scope 2 emissions from energy used from heating technology. There is no indication as to whether renewable technologies will be used to provide the energy.

Emission savings

None

Major Activity 2 - Training Plant production farmers about how to reduce the risk of frost

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

Potential for minor scope 2 emissions reductions through more informed farmers making better choices on energy usage.

Mitigation benefit assessment for whole action:

-1	Small increases in GHG emissions

A2.8.4 Potential Adaptation benefit assessment

Major activity 1 – Use of technology which reduce the effects of frost

The effect of frost in the agriculture sector include dehydration of crops and physical damages preventing crop growth in the future. Technology to reduce the effect of frost may, thus, reduce water demand while increasing agricultural productivity by ensuring that crops remain hydrated and preventing crop losses overall.

Preventing damage to crops may also ensure that farmers can retain a stable income and access health, food and other services necessary to adapt to the impacts of climate change.

Major activity 2 - Training Plant production farmers about how to reduce the risk of frost

Training farmers on techniques to reduce the risk of frost enables them to avoid damage by adjusting their management practices, harvesting schedules and the tools they use based on forecasts. This will help ensure that the benefits of Major Activity 1 are realised.

Adaptation potential

[33] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

Although projections are uncertain, it is expected that there will be fewer frost days in Jordan as a result of climate change. Hence, this activity would only have limited (and potentially decreasing) adaptation benefits in the future.[34]

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

0	The action has no effect on any key factors that influence a sector's vulnerability

A2.8.5 Co-benefits assessment

Economic	Social	Environmental
Possible reduction in food price volatility	Increased food security	Increased crop resilience
Revenue generation for low income groups		

[34] Ministry of Water and Irrigation (2016) Climate Change Policy for a Resilient Water Sector available athttp://extwprlegs1.fao.org/docs/pdf/jor165863.pdf

A2.9 Action 16: Integrated Pest Management System

Implement climate change proofing for agricultural crops including setting up an integrated Pest management (IPM) System

Lead Organisation	MOA/Plant Protection Directorate/Pest Control Department
Lead Organisation contact	Eng. Maram Masadeh (Head of Pestel Control Section) maram.masadeh11@yahoo.com 0798504831

Project description

The aim of this project is to implement climate proofing for agricultural crops with regard to pests. This will be achieved by setting up an integrated pest management (IPM) system. Steps to achieve this include monitoring, collecting data, field visits and control. Training courses will also be incorporated. This action is to be carried out over a period of five years.

A2.9.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Technical assistance of the farmers	Field visits to the farms and identifying the targeted farms (500,000 Dunums)	No. of field visits	200	2020-2025	Transportation and accommodation	130	26,000
	Distribution the requirements (traps and pheromones) to the targeted farms	No. of Traps and pheromones	3000	2020-2025	Transportation and accommodation, cost of traps and pheromones	72	216,000
	Follow up of the beneficiary farmers	No. of field visits	200	2020-2025	Transportation and accommodation	130	26,000
	Collection and analysing available data (farm area, No. of captured insects, percentage and severity of infestation, etc…)	No. of field visits	200	2020-2025	Transportation and accommodation, and reporting	130	26,000
2. Capacity Building for MoA staff	Training of MoA staff on pest control	No. of trainees	50	2020-2025	Trainers, coordinators, transportation, catering, training materials, venue, etc...	63	3,150
Total Cost							**297,150**

A2.9.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Field visits to the farms and identifying the targeted farms (500,000 Dunums)	-	-	5,300	-	5,300	-	-		20,700
Distribution the requirements (traps and pheromones) to the targeted farms	-	-	5,300	-	5,300	-	-		210,700
Follow up of the beneficiary farmers	-	-	5,300	-	5,300	-	-		20,700
Collection and analysing available data (farm area, No. of captured insects, percentage and severity of infestation, etc…)	-	-	5,300	-	5,300	-	-		20,700
Training of MoA staff on pest control	-	-	1,000	-	1,000	-	-		2,150
Total Funding Requirement									**254,250**

A2.9.3 Potential Mitigation benefit assessment

Major Activity 1 – Technical assistance of farmers and capacity building for MoA staff

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

Potential for minor scope 2 emissions reductions through more informed farmers making better choices on energy usage.

Mitigation benefit assessment for whole action:

0	No overall changes to GHG emissions

A2.9.4 Potential Adaptation benefit assessment

Major Activity 1 – Technical assistance of farmers

Climate change is likely to increase the spread of pests and diseases that lead to crop losses and/or contamination.

Providing technical assistance to farmers regarding pest management would help to avoid crop losses caused by diseases and, hence, would maintain agricultural productivity. By preventing contamination, farmers may also prevent damage to consumers' health.

Preventing damage to crops also ensures that farmers can retain stable incomes and access health, food and other services necessary to adapt to climate change impacts.

Major Activity 2 - Capacity building for MoA staff on pest control

Training staff from the Ministry of Agriculture on pest management may improve their capacity to forecast pests and to understand their impact. It may also provide a basis on which to develop innovative solutions to control the spread of pests through coordinated action nation-wide. Overall, this would allow for better management and prevention of potential outbreaks, so that the damages from pests are avoided and/or limited

Adaptation potential

As described above.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially increase its vulnerability

A2.9.5 Co-benefits assessment

Economic	Social	Environmental
Possible reduction in food price volatility	Increased food security	Increased crop resilience
Revenue generation for low income groups	Improved human health and animal welfare	

A3 Appendices - Health Sector Actions contributing to the Jordanian NDC

A3.1 Action 17: Surveillance System for Climate Sensitive Diseases

Strengthening surveillance and establishment of highly sensitive alert system by developing health forecast system for any climate sensitive disease through 15 sentinel hospitals and 20 health centres

Lead Organisation	Ministry of Health
Lead Organisation contact	Dr. Sami Sheikh Ali (Communicable Diseases Directorate Head/ Data Management Department) saadshali@hotmail.com

Project description

The project intends to establish a surveillance system for diseases sensitive to changes in climate. The project will cover 15 hospitals and 20 health centres across the country. The project will last for five years and involve setting up and training members. These members will then report quarterly on diseases in a standardised way. Collection of the logs will allow for analysis of disease behaviour and allow for an early warning system for potential changes/ or increases in disease risk. Once this is set up and running, there will be annual workshops to share and disseminate the information to relevant parties.

A3.1.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Forming steering committee to write study protocol and to select sentinel sites	Communication	No. of members	7	2020-2025	Steering committee members fees	1,650	11,550
	Field visits over 54 months	No. of members	4	2020 - 2025	Transportation	7,700	30,800
2. A systematic review to identify strengths and weaknesses of the existing surveillance system	Establishing sub-committees	No. of members	2	2020-2025	project director and supervisor fees, transportation	14,850	29,700
3. Design and printing logbooks and reporting forms	Consultation	No. of consultant	1	2020-2025	Designing fees	15,400	15,400
	Printing	No. of logbooks & forms	35	2020 - 2025	Printing fees	440	15,400
4. Conduct training workshops and seminars for the health workers who are involved in project implementation in the selected sentinel sites	Preparation of training material	No. of trainees	50	2020-2025	Training material, transportation, catering, and trainers	485	24,250
	Training follow-up	No. of hospitals and centres	50	2020 - 2025	Training material, transportation, catering, and trainers	485	24,250

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
5. Quarterly data analysis	Data analysis over 54 months for 17 hospitals, 20 health centres and 1 National Public Health Laboratory (NPLH)	No. of consultant	70	2020-2025	Consultants' fees, laboratory kits (Viral Panel)	23,270	1,628,900
7. First annual dissemination workshop	Workshop	No. of participants	200	2020-2025	Transportation, logistical aspects, catering, and trainers	55	11,000
8. Second annual dissemination workshop	Workshop	No. of participants	200	2020-2025	Transportation, logistical aspects, catering, and trainers	55	11,000
9. Third annual dissemination workshop	Workshop	No. of participants	200	2020-2025	Transportation, logistical aspects, catering, and trainers	55	11,000
10. Fourth annual dissemination workshop	Workshop	No. of participants	200	2020-2025	Transportation, logistical aspects, catering, and trainers	55	11,000
11. Final project outcome dissemination workshop	Workshop	No. of participants	200	2020-2025	Transportation, logistical aspects, catering, and trainers	55	11,000
Total Cost							**1,835,200**

A3.1.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Communication	-	-	1,050	-	1,050	-	-		10,500
Field visits over 54 months	-	-	2,808	-	2,808	-	-		27,992
Establishing sub-committees	-	-	2,700	-	2,700	-	-		27,000
Consultation	-	-	1,400	-	1,400	-	-		14,000
Printing	-	-	1,400	-	1,400	-	-		14,000
Preparation of training material	-	-	2,200	-	2,200	-	-		22,050
Training follow-up	-	-	2,200	-	2,200	-	-		22,050
Data analysis over 54 months for 17 hospitals, 20 health centres and 1 National Public Health Laboratory (NPLH)	-	-	14,820	-	14,820	-	-		1,614,080
Workshop	-	-	1,000	-	1,000	-	-		10,000
Workshop	-	-	1,000	-	1,000	-	-		10,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Workshop	-	-	1,000	-	1,000	-	-		10,000
Workshop	-	-	1,000	-	1,000	-	-		10,000
Workshop	-	-	1,000		1,000	-	-		10,000
Total Funding Requirement									**1,801,672**

A3.1.3 Potential Mitigation benefit assessment

Major Activity 1 – Conduct training workshops and seminars for the health workers who are involved in project implementation in the selected sentinel sites

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

None.

Mitigation benefit assessment for whole action:

0	No overall changes to GHG emissions

A3.1.4 Potential Adaptation benefit assessment

Major Activity 1 – Conduct training workshops and seminars for the health workers who are involved in project implementation in the selected sentinel sites

Climate-sensitive diseases may include respiratory diseases caused by heat, vector-borne diseases, water-borne diseases, etc.

Improving the health surveillance system would improve knowledge about these diseases, potentially highlighting synergies and interdependencies between them, their causes and their geographical location. This improved knowledge would increase the health system's ability to cure diseases by informing the development of medicines, purchase of relevant equipment and/or location of specific medical units in areas of need. It could also enable disease forecasts and inform the general public on their causes and risks and, hence, prevent the spread and/or contraction of diseases.

Adaptation potential

The benefits of this action would be best realised if the surveillance system encompasses different kinds of diseases that may be caused, or exacerbated, by climate change (vector-borne diseases, heat stress, etc). The surveillance system should address all regions of Jordan (urban and rural) to enable location-specific circumstances to be reflected in the data, as the results may differ across regions.

The staff should also be trained to translate findings in ways that are understandable to the general public in order to raise awareness of climate-related diseases.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially increase its vulnerability

A3.1.5 Co-benefits assessment

Economic	Social	Environmental
Reduced direct health costs	Reduced mortality and health impacts from specific diseases	Smarter health systems
	Strengthened diagnosis and health services delivery	

A3.2 Action 18: Establishment of a Leishmania Unit

Establishment of Leishmania Unit in the Division of Parasitic and Zoonotic Diseases

Lead Organisation	Ministry of Health
Lead Organisation contact	Dr. Sami Sheikh Ali (Communicable Diseases Directorate Head/ Data Management Department) saadshali@hotmail.com

Project description

Leishmaniasis is a parasitic disease commonly caught from sand-fly bites. Key risk factors include poverty, malnutrition, deforestation and urbanisation. The project seeks to set up a Leishmania unit within the division of parasitic and zoonotic diseases in order increase treatment and raise awareness of the disease.

A3.2.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Establish Entomology Section: training for insect identification and sampling methods	Communications	No. of members	7	2020 - 2025	Steering committee members fees	1,815	12,705
	Training	No. of trainees	5	2020 - 2025	Training material, transportation, catering, and trainers	535	2,675
2. Equip Diagnostic tools and Laboratory kits with needed equipment and staff training	Laboratory tool kits	No. of laboratory kits	10	2020 - 2025	Laboratory tool kits	5,940	59,400
	Choose staff	No. of trainees	5	2020 - 2025	Training material, transportation, catering, and trainers	535	2,675
3. Hire and train medical doctor for Treatment Unit	Hiring and training a medical doctor	No. of doctors	1	2020 - 2025	Doctor's fees	770	770
4. Produce awareness materials for the general public	Awareness	No. of posters and brochures	35	2020 - 2025	Designing and printing fees	485	16,975
5. Establish Leishmania Strain Unit to keep reference	Data analysis and reporting	No. of reports	2	2020 - 2025	Biannually reports	7,425	14,850
Total Cost							**110,050**

A3.2.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Communications	-	-	1,155	-	1,155	-	-		11,550
Training	-	-	242	-	242	-	-		2,433
Laboratory tool kits	-	-	5,400	-	5,400	-	-		54,000
Choose staff	-	-	242	-	242	-	-		2,433
Hiring and training a medical doctor	-	-	70	-	70	-	-		700
Awareness	-	-	1,540	-	1,540	-	-		15,435
Data analysis and reporting	-	-	1,350	-	1,350	-	-		13,500
Total Funding Requirement									**100,051**

A3.2.3 Potential Mitigation benefit assessment

Major activity 1 – Hire and train medical doctor for treatment unit

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings None.

Mitigation benefit assessment for whole action:

0	No overall changes to GHG emissions

A3.2.4 Potential Adaptation benefit assessment

Major activity 1 – Establishing entomology section, providing laboratory toolkits and establishing a strain unit to keep reference

This activity may allow to improve understanding of leishmaniasis by providing the necessary material to identify the insects causing the diseases and enable their assessment (their identity, geographical location, etc), as well as identify any changes over time and/or pattern through regular analysis and reporting. This improved knowledge would increase the health system's ability to develop medicines to treat and/or to prevent the disease, purchase relevant equipment, increase the health service's capacity in times or places of need, etc.

Major activity 2 – Hire and train medical doctor for treatment unit

This activity would ensure that the health infrastructure and professionals are sufficient to treat patients with leishmaniasis, hence, improving the prospects of patients recovering from the disease.

Major activity 3 – Produce awareness materials for the general public

This activity reduce cases of leishmaniasis by increasing awareness among the general public of the need to take necessary precautions. A decrease in the number of people contracting the disease would help to ensure that the health service has sufficient capacity to treat patients.

Adaptation potential

As described above.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A3.2.5 Co-benefits assessment

Economic	Social	Environmental
	Reduced mortality and health impacts from specific diseases	Smarter health systems
	Strengthened diagnosis and health services delivery	

A4 Appendices - Transport Sector Actions contributing to the Jordanian NDC

A4.1 Action 19: Bus Rapid Transit (BRT) Network

Fostering mobility in Amman through a bus rapid transit (BRT) network

Lead Organisation	Greater Amman Municipality / MOT
Lead Organisation contact	Eng. Ola Al-Kafaween (Director of Studies and Public Transportation Planning) Al-kafawin@AmmanCity.gov.jo 0778524469

Project description

This project involves the planning, design and implementation of the second stage of a BRT network in Amman. It will be integrated with the fare collection system for BRT Phase 1 and other public transport in the city. Key activities include construction of four additional BRT lines (as there are already two under construction), followed by implementation of fare-collection systems.

A4.1.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Environmental Impact Assessment	Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements	Consultations	1	2020 - 2025	Consultants, Field Visits, Air Quality Measurements, Reporting and Printing	110,000	110,000
2. Construction of BRT lines, including BRT underpasses, to include the cost of the feasibility study divided between lines according to route length	Construction of Phase 2 Line 1 - 23 km from Sweileh to South terminal (Customs Square), via the Airport Road	Kilometres of two-way BRT running way	23	2020 - 2025	Two-way single lane busway with new asphalt & concrete at stations. 50cm separator walls and basic landscaping along the entire length. Signalisation and pedestrian improvements to include sidewalks and crossings. Inc. 10% estimated cost of labour and engineers. (Construction materials, asphalt & concrete, labours, engineers, separator walls, landscaping, signalisation and pedestrian improvements, etc...)	1,772,210	40,760,830
	Construction of Phase 2 Line 2 - 13 km from Sana'a Intersection to South terminal (Customs Square)	Kilometres of two-way BRT running way	12	2020 - 2025	Two-way single lane busway with new asphalt & concrete at stations. 50cm separator walls and basic landscaping along the entire length. Signalisation and pedestrian improvements to include sidewalks and crossings. Inc. 10% estimated cost of labour and engineers. (Construction materials, asphalt & concrete, labours, engineers, separator walls, landscaping, signalisation and pedestrian improvements, etc...)	1,772,210	21,266,520

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	Construction of Phase 2 Line 3 - 8km from Princess Basma Street to Prince Hussein Interchange, via the Abdoun Corridor	Kilometres of two-way BRT running way	8	2020 - 2025	Two-way single lane busway with new asphalt & concrete at stations. 50cm separator walls and basic landscaping along the entire length. Signalisation and pedestrian improvements to include sidewalks and crossings. Inc. 10% estimated cost of labour and engineers. (Construction materials, asphalt & concrete, labours, engineers, separator walls, landscaping, signalisation and pedestrian improvements, etc...)	1,772,210	14,177,680
	Construction of Phase 2 Line 4 - 7km from Mahatta to Middle East Square.	Kilometres of two-way BRT running way	7	2020 - 2025	This was Line 3 from the original BRT plans for Phase 1 BRT. Two-way single lane busway with new asphalt & concrete at stations. 50cm separator walls and basic landscaping along the entire length. Signalisation and pedestrian improvements to include sidewalks and crossings. Inc. 10% estimated cost of labour and engineers (Construction materials, asphalt & concrete, labours, engineers, separator walls, landscaping, signalisation and pedestrian improvements, etc...)	1,772,210	12,405,470
	Construction of BRT underpasses - rough estimate of 2 per line	No. of underpasses	8	2020 - 2025	Construction of BRT Underpasses estimated as 2 per line. Inc. 10% estimated cost of labour and engineers (Construction materials, labours, engineers, etc...)	3,850,000	30,800,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
3. Construction of terminals and Stations for BRT Phase 2	Construction of terminals and facilities (restrooms, security cameras, an information kiosk, real-time information displays and 3 smart cards vending machines)	No. of terminals	2	2020 - 2025	Construction of terminals (including land acquisition of 300.000 m2 per terminal), each with restrooms, security cameras, an information kiosk, real-time information displays and 3 smart card vending machines. Inc. 10% estimated cost of labour and engineers exc. on cost of land acquisition (Construction materials, labours, engineers, etc...)	6,416,050	12,832,100
	Provision of infrastructure for 3-metre-wide stations, each with identification posts, security cameras, maps and receptacles.	No. of stops	22	2020 - 2025	3-metre-wide stations, each with identification posts, security cameras, maps and receptacles. Real-time information displays to be provided at half the stops. Inc. 10% estimated cost of labour and engineers. (Construction materials, labours, engineers, etc...)	246,455	5,422,010
	Provision of park and ride facility	No. of park and ride facilities	1	2020 - 2025	Provision of park and ride, including land acquisition, suggested site at Na'our Bridge on Line 1 and at the end of Line 3.Inc. 10% estimated cost of labour and engineers, exc. on cost of land acquisition.	3,650,00	3,650,000
4. Other Infrastructure for BRT Phase 2	Construction of depot and facilities	No. of depots	1	2020 - 2025	Construction of depot facilities, including land acquisition on outskirts of Amman, of 500,000 m2 Inc. 10% estimated cost of labour and engineers, exc. on land acquisition	10,500,000	10,500,000
	Construction of control Centre for BRT Phase 2	No. of control centres	1	2020 - 2025	Construction material, purchase of GPS control equipment & related software, purchase of smart card	6,600,000	6,600,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
					system software Inc. 10% estimated cost of labour and engineers		
	Cost of transfer stations	No. of route corridors	4	2020 - 2025	Provision of standard transfer stations for each route corridor i.e. provision of stops for feeder services etc. for a corridor. Inc. 10% estimated cost of labour and engineers	880,000	3,520,000
5. Operational costs	Maintenance, training of drivers, and management for 2 years	No. of years	2	2020 – 2025	Maintenance, insurance, licence and registration, drivers, station staff, other staff, management team, office expenses, external support services, and software renewal cost,	47,300,000	94,600,000
6. Contingency	Contingency @ 10%	No. of contingency sums	1	2020 - 2025	Contingency amount calculated at 10% of estimated costs for project	25,664,461	25,664,461
Total Cost							**282,309,071**

A4.1.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements			10,000		10,000				100,000
Construction of Phase 2 Line 1 - 23 km from Sweileh to South terminal (Customs Square), via the Airport Road			3,705,530		3,705,530				37,055,300
Construction of Phase 2 Line 2 - 13 km from Sana'a Intersection to South terminal (Customs Square)			1,933,320		1,933,320				19,333,200
Construction of Phase 2 Line 3 - 8km from Princess Basma Street to Prince Hussein Interchange, via			1,288,880		1,288,880				12,888,800

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
the Abdoun Corridor									
Construction of Phase 2 Line 4 - 7km from Mahatta to Middle East Square.			1,127,770		1,127,770				11,277,700
Construction of BRT underpasses - rough estimate of 2 per line			2,800,000		2,800,000				28,000,000
Construction of terminals and facilities (restrooms, security cameras, an information kiosk, real-time information displays and 3 smart cards vending machines)			621,100		621,100				12,211,000
Provision of infrastructure for 3-metre-wide stations, each with identification posts, security cameras,			492,910		492,910				4,929,100

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
maps and receptacles.									
Provision of park and ride facility			150,000		150,000				3,500,000
Construction of depot and facilities			500,000		500,000				10,000,000
Construction of control Centre for BRT Phase 2			600,000		600,000				6,000,000
Cost of transfer stations			320,000		320,000				3,200,000
Operational costs			8,600,000		8,600,000				86,000,000
Contingency @ 10%									25,664,461
Total Funding Requirement									**260,159,561**

A4.1.3 Potential Mitigation benefit assessment

Major activity - Construction of BRT lines, underpasses, terminals and stations

Construction

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing. Emissions generation will also be dependent on the expected duration of construction of 5 years[35]. Scope 3 emissions from transport to and from the building site.

Operation

Scope 1 emissions from the BRT fleet over life cycle of 10-40 years[36].

Emission savings

Potential for mitigation through (1) mode shift of trips from private car and taxi to BRT (2) Fuel type to be discussed but at minimum this will be Euro V, which is an improvement over much of the current public transport fleet.

Phase 1 of the BRT implementation in Amman involved 2 lines of BRT, which will be operational from 2021 and save 48,000 tonnes CO_2e per year[37]. It is expected that the implementation of a further 4 lines in addition to this will produce further emissions savings of 96,000 tonnes CO_2e per year, with the caveat that the BRT lines will be of similar length and carrying a similar number of passengers.

Mitigation benefit assessment for whole action:

2	Large reductions in GHG emissions

A4.1.4 Potential Adaptation benefit assessment

Major activity - Construction of BRT lines, underpasses, terminals and stations

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

While in operation, the network has the potential to improve access to key services by vulnerable people, such as women, children and the elderly, including access to healthcare regarding diseases, injuries and other health issues caused by climate events.

Adaptation potential

There is a need to ensure that the social and environmental impact assessment of Phase I considers the range of possible future climate scenarios and their impact on infrastructure and the transport sector, and recommends building practices accordingly (location, material, etc).

Adaptation benefit assessment for whole action

[35] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[36] Emissions from transportation in vehicles owned or controlled by the reporting company are defined as scope 1.
[37] https://www.c40.org/case_studies/bus-rapid-transit-to-tackle-air-pollution-co2-emissions-and-improve-mass-public-transportation

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A4.1.5 Co-benefits assessment

Economic	**Social**	**Environmental**
Short term job creation from upgrading infrastructure	Reduced health impacts from air pollution	Improved air quality (reduced PMs, SO2, NOx, other pollutants)
	Improved mobility	
Reduced congestion, increased productivity and growth	Improved road safety	Reduced environmental noise
	Reduced need for car parking	

A4.2 Action 20: Urban Bus Reform Public Transport project in Irbid and Zarqa

Increased access to public transport services in Irbid and Zarqa cities

Lead Organisation	MOT
Lead Organisation contact	Eng. Naim Hassan (Planning and Studies Director) nhassan@mot.gov.jo Eng. Majdi Abuhammoudeh Majdi.Abuhammoudeh@mot.gov.jo Eng. Sharehan Abu Haswah Sabu-haswah@mot.gov.jo Eng. Rasha Qadoura anjjor1@gmail.com Eng. Aya Hazaymeh Ayaa.HAZAYMEH@mot.gov.jo

Project description

The Jordan local bus reform project is to provide new bus services for the cities of Irbid and Zarqa with a public sector funded model. Each city will have a public sector organisation to oversee the operation of the system, be responsible for funding and to plan service changes. The new buses will be of the latest design, which will be reliable, accessible, efficient and safe, and will include some electric vehicles. Further, new ticketing systems will be introduced, through smart cards and ITS, compatible with other existing and planned systems in Jordan. The total number of buses is expected to be approximately 73 depending on the number of electric buses.

A4.2.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Bus purchase (to be updated with electric vehicles when assessed)	Bus purchase Irbid	Buses	39	2020-2025	Purchase a new buses of the latest design which will be reliable, accessible, efficient and safe	170,000	6,630,000
	Bus purchase Zarqa	Buses	34	2020-2025	Purchase a new buses of the latest design which will be reliable, accessible, efficient and safe	170,000	5,780,000
2. Depot construction	Depots Irbid	Depot	1	2020-2025	Provide the municipalities with capital to prepare and construct the depot infrastructure and machines	2,450,000	2,450,000
	Depots Zarqa	Depot	1	2020-2025	Provide the municipalities with capital to prepare and construct the depot infrastructure and machines	2,450,000	2,450,000
3. e-ticketing / AVL machine purchase	E-tickets Irbid	System	1	2020-2025	Provide the municipalities with capital to install ITS systems for both cities	2,177,000	2,177,000
	E-tickets Zarqa	System	1	2020-2025	Provide the municipalities with capital to install ITS systems for both cities	2,154,000	2,154,000
4. Technical Assistance	Technical assistance in Irbid and Zarqa	TA	1	2020-2025	To support institutional set up and implementation	2,600,000	2,600,000
Total Cost							**24,241,000**

A4.2.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted	Submitted, Awaiting Decision	Total international contribution	
Bus purchase Irbid						6,630,000			
Bus purchase Zarqa						5,780,000			
Depots Irbid									2,450,000
Depots Zarqa									2,450,000
E-tickets Irbid									2,177,000
E-tickets Zarqa									2,154,000
Technical assistance in Irbid and Zarqa			600,000			2,000,000			
Total Funding Requirement									**9,231,000**

A4.2.3 Potential Mitigation benefit assessment

Major activity 1 – Purchase and operation of 73 buses including some electric buses, construction and operation of depots and e-ticket systems

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing. Emissions generation will also be dependent on the expected duration of construction of up to 5 years[38]. Scope 3 emissions from transport to and from the building site.

Operation emissions

Scope 1 emissions from the operation of 73 buses, which will be in operation for 10-40 years. Scope 2 emissions from electricity consumption of the depots, and from electricity required to charge a number of the buses, which will be electric. E-ticketing should reduce waiting times for buses and reduce emissions.

Emission savings

Large potential to reduce scope 1 transport emissions if the new buses displace older, less efficient buses and lead to a mode shift towards public transport from private vehicles. There will be an even larger potential to reduce emissions with the introduction of electric buses due to a shift away from petrol and diesel usage. Also potential for emissions reduction through reducing congestion and waiting times for buses while issuing tickets after increasing efficiency through e-ticketing.

Mitigation benefit assessment for whole action

2	Large reductions in GHG emissions

A4.2.4 Potential Adaptation benefit assessment

Major activity 1

Purchase and operation of 73 buses, including some electric buses, construction and operation of depots and e-ticket systems

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

While in operation, the network has the potential to improve access to key services by vulnerable people, such as women, children and the elderly, including access to healthcare regarding diseases, injuries and other health issues caused by climate events.

Adaptation potential

To achieve the benefits identified above while preventing damage to ecosystems, the construction of the charging infrastructure should follow the results of a social and environmental impact assessment. This should ensure that materials and building processes can withstand climate change or extreme weather events, and that construction activity does not compromise the health of the surrounding ecosystems, as a result of increased pollution (to air, water bodies, soil, etc) or of land use (of forest areas, rangelands, etc). The assessment should consider the range of possible future climate

[38] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

scenarios and their impact on the infrastructure and the transport sector, and recommend building practices accordingly (location, material, etc).

Disbenefits could arise from disposal of old EV batteries used by electric buses (i.e. increased depletion of mineral resources and pollution of soil and water bodies as a result of waste). Thus, the programme should plan for the "re-use" and "recycling" of batteries from the outset. Old batteries can still retain up to 80% of power, so they can still be used to power shops or houses. Using the materials from old EV batteries to make new ones would also reduce mining of more cobalt needed to make lithium batteries.

Adaptation benefit assessment for whole action

Stakeholders have not confirmed that the measures described under the "Adaptation Potential" section can be implemented, two ratings are provided, one based on the measures being undertaken, the other if they are not considered.

-1	The action affects key factors that influence a sector's vulnerability in a way that increases it – if conditions are not met preventing disbenefits
1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability – if a social and environmental assessment is conducted for infrastructure construction and old batteries for electric buses are re-used or recycled.

A4.2.5 Co-benefits assessment

Economic	Social	Environmental
Short term job creation from upgrading infrastructure	Reduced health impacts from air pollution	Improved air quality (reduced PMs, SO2, NOx, other pollutants)
	Improved mobility	
Reduced congestion, increased productivity and growth	Improved road safety	Reduced environmental noise
	Reduced need for car parking	

A4.3 Action 22: Battery Electric Buses in Public Transport

Battery-electric buses deployed for use in public transportation

Lead Organisation	MOT-LTRC-GAM-MEMR-NEPCO-MoEnv-JEF
Lead Organisation contact	Eng. Ola Al-Kafaween (Director of Studies and Public Transportation Planning) Al-kafawin@AmmanCity.gov.jo 0778524469

Project description

This project, proposed by Greater Amman Municipality, is a continuation of the implementation of a second stage of the BRT network. This project aims to implement electric buses for 4 lines of the BRT in Phase 2, and an electric tram which will provide a link with main BRT and bus networks downtown. The main activities are the feasibility study and implementation of the electric buses, followed by feasibility study and implementation of downtown linking electric tram line.

A4.3.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Implementation of electric bus infrastructure for the 4 lines of BRT in Phase 2, based on feasibility study for BRT phase 2	Provision of buses for Line 1 Phase 2	No. of buses	117	2020 - 2025	Cost of 18m electric buses to be implemented on Line 1 Phase 2, numbers to be revised in feasibility study for BRT phase 2. Current estimate assumes 58 buses per line, plus 10% reserve, assigned to lines according to route length.	800,000	93,600,000
	Provision of buses for Line 2 Phase 2	No. of buses	61	2020 - 2025	Cost of 18m electric buses to be implemented on Line 2 Phase 2, numbers to be revised in feasibility study for BRT phase 2. Current estimate assumes 58 buses per line, plus 10% reserve, assigned to lines according to route length.	800,000	48,800,000
	Provision of buses for Line 3 Phase 2	No. of buses	36	2020 - 2025	Cost of 18m electric buses to be implemented on Line 3 Phase 2, numbers to be revised in feasibility study for BRT phase 2. Current estimate assumes 58 buses per line, plus 10% reserve, assigned to lines according to route length.	800,000	28,800,000
	Provision of buses for Line 4 Phase 2	No. of buses	41	2020 - 2025	Cost of electric buses to be implemented on Line 4 Phase 2, numbers to be revised in feasibility study for BRT phase 2. Current estimate assumes 58 buses per line, plus 10% reserve, assigned to lines according to route length.	800,000	32,800,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	Provision of charging infrastructure	No. of chargers	54	2020 - 2025	Cost of chargers - slow (25kW) and rapid (400kW), transportation and installation	175,288.89	9,465,600
	Provision of electric substations	No. of substations	13	2020 - 2025	Cost of 1.5 MW substations	1,500,000	19,500,000
	Provision of extra wiring	Km of wiring	682	2020 - 2025	Cost of medium voltage wires	12,000	8,184,000
	Installation of solar PV	MW of installed solar capacity	16.4	2020 - 2025	Cost of installation of solar PV to support Phase 2 BRT, plus 2 years operation and maintenance.	1,289,400	21,146,160
	Electricity operation costs for 2 years	kilometres travelled by all buses over 2 years	42,340,000	2020 - 2025	Cost of electricity for all buses (excluding reserve buses), assuming 250 km/ bus/day and 2kWh/km/bus	0.42	17,782,800
	Engineering costs	No. of Tenders	4	2020-2025	10% of the activity cost to include tender documents, design and choosing contractor	7,001,964	28,007,856
2. Implementation of a Downtown Link between Fountain Square in the Downtown of Amman and Mahatta, the main bus terminal in East Amman, to connect with Amman BRT - Lines 1	Feasibility study for Downtown Link & Implementation of Downtown Link to be	km	4	2020 - 2025	Estimate based on benchmark for tram systems (construction materials, labours, engineers, etc…)	10,000,000	40,000,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
and 2 and Amman Zarqa BRT - suggested electric tram	operated by Electric tram						
Operational costs	Maintenance, training of drivers, and management for 2 years	No. of years	2	2020 – 2025	Maintenance, insurance, licence and registration, drivers, station staff, other staff, management team, office expenses, external support services, and software renewal cost,	36,850,000	73,700,000
Total Cost							**421,786,416**

A4.3.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Provision of buses for Line 1 Phase 2			9,360,000		9,360,000				84,240,000
Provision of buses for Line 2 Phase 2			4,880,000		4,880,000				43,920,000
Provision of buses for Line 3 Phase 2			2,880,000		2,880,000				25,920,000
Provision of buses for Line 4 Phase 2			3,280,000		3,280,000				29,520,000
Provision of charging infrastructure			946,560		946,560				8,519,040
Provision of electric substations			1,950,000		1,950,000				17,550,000
Provision of extra wiring			818,400		818,400				7,365,600
Installation of solar PV			2,114,616		2,114,616				19,031,544
Electricity operation costs for 2 years			1,778,280		1,778,280				16,004,520
Engineering costs									28,007,856
Feasibility study for Downtown Link & Implementation of Downtown Link to be operated by Electric tram			4,000,000		4,000,000				36,000,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Operational costs			6,700,000		6,700,000				67,000,000
Total Funding Requirement									**383,078,560**

A4.3.3 Potential Mitigation benefit assessment

Major activity 1 – Electric buses for 4 BRT lines and solar power installation

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing. Emissions generation will also be dependent on the expected duration of construction of up to 5 years[39]. Scope 3 emissions from transport to and from the building site.

Operation emissions

None, as long as the electric buses are powered entirely by solar.

Emission savings

Potential for mitigation through (1) mode shift of trips from private car and taxi to BRT (2) fuel shift away from petrol and diesel, (3) solar power displacing scope 2 electricity emissions to charge the electric buses.

Major activity 2 – Downtown Electric Tram link

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing. Emissions generation will also be dependent on the expected duration of construction of up to 5 years[40]. Scope 3 emissions from transport to and from the building site.

Operation emissions

None, as long as the electric tram is powered entirely by solar.

Emission savings

Potential for mitigation through (1) mode shift of trips from private car and taxi to tram (2) fuel shift away from petrol and diesel, (3) increasing the efficiency of public transport by linking the main BRT and bus networks downtown.

Mitigation benefit assessment for whole action:

2	Large reductions in GHG emissions

A4.3.4 Potential Adaptation benefit assessment

Major activity 1 – Electric buses for 4 BRT lines and solar power installation

The network has the potential to improve access to key services by vulnerable people, such as women, children and the elderly, including access to healthcare regarding diseases, injuries and other health issues caused by climate events.

[39] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[40] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

The installation of solar power capacity to support the deployment of electric vehicles reduces the dependence on imports. Hence, it may reduce the risk of disruption in energy supply that climate change may cause, and ensure consumers retain access to cooling.

Major activity 2 – Downtown Electric Tram link

As above.

Adaptation potential

To achieve the benefits identified above while preventing damage to ecosystems, the construction of the downtown electric tram link, infrastructure should follow the results of a social and environmental impact assessment. This should ensure that materials and building processes can withstand climate change or extreme weather events, and that construction activity does not compromise the health of the surrounding ecosystems, as a result of increased pollution (to air, water bodies, soil, etc) or of land use (of forest areas, rangelands, etc). The assessment should consider the range of possible future climate scenarios and their impact on the infrastructure and the transport sector, and recommend building practices accordingly (location, material, etc).

To prevent disbenefits arising from disposal of old EV batteries (i.e. increased depletion of mineral resources and pollution of soil and water bodies as a result of waste), the programme should plan for the "re-use" and "recycling" of batteries from the outset. Old batteries can still retain up to 80% of power, so they can still be used to power shops or houses. Using the materials from old EV batteries to make new ones would also reduce mining of more cobalt needed to make lithium batteries.

Adaptation benefit assessment for whole action

Stakeholders have not confirmed that the measures described under the "Adaptation Potential" section can be implemented, two ratings are provided, one based on the measures being undertaken, the other if they are not considered.

-1	The action affects key factors that influence a sector's vulnerability in a way that increases it – if conditions are not met preventing disbenefits
1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability – if a social and environmental assessment is conducted for infrastructure construction and old batteries for electric buses are re-used or recycled.

A4.3.5 Co-benefits assessment

Activities	Economic	Social	Environmental
New mass transport – electric buses	Short term job creation from upgrading infrastructure	Reduced health impacts from air pollution	Improved air quality (reduced PMs, SO2, NOx, other pollutants)
		Improved mobility	
	Reduced congestion, increased productivity and growth	Improved road safety	Reduced environmental noise)
	Technology spill overs (e.g. battery technologies for consumer electronics)	Reduced need for car parking	
Renewable energy	Local job creation	Health impacts from improved air quality	Improved air quality
	Increased energy security		

A4.4 Action 24: Intelligent Transport System

Intelligent Transport System (ITS)

Lead Organisation	GAM-MOT-LTRC
Lead Organisation contact	Eng. Najat Tanash (LTRC) Najat.Tanash@ltrc.gov.jo Eng. Hend.Al-Hyari (GAM) Hend.Al-Hyari@AmmanCity.gov.jo

Project description

This 5 year project involves integrating information and communication technologies into transportation in order to increase the efficiency of the system. This includes installation of TV surveillance systems, electronic tracking and electronic payment systems and electric card charging devices. Daily monitoring and maintenance are also an important aspect of this project. Overall, this will deliver improved congestion and reduced journey times

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A4.4.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Supply of smart transportation systems, electronic tracking and television surveillance cameras for 5000 public transport buses	TV surveillance systems	No. of TV surveillance cameras	5000	2020 - 2025	Purchasing and installation costs	3,300	16,500,000
	Electronic tracking systems and electronic payment systems	No. of Automatic fare collection systems	5000	2020 - 2025	Purchasing and installation costs	5030	25,150,000
2. Construction of point sales	Installing of stalls	No. of stalls	10	2020 - 2025	Purchasing and installation costs	7,100	71,000
	Construction of point sales	Point of sale	10	2020 - 2025	Construction material, engineers, labours, etc…	3,070	30,700
	Installing of electric card charging device	Electronic card charging device	10	2020 - 2025	Purchasing and installation costs	34000	340,000
3. Operation of smart transportation systems, electronic tracking and television surveillance cameras for 5000 public transport buses	Daily monitoring and maintenance, training of drivers, and clearing house management for 5 years	No. of years	5	2020 - 2025	Systems operating, monitoring and follow up	5,800,000	29,000,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	Providing sim cards for 5 years	No. of years	5	2020 - 2025	Communications (sim card)	923,000	4,615,000
	Operating stalls	No. of years	5	2020 - 2025	Workers' salaries and utilities fees	570,000	2,850,000
Total Cost							**78,556,700**

A4.4.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
TV surveillance systems	-	-	15,200	-	15,200	-	-		16,484,800
Electronic tracking systems and electronic payment systems	-	-	15,200	-	15,200	-	-		25,134,800
Installing of stalls	-	-	15,200	-	15,200	-	-		55,800
Construction of point sales	-	-	15,200	-	15,200	-	-		15,500

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Installing of electric card charging device	-	-	15,200	-	15,200	-	-		324,800
Daily monitoring and maintenance, training of drivers, and clearing house management for 5 years	-	-	76,000	-	76,000	-	-		28,924,000
Providing sim cards for 5 years	-	-	38,000	-	38,000	-	-		4,577,000
Operating stalls	-	-	38,000	-	38,000	-	-		2,812,000
Total Funding Requirement									**78,328,700**

A4.4.3 Potential Mitigation benefit assessment

Major activity 1 - Supply and operation of smart transportation systems, electronic tracking and television surveillance cameras for 5000 public transport buses

Construction emissions

No scope 1 emissions. Minor scope 2 emissions from energy usage to install surveillance cameras, construction timeframe of which is assumed at 1-5 years. Minor scope 3 emissions likely as a result of transport during site visits.

Operation emissions

Scope 2 emissions from energy usage of surveillance cameras and other computing equipment over 10-40 years.

Emission savings

Potential to make the public transport system more efficient. If the buses are electronically monitored, this will allow for more efficient management through, for example, route choice and fleet dispersal. This will act to reduce congestion, therefore reducing emissions. Also, if electronic payment is improved and made quicker, it will reduce the time taken for buses to leave their engines running and wait, again reducing congestion and emissions. If this is successful in its implementation, the activity is likely to encourage the uptake of public transport, reducing dependency on private vehicles.

Major activity 2 - Construction of point sales

Construction emissions

No scope 1 emissions from construction. Minor scope 2 emissions from energy usage to install point sales meters over a 1-5 year period, and scope 3 emissions likely as a result of transport during site visits to install the point sales meters.

Operation emissions

None

Emission savings

None

Mitigation benefit assessment for whole action:

1	Small reductions in GHG emissions

A4.4.4 Potential Adaptation benefit assessment

No adaptation benefits identified.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

0	The action has no effect on any key factors that influence a sector's vulnerability

A4.4.5 Co-benefits assessment

Economic	Social	Environmental
Reduced congestion	Reduced mortality and injuries from road-related accidents	Improved air quality (reduced PMs, SO2, NOx, other pollutants)
Increased productivity and growth	Reduced health impacts from air pollution	Reduced environmental noise
Long term local job creation		

A4.5 Action 25: Pre-feasibility study for solar powered electric bus fleet

Phase 1: Solar Powered Electric Bus Fleet Pilot in Karak, Ma'an and Tafeilah Governorates

Lead Organisation	MOT-LTRC-Southren Jordan-Municipalities-in Ma'an, Karak, Tafilah governorates.
Lead Organisation contact	Eng. Tamara El-Hreimi (Director of Studies Dep.) Tamara.EL-Hereimi@ltrc.gov.jo

Project description

A project to assess the feasibility of implementing a solar powered electric bus fleet. A pre-feasibility study will be carried out to address applicable technologies and financing requirements to upgrade some of the existing fleet and add additional buses to the fleet.

A4.5.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Pre-feasibility study for the project to address applicable technologies and financing needs (based on specific bus technology, charging stations, onsite solar power for the charging stations vs linking the stations to the grid)	Studying of feasibility to change existing line buses and new buses to electric type	No. of pre-feasibility studies	1	2020 - 2025	Consultation, site survey and transportation	70,000	70,000
Total Cost							**70,000**

A4.5.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Studying of feasibility to change existing line buses and new buses to electric type			1,267		1,267				68,733
Total Funding Requirement									**68,733**

A4.5.3 Potential Mitigation benefit assessment

Major activity 1 - Pre-feasibility study for solar powered electric bus fleet

Direct impact of this action:

Construction emissions

There are currently no plans for construction under this action, and therefore no emissions.

Operation emissions

There will be minor scope 2 emissions from electricity use from the building used to conduct the study, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days to months, and therefore will be minor to insignificant.

Emission savings

This is an **enabling action**. While it does not directly result in emission savings, if it is implemented, it will enable direct emission savings (mitigation benefits) to be realised through a future project (See below).

Potential impact of this action, assuming a solar powered electric bus fleet *is* implemented:

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[41]. Emissions generation will also be dependent on the duration of construction, which could last for up to 5 years. Scope 3 emissions from transport to and from the building site.

Operation emissions

There will be no emissions as the bus fleet will be powered by renewable energy over its operational life-cycle.

Emission savings

There is a large mitigation potential if a solar powered electric bus fleet is implemented, through (1) mode shift of trips from private car and taxi to bus (2) Fuel switch from petrol/diesel to EV, and (3) the use of solar to power charging stations to displace any scope 2 emissions from charging.

A pilot has been prepared for a gradual rollout of EVs in Amman, with an expected next phase including 10,000 EVs and 3,000 charging stations that will be supplied with electricity from a 30 MWh solar farm. The city hopes to further scale the project if the pilot is deemed successful. A 10% shift to solar-powered EVs in Amman would save 120 million litres of fuel and 268,000 tonnes of CO_2[42]. Depending on the percentage of modal shift to solar-powered EVs in Karak, Ma'an and Tafeilah Governorates and the expected fuel savings, it is expected that a rollout in these regions could produce similar emissions savings of 300 tonnes of CO_2 per year.

Mitigation benefit assessment for whole action: based on current activities, 0. This will change to a 2 if the pre-feasibility study is successful and the solar powered electric bus fleet is implemented. Without the study, potential future savings could not be realised. As an **enabling action** it is considered to have an indirect mitigation benefit of 1.

1	Small reductions in GHG emissions

[41] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[42] https://www.c40.org/case_studies/cities100-amman-solar-charged-ev-rollout

A4.5.4 Potential Adaptation benefit assessment

No adaptation benefits identified.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

0	The action has no effect on any key factors that influence a sector's vulnerability

A4.5.5 Indirect co-benefit assessment

Activities	Economic	Social	Environmental
New mass transport – electric buses	Short term job creation from upgrading infrastructure	Reduced health impacts from air pollution	Improved air quality (reduced PMs, SO2, NOx, other pollutants)
		Improved mobility	
	Reduced congestion, increased productivity and growth	Improved road safety	Reduced environmental noise)
	Technology spill overs (e.g. battery technologies for consumer electronics)	Reduced need for car parking	
Renewable energy	Local job creation	Health impacts from improved air quality	Improved air quality
	Increased energy security		

A5 Appendices - Energy Sector Actions contributing to the Jordanian NDC

A5.1 Action 26: Supporting the Manufacturing of Renewable Energy Components

Encouraging and supporting local industries to manufacture renewable energy components

Lead Organisation	JCI
Lead Organisation contact	Eng. Maen Ayasrah maen@jci.org.jo 0787262807

Project description

An action to support local industries in Jordan to manufacture renewable energy and Energy Efficiency Components. This will be done by developing a study, industry guidance and holding a national conference for industries in Jordan, over a 3 year period. The action will be country wide, covering all of Jordan. The main aim is to strengthen this manufacturing sector, enabling benefits to local industries and increased numbers of national renewable energy projects.

A5.1.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Preparation of a study and an introductory guide of the Jordanian industries that manufacture components of renewable energy systems like PV manufacturing components, solar water heaters, small wind turbines, etc and energy efficiency components and systems for example high efficient lighting and home appliances and industrial insulation and building insulation applications.	Data collection and analysis	Consultations and transportation	1	2020 - 2025	Consultation and transportation for a senior expert	16,100	16,100
	Data analysis	Consultations and transportation	4	2020 - 2025	Consultation and transportation for junior engineers	5,200	20,800
2. Design and printing of the study and guideline	Designing and printing	No. of copies	1000	2020 - 2025	Designing and printing fees	12	12,000
3. Holding a national conference over several days (Energy Components Manufacturers' Conference in Jordan) targeting all energy partners, including governmental partners, donors, energy field contractors, etc	Preparation for the conference, inviting stakeholders and host the conference	No. of attendees	1000	2020 - 2025	Communication with stakeholder, transportation, logistical aspects, technical aspects, backdrop, menu and catering, B2B meetings, etc…	68	68,000
Total Cost							**116,900**

A5.1.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Data collection and analysis	-	-	2,000	-	2,000	-	-	-	14,100
Data analysis	-	-	4,000	-	4,000	-	-		16,800
Designing and printing	-	-	1,000	-	1,000	-	-		11,000
Preparation for the conference, inviting stakeholders and host the conference	-	-	8,000	-	8,000	-	-		60,000
Total Funding Requirement									**101,900**

A5.1.3 Potential Mitigation benefit assessment

Major activity 1 – Developing a study and holding a national conference

Operation emissions

Scope 2 emissions from the building used for the conference. Scope 3 emissions from transport to and from the venue.

Emission savings

None until the installation of energy systems is confirmed. Once the manufacturing of renewable energy components begins, there will be large scope for mitigation potential and emissions reductions. There is also potential for a slight emissions increase due to an increase in manufacturing the renewable energy components, but this will likely be negligible in comparison to the emissions savings from renewable energy.

Mitigation benefit assessment for whole action: (based on the current activities).

0	No overall changes to GHG emissions

A5.1.4 Potential Adaptation benefit assessment

Major activity – Study, introductory guide and national conference on renewable energy system

Jordan is currently reliant on fuel imports for its energy consumption, the majority of it being consumed in urban areas. This exposes the country to severe disruption in energy supply, as climate events may cause physical infrastructure damages, conflicts in neighbouring countries, etc.

Building capacity of local manufacturers and industries to manufacture renewable energy components can reduce the dependence on imports and hence reduce the risk of disruption in energy supply that climate change may cause, allowing for consumers to retain stable access electricity and other services.

Adaptation potential

To ensure that these adaptation benefits can be realised, it is key that the guides being developed, and the conference being delivered account for potential future climate events that may have a damaging physical impact on the items being manufactured. In this way, manufacturers would also ensure that the renewable energy system is able to withstand climate change or extreme weather events and hence retaining its capacity to supply.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A5.1.5 Indirect co-benefit assessment

While the conference doesn't deliver the benefits below directly, it will enable the development of manufacturing of RE system which can then lead to these benefits. These should be considered indirect benefits.

Economic	**Social**	**Environmental**
Long term local job creation	Reduced fuel poverty	Improved air quality
Revenue from component sales	(Indirect: Health benefits from improved air quality)	
Possibility of improved prices for renewable energy components		
Improved competitiveness and productivity		
Revenue from energy generation		
Stable power supply for commercial operators		
Reduced price volatility for energy services		

A5.2 Action 27: Utilising the JREEEF Fund

Activating the recently established Jordan Renewable Energy and Energy Efficiency Fund (JREEEF)

Lead Organisation	MEMR/ JREEEF
Lead Organisation contact	Eng. Lina Mobiedeen (Projects Dev Section, Head) Lina.Mobaideen@memr.gov.jo

Project description

This action is based on JREEEF's Strategy and the aim of encouraging investment in renewable energy (RE) and energy efficiency (EE) in small facilities in all sectors. This action aims to make funds available through JREEEF for RE and EE projects across sectors (residential, government and public buildings, agriculture) in small facilities with a focus on PV and energy efficiency measures, such as efficient air conditioning (AC)and installation of Solar Water Heater (SWHs).

A5.2.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Encourage the investment in renewable energy and energy efficiency in residential sector by providing partial grants of at least 30% for the installation of RE &EE systems	Design the right financial support and funding window mechanism with the approval from the JREEEF Board	Financial study	1	2020 - 2025	Consultation	1000	1,000
	Installation of solar water heaters for the households with partial grant of at least 30% of the total cost	SWHs	5000	2020-2025	Average system cost for each system	580	2,900,000
	Installation of roof top PV for the households with systems no greater than 3.6 KW with a partial grant of at least 30% of the total cost	PV system	1000	2020-2025	Average cost per system	2830	2,830,000
2. Encourage the investment in renewable energy in public buildings by providing incentives (partial grant up to 50%, interest loan subsidies, with maximum loan about $22000) for agricultural RE installation projects in cooperation with the Agricultural Credit Institution	Installation of renewable energy systems for small farmers	PV system	133	2020-2025	Total system cost	22770 [43]	3,028,410
3. Encourage the investment in RE & EE for governmental & public buildings for installation	Installation of roof top PV systems/ AC units, and some energy efficiency on schools	PV system / AC Unit	30	2021 -2025	Average cost for each school	86000	2,580,000

[43] 22,000 + 770 (3.5 % interest rate for each loan)

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
RE & EE systems for schools, through the provision of a full grant (100%).							
4. Encourage the investment in renewable energy in public buildings by providing a partial grant of at least 50% (25% from JREEEF , 25% from the ministry of Awqaf and Islamic affairs and 50% from local entity) to install roof top PV systems for worship places	Tendering procedures of the installation of roof top PV systems and reviewing the proposals technically and financially and implementation for the worship buildings.	PV system	150	2020 -2025	Average cost per system	16000	2,400,000
5. Encourage the investment in renewable energy in public buildings for municipalities buildings by providing full grant (100%) for the installation of roof top PV	Installation of roof top PV on the municipalities with average 20 KW for each municipality	PV system for each municipality	100	2020-2025	Average cost system	11000	1,100,000
6. Encourage the investment in renewable energy in public buildings for health centres buildings by providing total grant 100% for the installation of roof top PV the health centres buildings	Installation of roof top PV on the health centres with average 20 KW for each centre	PV system for each centre	100	2020-2025	Average cost system	11000	1,100,000
7. Training programme on energy efficiency and renewable energy management.	Sign needed MOU detailing all needed fees and times and content of each online course and deliver the training courses.	No. of trainees	80	2020-2025	Trainer fees	1,000	80,000
Monitoring and evaluation for JREEEF Program and Projects	Design and implementation of a program for monitoring and evaluating the JREEEF program by a third party	Monitoring and evaluation study for	8	2020-2025	Cost of monitoring and evaluation team and	10000	80,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
		each program			consultants , field visits, measuring equipment , reporting		
Total Cost							**16,099,410**

A5.2.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD				Activity funding: International Funding, USD				Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector/ final beneficiary	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Design the right financial support and funding window mechanism with the approval from the JREEEF Board			1000		1000				
Installation of solar water heaters for the households with partial grant of at	870,000			870,000	1740000				1,160,000

Sub-activities	Activity funding: national contribution, USD				Activity funding: International Funding, USD				Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector/ final beneficiary	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
least 30% of the total cost									
Installation of roof top PV for the households with systems no greater than 3.6 KW with a partial grant of at least 30% of the total cost	191,400			1,138,600	1,330,000				1,500,000
Installation of renewable energy systems for small farmers	102410			1463000	1565410				1463000
Installation of roof top PV systems/ AC units, and some energy efficiency on schools	1,290,000				1,290,000				1,290,000
Tendering procedures of the installation of roof top PV systems and reviewing the proposals technically and financially and implementation	600,000			600,000	1,200,000				1,200,000

Sub-activities	Activity funding: national contribution, USD				Activity funding: International Funding, USD				Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector/ final beneficiary	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
for the worship buildings.									
Installation of roof top PV on the municipalities with average 20 KW for each municipality	110000	990000			1,100,00				
Installation of roof top PV on the health centres with average 20 KW for each centre	550000				550,000				550,000
Sign needed MOU detailing all needed fees and times and content of each online course and deliver the training courses.	20000								60000
Design and implementation of a program for monitoring and evaluating the JREEEF program by a third party					-				80000

Sub-activities	Activity funding: national contribution, USD				Activity funding: International Funding, USD				Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector/ final beneficiary	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Total Funding Requirement									**7,303,000**

A5.2.3 Potential Mitigation benefit assessment

Major activity 1 – Installation of renewable energy and energy efficiency systems (SWH, solar PV), activities 1-6

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[44]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years.

Operation emissions

No GHG emissions from SWH or solar PV, as electricity will no longer be used from the grid.

Emission savings

There is a large potential for mitigation savings. Over a typical operational lifetime of 25-30 years[45], PV will reduce the reliance on the national grid and a reduce the use of fossil fuels. In total, there is expected to be 2,308 units of solar PV systems installed over 5 years. Once these are in operation, assuming 310 days of sunshine a year[46] and 12 hours of operation per day, this action could save 598 tonnes CO_2 per year (based on an average PV size of 5kW and an emission factor for grid electricity of 0.644kg CO_2/kWh[47]).

Major activity 2 – Develop MOUs

There are no GHG emissions production or savings associated with this activity.

Mitigation benefit assessment for whole action:

2	Large reductions in GHG emissions

A5.2.4 Potential Adaptation benefit assessment

Major activity 1- Installation of renewable energy systems

Jordan is currently reliant on fuel imports for its energy consumption, the majority of it being consumed in urban areas. This exposes the country to severe disruption in energy supply, as climate events may cause physical infrastructure damages, conflicts in neighbouring countries, etc.

As for Activity 26, installing renewable energy systems can reduce the dependence on fuel imports and, hence, reduce the risk of disruption in energy supply that climate change may cause, allowing for consumers to retain stable access electricity and other services.

Major activity 2 – Incentives for Energy efficiency

Providing incentives for energy efficiency may reduce demand pressure on energy supply, hence, reducing demand for energy to be imported from traditional sources reduction in import of energy from and encouraging the use of renewable energy as the main source.

Adaptation potential

To ensure that these adaptation benefits can be realised, it is key that the systems being installed take into account potential future climate events that may have a damaging physical impact on them.

[44] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[45] https://circularecology.com/solar-pv-embodied-carbon.html
[46] https://www.jdtours.com/jordan/weather-and-climate.
[47] https://ecometrica.com/assets/Electricity-specific-emission-factors-for-grid-electricity.pdf

Consideration of these events may lead to a different material, location or orientation of the PV systems being chosen to safeguard them from any damages.

Similarly, awareness campaigns should communicate the potential impacts of climate events on the current import-dependent energy system and on the future renewable energy systems in order to highlight the benefits of using renewable energy, as well as the remaining risks, and ensure that financial mechanisms account for potential losses and/or expenses caused by the impacts of climate events on the system.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A5.2.5 Co-benefits assessment

Activities	Economic	Social	Environmental
Renewable energy	Long term local job creation	Reduced fuel poverty	Improved air quality
	Revenue from energy generation		
	Stable power supply for commercial operators	Health benefits from improved air quality	
	Reduced price volatility for energy services		
Energy efficiency	Increased energy security	Health benefits from improved air quality	Improved air quality
	Cost savings due to reduction in energy usage		

A5.3 Action 28: Solar Water Heating

Encouraging the use of solar energy for water heating

Lead Organisation	MEMR/JREEEF, local banks, chambers of commerce and industry, local CBOs
Lead Organisation contact	Eng. Lina Mobiedeen (Projects Dev Section, Head) Lina.Mobaideen@memr.gov.jo

Project description

This project aims to encourage and promote the use of solar energy for water heating by developing an awareness campaign and capacity building for SWH's manufacturers, and all concerned parties. Monitoring and evaluation will be carried out related to the implementation and commissioning of the installation of the SWH's projects.

A5.3.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Capacity building for SWHs Manufacturers, and all the concerned parties	Organize workshops, scoping sessions in all governorates	No. of workshops and awareness sessions	20	2020 - 2025	Cost of activities for workshops and sessions	1,410	28,200
2. Design and implement the appropriate awareness and promoting campaigns	Tendering procedures for the appropriate awareness and promoting campaigns, evaluation, and implementations	No. of awareness activities	48[48]	2020 - 2025	Cost for each awareness Activity and promoting for 4 years	2,817	135,216
3. Monitoring & Evaluation of the ongoing SWHs projects, and evaluate the impact of the awareness campaign	Design and implementation of a program for monitoring and evaluation for JREEEF SWH program by a third party, and evaluate the impact of the awareness campaign	M&E Report	1	2020 - 2025	Consultation, field visit, measurement, reporting	14,085	14,085
Total Cost							**177,501**

[48] 12 per year for 4 years

A5.3.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Organize workshops, scoping sessions in all governorates	7,042				7,042				21,158
Tendering procedures for the appropriate awareness and promoting campaigns, evaluation, and implementations	36,620				36,620				98,596
Design and implementation of a program for monitoring and evaluation for JREEEF SWH program by a third party, and evaluate the impact of the awareness campaign									14,085
Total Funding Requirement									**133,839**

A5.3.3 Potential Mitigation benefit assessment

Major activity – Workshops, awareness campaigns, and monitoring impact of SWH programme

Direct impact of this action:

Construction emissions

There are currently no plans for construction under this action, and therefore no emissions.

Operation emissions

If conducted in a training facility, there will be minor scope 2 emissions from electricity use from the building, and scope 3 emissions from transport to and from the venue. It is assumed that these emissions will occur over a number of days, and therefore will be minor to insignificant.

Emission savings

This is an **enabling action**. While it does not directly result in emission savings, if it is implemented, it will enable direct emission savings (mitigation benefits) to be realised through a future project (See below).

Potential impact of this action, assuming SWH units *are* constructed:

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[49]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions from transport to and from the building site.

Operation emissions

Once the solar water heating has been constructed, there will be large potential for mitigation through a reduced reliance on fossil fuels to heat water while in operation for 10-40 years.

Emission savings

If implemented, the average domestic SHW system can save up to 400kg CO_2 per year[50]. 1500 SWH systems could therefore save 600 tonnes CO_2 per year.

Mitigation benefit assessment for whole action: Based on current activities, 0. Based on the assumption that SWH will be implemented, 2. Without the action, potential savings of SWH implementation could not be realised. As an **enabling action** it is considered to have an indirect mitigation benefit of 1.

1	Small reductions in GHG emissions

A5.3.4 Potential Adaptation benefit assessment

Major activity – Workshops, awareness campaigns, and monitoring impact of SWH's programme

[49] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[50] https://www.greenmatch.co.uk/solar-energy/solar-thermal

Jordan is currently reliant on fuel imports for its energy consumption, the majority of it being consumed in urban areas. This exposes the country to severe disruption in energy supply, as climate events may cause physical infrastructure damages, conflicts in neighbouring countries, etc.

Promoting a mechanism to enable water heating through renewable energy can encourage people to use alternative sources, and in this way reduce dependence on imported energy. This can reduce the risk of disruption in energy supply that climate change may cause, allowing for consumers to retain stable access to heated water. This project may also increase access to heated water to people by depending on local sources, benefitting sanitation and health.

Adaptation potential

As above

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A5.3.5 Indirect co-benefits assessment

Economic	Social	Environmental
Short term local job creation from upgrading infrastructure	Reduced fuel poverty	Improved air quality
Revenue from energy generation		
Stable power supply for commercial operators	Health benefits from improved air quality	
Increased energy security		

A5.4 Action 29: Green Building Codes

Requiring the implementation of green building codes

Lead Organisation	MEMR/JREEEF , local banks, chambers of commerce and industry, local CBOs, CBOs including Jordan GBC
Lead Organisation contact	Eng. Muheeb Arabiyat m.arabiyat@mpwh.gov.jo 0799795663

Project description

This project involves updating and enforcing the legislation framework that would ensure the implementing of national green building codes as a mandatory requirement for building design and construction, thereby resulting in increased standards within buildings. Stages include developing an enforcement strategy and creating a unit for inspection and control to ensure the regulations are complied with.

A5.4.1 Breakdown of actions and costs

Breakdown of action				Times cales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Developing code enforcement strategy and identifying the action plan to support mandatory applying of the codes (180 business days) (Leading entity: Jordan GBC)	Legal framework analysis report (60 business days) and developing Code Enforcement Strategy & action plan (150 business days)	No. of consultants	5	2020 - 2025	1. Legal consultant fees 2. Technical consultant fees 3. Administration & manager fees 4. Coordinator fees 5. Virtual meetings platform fees 6. in person meeting transportation fees 7. Workshops catering fees 8. Workshops Venue fees 9. Workshops printing fees	18,700	93,500
2. Updating legislations by implementing action plan.	New legislations	No. of consultants	4	2020 - 2025	Legal consultant fees, coordinator, meetings, transportation, venue, and printings	5,500	22,000
3. Creating a unit for inspection and control.	Stakeholder engagement to identify suggested scope and objective for the unit. (Leading entity: Jordan GBC)	No. of consultants	4	2020 - 2025	Consultants' fees, coordinator, meetings, transportation, venue, catering and printing	22,000	88,000
	Set targets and KPI's System, Action Plan & Budget.	No. of consultants	3	2020 - 2025	Consultants' fees, coordinator, meetings, transportation, venue and printing	5,500	16,500
	Operate through a pilot project for an already being constructed public building. – (150 – 210 business days) (Leading entity: Jordan GBC)	No. of consultants	6	2020 - 2025	Consultants' fees, site engineers, administration & manager fees, coordination fees, operation and transportation	82,500	495,000

Breakdown of action				Times cales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	Evaluate and modify.	No. of consultants	1	2020 - 2025	Consultants' fees, coordinator, meetings, transportation, venue and printing	11,000	11,000
Total Cost							**726,000**

A5.4.2 National Contribution and Funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Legal framework analysis report (60 business days) and developing Code Enforcement Strategy & action plan (120 business days)	-	-	8,500	-	8,500	-	-		85,000
New legislations	-	-	2,000	-	2,000	-	-		20,000
Stakeholder engagement to identify suggested scope and objective for the unit. (Leading entity: Jordan GBC)	-	-	8,000	-	8,000	-	-		80,000
Set targets and KPI's System, Action Plan & Budget.	-	-	1,500	-	1,500	-	-		15,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Operate through a pilot project for an already being constructed public building. – (150 – 210 business days) (Leading entity: Jordan GBC)	-	-	45,000	-	45,000	-	-		450,000
Evaluate and modify.	-	-	1,000	-	1,000.	-	-		10,000
Total Funding Requirement									**660,000**

A5.4.3 Potential Mitigation benefit assessment

Major activity 1- Green building codes

Direct impact of this action:

Construction emissions

There are currently no plans for construction under this action, and therefore no emissions.

Operation emissions

Scope 2 emissions from venue electricity and minor scope 3 emissions from transport to enable legislation and stakeholder engagement activities, thought to last less than a year.

Emission savings

This is an **enabling action**. While it does not directly result in emission savings, if it is implemented, it will enable direct emission savings (mitigation benefits) to be realised through a future project (See below).

Potential impact of this action, assuming that the Green Building codes *are* implemented:

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[51]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions from transport to and from the building site.

Operation emissions

Green buildings have the potential to reduce emissions through improvements in energy efficiency over their operational timescale assumed at 10-40 years through fuel switching and the integration of renewable energy and low-carbon technologies to supply the building's energy needs. There is also potential for providing the correct resources for waste reduction measures and the enabling of re-use and recycling, which will also act to reduce GHG emissions.

Emission savings

There is large potential for emissions savings from Green Buildings if they are resource efficient throughout the building's lifecycle, from planning to design, construction, operation, maintenance, renovation and demolition.

Mitigation benefit assessment for whole action: Based on current activities, 0. Based on the assumption that Green Building Codes will be implemented, 2. Without the codes, potential future savings could not be realised. As an **enabling action** it is considered to have an indirect mitigation benefit of 1.

1	Small reductions in GHG emissions

[51] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

A5.4.4 Potential Adaptation benefit assessment

Major activity 1- Green building codes

Jordan is currently reliant on fuel imports for its energy consumption, the majority of it being consumed in urban areas. This exposes the country to severe disruption in energy supply, as climate events may cause physical infrastructure damages, conflicts in neighbouring countries, etc.

Ensuring energy efficiency through Green Building Codes may reduce demand pressure on energy supply, hence, reducing demand for energy to be imported from traditional sources and encouraging the use of renewable energy as the main source. Using renewable energy sources can reduce dependence on imports and hence reduce the risk of disruption in energy supply that climate change may cause.

Moreover, buildings are exposed to climate change events. These may cause physical damages and incur financial losses and/or cost to rebuild them, as well as physical injuries among citizens. Embedding climate resilience in the codes to ensure that buildings are not damaged by climate events may reduce the risk of these damages.

Finally, infrastructure building may damage ecosystems and biodiversity (including terrestrial ecosystems (rangelands, forests, etc) and water ecosystems) due to land grabbing, or through an increase in economic activity causing waste being delivered to the surrounding ecosystems and air quality pollution. Green Building Codes can ensure that future infrastructure does not damage ecosystems, hence allowing them to keep providing services that allow for stable food production, freshwater supply, soil stability, etc.

Adaptation potential

To achieve the above-mentioned adaptation benefits, Green Building Codes should not only target energy consumption in buildings but also their impact on ecosystems and their ability to withstand climate events.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

2	The action affects key factors that influence a sector's vulnerability in a way that substantially reduces it, and/or prevents damage that would otherwise substantially increase its vulnerability

A5.4.5 Indirect co-benefits assessment

Economic	Social	Environmental
Long term local job creation	Health impacts from improved air quality	Improved air quality
Increased asset value of buildings		
Cost savings to building owners and occupiers	Increased thermal comfort	
Increased energy security		

A5.5 Action 30: Leadership in Environmental Design applied to new buildings in the public sector

Requiring all new buildings in the public sector to comply with Leadership in Energy & Environmental Design (LEED) or a local rating system of same principles but market-focused

Lead Organisation	Jordan GBC
Lead Organisation contact	Alaa Abdulla alaa.abdulla@jordangbc.org

Project description

The Jordanian Green Building Council have proposed that the public sector should act as leaders in terms of Energy and Environmental design, and wish to develop a green building certification process with this action. This action takes place across Jordan as a whole and will impact all new public sector buildings. This action requires: a study of building energy and technological efficiencies; determination of feasibility through stakeholder engagement; drafting and finalisation of policy documents; and, development of building certification process. As a result, all new public buildings will be efficient and use less fossil fuels for heating, less CFCs for cooling and less electricity for appliances.

A5.5.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Conduct market research to identify relevant market segments and technologies, which would be essential to design or decide on proper certification tool.	Collect and analyse data relevant to assignment via different methodologies: Desk research, surveys, focus groups and several meetings and provide recommendation report (paper) for implementation (60 business days)	No. of consultants	5	2020-2025	1.Legal consultant fees 2.Technical consultant fees 3. Administration & manager fees 4.Coordinator fees 5.Virtual meetings platform fees 6.In person meeting transportation fees 7.Workshops catering fees 8.Workshops Venue fees 9.Workshops printing fees	7,000	35,000
2. Stakeholder mapping to categorize and identify different stakeholders and their roles relevant to designing or deciding on a certification tool, also to build upon in the stakeholders' engagement planning step (next step)	Overview of relevant groups & relevant policies then categorization and Identifying different key stakeholders and their roles and communicate them then review the outcomes (30 business days)	No. of consultants	4	2020 - 2025	1. Communication consultant fees 2.Technical consultant fees 3. Administration & manager fees 4.Coordinator fees 5.Virtual meetings platform fees 6.In person meeting transportation fees 7.Workshops catering fees 8.Workshops Venue fees 9.Workshops printing fees	12,500	50,000
3. Stakeholder engagement to ensure their buy-in and ownership to project, in addition to hearing their input regarding different project outcomes and initial products.	Develop a detailed communication plan, conduct meetings, and workshops for stakeholders, and preparing reports and develop findings & finalising plans based	No. of consultants	4	2020 - 2025	1.Communication consultant fees 2.Technical consultant fees 3. Administration & manager fees 4.Coordinator fees 5.Virtual meetings platform fees 6.In person meeting transportation fees 7.Workshops catering fees	8,750	35,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	on feedback (60 business days)				8.Workshops Venue fees 9.Workshops printing fees		
4. Regulations and law review	Desk research and gathering data, analysing the data and finalizing the report.	No. of consultants	5	2020 - 2025	1.Legal consultant fees 2.Technical consultant fees 3. Administration & manager fees 4.Coordinator fees 5.Virtual meetings platform fees 6.In person meeting transportation fees 7.Workshops catering fees 8.Workshops Venue fees 9.Workshops printing fees	7,000	35,000
5. Developing policy paper to provide comprehensive & persuasive regarding policy and regulatory framework related to green building certification.	Developing policy paper	No. of consultants	4	2020-2025	1.Legal consultant fees 2.Administration & manager fees 3.Coordinator fees 4.In person meeting transportation fees 5.Virtual meetings platform fees	5,000	20,000
6. Design and implement an Advocacy campaign	Design communication plan, develop implementation plan and communication strategy, design messages and planning for activities and implementation of activities	No. of consultants	4	2020 - 2025	1.Communication consultant fees 2.Technical consultant fees 3.Administration & manager fees 4.Coordinator fees 5.Virtual meetings platform fees 6.In person meeting transportation fees 7.Workshops catering fees 8.Workshops Venue fees 9.Workshops printing fees 10.Design Fees 11.Printing fees	23,250	93,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
7. Develop local certification scheme for public building	Developing report related to building stock in Jordan & relevant existing systems, designing Governance and legal framework for program and designing technical aspect of program	No. of consultants	5	2020 - 2025	1.Legal consultant fees 2.Technical consultant fees 3.Administration & manager fees 4.Coordinator fees	105,000	525,000
8. Conduct training for certifying auditors	Develop Training Material and criteria for candidates and deliver Training for candidates & obtaining credential related to certification program.	No. of consultants	4	2020 - 2025	1.Trainers fees 2.Administration & manager fees 3.Marketing & designer fees 4.Coordinator fees 5.In person course venue fees 6.Catering fees 7.Printing fees	9,000	36,000
9. Launch new certification scheme	Prepare marketing campaign, develop certification scheme guides and launching event	No. of consultants	4	2020 - 2025	1.Technical consultant fees 2. Administration & manager fees 3.Coordinator fees 4.Workshops catering fees 5.Workshops Venue fees 6.Workshops printing fees 7.Design Fees 8.Printing fees	8,000	32,000
10. Start the implementation by pilot project	Analysis of an existing building, implementation of strategies and solutions, registering for certification and certification process decide on implementing	No. of experts	7	2020-2025	1.Technical consultant fees 2.Site engineers' fees 3.Manager fees 4.Coordinator fees 5.Certification auditor fees 6.Registration under certification program fees 7.Certification process fees	9,250	64,750

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	strategies and solutions to obtain certificate						
Total Cost							**925,750**

A5.5.2 National contribution and funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Collect and analyse data relevant to assignment via different methodologies: Desk research, surveys, focus groups and several meetings and provide recommendation report (paper) for implementation (60 business days)	-	-	10,000	-	10,000	-	-		25,000
Overview of relevant groups & relevant policies then categorization and Identifying different key stakeholders and their roles and communicate	-	-	10,000	-	10,000	-	-		40,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
them then review the outcomes (30 business days)									
Develop a detailed communication plan, conduct meetings, and workshops for stakeholders, and preparing reports and develop findings & finalising plans based on feedback (60 business days)	-	-	10,000	-	10,000	-	-		25,000
Desk research and gathering data, analysing the data and finalizing the report.			10,000		10,000				25,000
Developing policy paper									20,000
Design communication plan, develop implementation plan and communication strategy, design messages and planning for activities and implementation of activities			10,000		10,000				83,000
Developing report related to building stock in Jordan & relevant existing systems, designing Governance and legal framework for program and designing technical aspect of program									525,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Develop Training Material and criteria for candidates and deliver Training for candidates & obtaining credential related to certification program.									36,000
Prepare marketing campaign, develop certification scheme guides and launching event									32,000
Analysis of an existing building, implementation of strategies and solutions, registering for certification and certification process decide on implementing strategies and solutions to obtain certificate									64,750
Total Funding Requirement									**875,750**

A5.5.3 Potential Mitigation benefit assessment

Major activity 1: Leadership in Environmental Design

Direct impact of this action:

Construction emissions

There are currently no plans for construction under this action, and therefore no emissions.

Operation emissions

Scope 2 emissions from venue electricity and minor scope 3 emissions from transport to enable legislation and stakeholder engagement activities, thought to last less than a year.

Emission savings

This is an **enabling action**. While it does not directly result in emission savings, if it is implemented, it will enable direct emission savings (mitigation benefits) to be realised through a future project (See below).

Potential impact of this action, assuming that public buildings *will* be made more energy efficient under the new green building certification:

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[52]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions from transport to and from the building site.

Operation emissions

There is large potential for emissions savings through the consideration of building materials used, and the building design which can lead to improvements in energy efficiency. The environmental design of buildings can also act to reduce a very small amount of GHGs if walls/roofs are covered with plants.

Emission savings

There is large potential for emissions savings from buildings if they are resource efficient throughout the building's lifecycle of 10-40 years, from planning to design, construction, operation, maintenance, renovation and demolition.

Mitigation benefit assessment for whole action: Based on current activities, 0. Based on the assumption that environmental design measures will be implemented, 2. Without the action, potential future savings could not be realised. As an **enabling action** it is considered to have an indirect mitigation benefit of 1.

1	Small reductions in GHG emissions

[52] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

A5.5.4 Potential Adaptation benefit assessment

Major activity 1: Leadership in Environmental Design

Jordan is currently reliant on fuel imports for its energy consumption, the majority of it being consumed in urban areas. This exposes the country to severe disruption in energy supply, as climate events may cause physical infrastructure damages, conflicts in neighbouring countries, etc.

Promoting energy efficiency in public sector buildings through "Green Environmental design" may act as a catalyst for other buildings to adopt the same design. Overall, these improvements in energy efficiency may reduce demand pressure on energy supply, hence, reducing demand for energy to be imported from traditional sources and encouraging the use of renewable energy as main source. In turn, using renewable energy sources can reduce dependence on imports and hence reduce the risk of disruption in energy supply that climate change may cause.

Adaptation potential

Additional adaptation benefits may be reaped from including resilience into "Green Environmental design" principles, to ensure that public buildings are not only energy efficient but also resilient to climate change or extreme weather events as well as prevent damages to the surrounding ecosystems.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A5.5.5 Indirect co-benefits assessment

Economic	Social	Environmental
Short term local job creation	Health impacts from improved air quality	Improved air quality
Increase in property values through efficiency, 'green' branded buildings	Reduced fuel poverty	
Cost savings to building owners and occupiers	Increased thermal comfort	
Increased energy security		
Increased productivity in commercial buildings		

A5.6 Action 31: Energy Audits to support Energy Efficiency Improvements

Rationalising energy consumption in all sectors, improving their efficiency and raising awareness about the long-term financial benefits of energy efficiency

Lead Organisation	MEMR, MEMR/JREEEF, local banks, chambers of commerce and industry, local CBOs, EDCOs, local banks
Lead Organisation contact	Eng. Lina Mobaideen (Projects Dev Section, Head) Lina.Mobaideen@memr.gov.jo

Project description

MEMR/JREEEF are providing financial support (grant + interest subsidies) for energy audits and the implementation of energy audit outputs in small and medium industrial complexes (factories) and the resultant improvements in relation to energy efficiency. This will be realised through educational tools on the financial benefits of energy efficiency improvements**.**

A5.6.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Energy efficiency programme for small and medium industries in industrial sector	Launch the program	Launching event	1	2020-2025	Launching event	14,085	14,085
	Receive the application from the targeted industries, premium evaluation from all local chambers of industry, then final evaluation from the program technical committee, contracting with the approved industries	No. of approved application	20	2021-2025	Meeting in local champers of industry, meeting of the technical committee, evaluation, reporting	141	2,820
2. Conducting energy audit studies with a partial grant of at least 50% of the total cost of the energy audit studies with a max limit total cost 10000 JD for each study	Support for the submission of technical and financial(T&F) proposals for energy audits from 20 factories	Evaluation report	1	2021-2025	Meeting, evaluation, field visits	1,408	1,408
	Evaluate and approve the T& F proposals for each industry according to certain criteria and conditions approved by JREEEF Board	T&F proposal reports	20	2021-2025	Meetings, evaluation, and validation	141	2,820

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	Conducting energy audit studies in the industries	Energy audit study	20	2021-2025	Cost of the energy audit study that conducting by licenced companies	14,085	281,700
3. Rationalize factory energy consumption by applying the energy audit report outcomes, with a loan from banks (350000 JD max) and interest rate subsidies + loan guarantee from JREEEF	The factory will obtain the financial support to implement energy efficiency measures, having submitted T&F proposals for energy audit measures implementation. The technical committee will evaluate proposals and give recommendations for proceeding, with a financial approval letter for banks to give the targeted industry the loan	Evaluation reports, approved financial letters to the banks	20	2020-2025	Consultation, evaluation, and reporting	141	2,820
	Implement the approved energy efficiency measures	Loans + interest subsidies + loan guarantee	20	2021-2025	Loans from bank (max 350,000) + 4.5% interest (78,750) + 1.5 % loan guarantee (26,250) for 5 years	640,845	12,816,900
4. Monitoring and Evaluation for the implementation the program for each industry	Design an action plan for conducting M& E plan, contracting with third party	Action plan report, contract	1	2021-2025	Consultation & contracting	14,085	14,085

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
	Conducting M& E plan before, during and after energy efficiency measures implementation	Reports	20	2021-2025	Field visits, measurements, equipment, reporting	4,225	84,500
Total Cost							**13,221,078**

A5.6.2 National contribution and funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution private sector / final beneficiary	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Launch the program									14,085
Receive the application from the targeted industries, premium evaluation from all local chambers of industry, then final evaluation from the program technical committee, contracting with the approved industries			2,820		2,820				
Support for the submission of technical and financial			1,408		1,408				

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution private sector / final beneficiary	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
(T&F) proposals for energy audits from 20 factories									
Evaluate and approve the T& F proposals for each industry according to certain criteria and conditions approved by JREEEF Board			2,820		2,820				
Conducting energy audit studies in the industries	70,423			70,423	140,846				140,854
The factory will obtain the financial support to implement energy efficiency measures, having submitted T&F proposals for energy audit measures implementation. The technical committee will evaluate proposals and give recommendations for proceeding, with a financial approval letter for banks to give the targeted industry the loan			2,820		2,820				
Implement the approved energy efficiency measures	1,408,450			1,408,450	2,816,900				10,000,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution private sector / final beneficiary	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Design an action plan for conducting M& E plan, contracting with third party									14,085
Conducting M& E plan before, during and after energy efficiency measures implementation									84,500
Total Funding Requirement									**10,253,524**

A5.6.3 Potential Mitigation benefit assessment

Major activity 1 - Management and monitoring of the energy audit programme, and carrying out energy audits

Construction emissions

No GHG emissions foreseen.

Operation emissions

Minor scope 3 emissions from transport to and from energy audit sites.

Emission savings

While there are no direct emission savings, this is an important enabling action which may indirectly result in significant and long enduring emission savings due to energy standards being audited and energy efficiency improvements being encouraged.

Major activity 2 - Installing EE equipment

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[53]. Scope 3 emissions from transport to and from the building site. These emissions will occur throughout the construction timeline of up to 5 years.

Operation emission

Scope 1 emissions from industrial factories, although these would have already been taking place before the activity. Scope 2 emissions from energy consumption.

Emission savings

GHG savings from more efficient small and medium (SMs) industrial complexes (factories). The scale of this is dependent on the types of EE equipment installed, but mitigation potential is large.

Mitigation benefit assessment for whole action:

2	Large reductions in GHG emissions

A5.6.4 Potential Adaptation benefit assessment

Major activity 1 – Management and monitoring of the energy audit programme, and carrying out energy audits

Jordan is currently reliant on fuel imports for its energy consumption, the majority of it being consumed in urban areas. This exposes the country to severe disruption in energy supply, as climate events may cause physical infrastructure damages, conflicts in neighbouring countries, etc.

Managing and monitoring the energy audit programme, as well as carrying out energy audits, can raise awareness among small and medium industrial complexes of the financial benefits of energy efficiency improvements, which, in turn, could reduce demand pressure on energy supply.

However, the current activities under this action only directly impact energy efficiency and exclude renewable energy from the scope, so adaptation benefits remain minimal.

[53] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

Major activity 2 - Installing energy efficiency equipment

Installing energy efficiency equipment can reduce demand pressure on energy supply, hence, reducing reduction indemand for energy to be imported energy from traditional sources and encouraging the use of renewable energy as the main source. In turn, using renewable energy sources can reduce dependence on imports and, hence, reduce the risk of disruption in energy supply that climate change may cause.

However, the current activities under this action only directly impact energy efficiency and exclude renewable energy from the scope, so adaptation benefits remain minimal.

Adaptation potential

As above.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

0	The action has no effect on any key factors that influence a sector's vulnerability

A5.6.5 Co-benefits assessment

Economic	Social	Environmental
Short term local job creation	Health impacts from improved air quality	Improved air quality
Cost savings through energy efficiency		
Increased energy security	Reduced fuel poverty	Reduced environmental impacts through associated awareness
Increased productivity in commercial buildings		

A5.7 Action 34: Solar Cooling

Expanding the use of solar cooling in commercial and industrial facilities

Lead Organisation	JCI
Lead Organisation contact	Eng. Maen Ayasrah maen@jci.org.jo 0787262807

Project description

JCI are looking to increase the uptake of solar cooling and heating in commercial and industrial facilities across the nation over the course of 5 years, as the use of traditional energy resources is heavily used for such purposes of heating and cooling applications. They will achieve this by raising awareness, identifying the key groups, promoting success stories, conducting a technical study and designing and implementing a pilot study.

A5.7.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	Sub-activities	Unit name	No. of Units		Description of costs	Unit Cost	Total cost of sub-activity
1. Conduct awareness campaign	Forming steering technical team	No. of members	5	2020 - 2025	Steering technical team members fees	3,200	16,000
	Preparing, designing and printing workshop materials; videos, guidelines, brochures, etc	No. of copies	1000	2020 - 2025	Consultations	12	12,000
	Conduct one-workshop in the central region.	No. of attendees	400	2020 - 2025	Menu and catering	55	22,000
	Conduct one-workshop in the northern region.	No. of attendees	400	2020 - 2025	Menu and catering	55	22,000
	Conduct one-workshop in the southern region.	No. of attendees	400	2020 - 2025	Menu and catering	55	22,000
	Activate other tools for awareness; (email, media (TV, radio and newspapers) social media, design smartphone application; to ensure awareness of all targeted groups	No. of tools	5	2020 - 2025	Designing and advertising	6,000	30,000

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
2. Conduct technical study in the targeted industrial subsectors to identify the most potential sectors to achieve savings in solar heating. (Before networking)	Data collection and analysis	No. of experts	5	2020 - 2025	Consultation and transportation	7,000	35,000
3. Networking between stakeholders including promotion of previous success stories	Data collection and analysis	No. of experts	5	2020 - 2025	Consultation and transportation	7,000	35,000
	Identify target groups of stakeholders to include, governmental parties, manufacturers, targeted industries, financing agencies and M&E consultant.	Consultation	1	2020 - 2025	Meetings, transportation and logistics	5,000	5,000
	Design and printing of success stories guidebooks	No. of copies	1000	2020 - 2025	Designing and printing fees	12	12,000
4. Designing and implementing of pilot projects by networking between the targeted groups.	Field visits	No. of projects	5	2020 - 2025	Logistics, transportation meetings & implementation	17,000	85,000
Total Cost							**296,000**

A5.7.2 National contribution and funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Forming steering technical team	-	-	1,000	-	1,000	-	-		15,000
Preparing, designing and printing workshop materials; videos, guidelines, brochures, etc	-	-	2,000	-	2,000	-	-		10,000
Conduct one-workshop in the central region.	-	-	1,000	-	1,000	-	-		21,000
Conduct one-workshop in the northern region.	-	-	1,000	-	1,000	-	-		21,000
Conduct one-workshop in the southern region.	-	-	1,000	-	1,000	-	-		21,000
Activate other tools for awareness; (email, media (TV, radio and newspapers) social media, design smartphone application; to ensure awareness of all targeted groups	-	-	4,000	-	4,000	-	-		26,000
Data collection and analysis	-	-	5,000	-	5,000	-	-		30,000

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Data collection and analysis	-	-	3,000	-	3,000	-	-		32,000
Identify target groups of stakeholders to include, governmental parties, manufacturers, targeted industries, financing agencies and M&E consultant.			1,000	-	1,000	-	-		4,000
Design and printing of success stories guidebooks	-	-	1,000	-	1,000	-	-		11,000
Field visits	-	-	5,000	75,000	80,000	-	-		5,000
Total Funding Requirement									**196,000**

A5.7.3 Potential Mitigation benefit assessment

Major activity 1 – Awareness campaign, technology study, stakeholder networking

Operation emissions

Minor scope 3 GHG emissions foreseen from transportation to and from campaign sites.

Major activity 2 – Implementation of solar cooling technology

Construction emissions

No direct scope 1 sources of GHG emissions from construction. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[54]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions from transport to and from the site.

Operation emissions

Significant GHG savings as a result of reduced reliance the national grid for electricity over operational timescale of 10-40 years. The full benefit of solar cooling would be realised when used in conjunction with energy efficiency home standards.

Emission savings

Yes, once the solar cooling technologies have been implemented. Solar cooling systems can result in electricity savings of up to 95%[55].

Mitigation benefit assessment for whole action:

1	Small reductions in GHG emissions

A5.7.4 Potential Adaptation benefit assessment

Major activity – solar cooling

Jordan's energy consumption (the majority in urban areas) is currently reliant on fuel imports, which exposes the country to potentially severe disruption to its energy supply, as climate change and extreme weather events may cause physical damage to infrastructure, conflicts in neighbouring countries, etc.

Increasing and promoting the uptake of solar cooling and heating in commercial and industrial facilities can reduce dependence on imports by rising reliance on renewable energy locally. Hence, it may reduce the risk of disruption in energy supply that climate change may cause, and ensure consumers retain access to cooling. In turn stable access to cooling reduces potential negative impacts from heat such as physical damages to infrastructure and IT networks as well as health issues.

Adaptation potential

As above

Adaptation benefit assessment for whole action

[54] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view
[55] https://www.intechopen.com/books/energy-conversion-current-technologies-and-future-trends/solar-cooling-technologies

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

1	The action affects key factors that influence a sector's vulnerability in a way that reduces it, and/or prevents damage that would otherwise increase its vulnerability

A5.7.5 Co-benefits assessment

Economic	**Social**	**Environmental**
Short term local job creation from upgrading infrastructure	Reduced fuel poverty	Improved air quality
Reduced price volatility for energy services		
Stable power supply for commercial operators	Health impacts from improved air quality	
Increased energy security		

A5.8 Action 35: Hydro Pumped Storage

Hydro pumped storage

Lead Organisation	Ministry of Energy, private sector, NEPCO
Lead Organisation contact	Eng. Rasha Hudeeb rasha.Hudeeb@memr.gov.jo

Project description

This project involves building a hydro pumped storage site where a feasibility study will first be undertaken. If the project is deemed to be feasible, later stages of this project will involve construction and commissioning of the hydro pumped storage.

A5.8.1 Breakdown of actions and costs

Breakdown of action				Timescales	Costs (USD)		
Breakdown of action into activities	**Sub-activities**	**Unit name**	**No. of Units**		**Description of costs**	**Unit Cost**	**Total cost of sub-activity**
1. Conduct a Feasibility Study for the project	Feasibility study is currently under tendering from the GIZ, consultant is expected to start work by end of 2020	No. of studies	1	2020-2025	Cost of feasibility study	1,900,000	1,900,000
2. (If feasible) and based on the best identified business model for the project, project tender will be prepared, issued and evaluated. In order to select project developer/contractor	Select Consultant to Prepare Tender Documents including detailed project design, and contractor requirements, technical proposals evaluation, implementation and supervision.	No. of consultants	4	2020-2025	Consultations, designing, experts, meeting and transportation	137,500	550,000
3. Environmental Impact Assessment	Perform Environmental & Social Impact Assessment According to the MoEnv. Requirements	Consultations	1	2020 - 2025	Consultants, Field Visits, Air Quality Measurements, Reporting and Printing	47,300	47,300
4. Project Implementation	Project Construction (Construction of reservoirs)	No. of reservoirs	2	2020-2025	Construction material, tunnels, motors, powerhouses, labours, engineers and transportation	57,750,000	115,500,000
	Project Commissioning and operation	No. of reservoirs	2	2020-2025	Labours, engineers, supervision, substation, and utilities fees	57,750,000	115,500,000
Total Cost							**233,497,300**

A5.8.2 National contribution and funding

Sub-activities	Activity funding: national contribution, USD					Activity funding: International Funding, USD			Funding Required, USD
	Fiscal Incentives	Grants	Help-in-kind	Contribution from private sector	Total National Contribution	Awarded since NDC Adopted (insert date)	Submitted, Awaiting Decision	Total international contribution	
Feasibility study is currently under tendering from the GIZ, consultant is expected to start work by end of 2020	-	-	172,727	-	172,727	1,727,273	-	1,727,273	
Select Consultant to Prepare Tender Documents including detailed project design, and contractor requirements.	-	-	50,000	-	50,000	-	-		500,000
Perform Environmental & Social Impact Assessment	-	-	4,300	-	4,300	-	-		43,000
Project Construction (Construction of reservoirs)	-	-	5,775,000	-	5,775,000	-	-		109,725,000
Project Commissioning	-	-	5,775,000	-	5,775,000	-	-		109,725,000
Total Funding Requirement									**219,993,000**

A5.8.3 Potential Mitigation benefit assessment

Major activity – Project implementation

Construction emissions

The construction of reservoirs will involve no direct scope 1 sources of GHG emissions. Scope 2 emissions are likely to include those from: demolition and site preparation, electrical, plumbing and other construction (building activities such as concrete, mortar and plaster mixing, cutting, grinding, wielding etc) installation activities, building completion and finishing[56]. Emissions generation will also be dependent on the duration of construction, which is thought to last for up to 5 years. Scope 3 emissions from transport during site visits.

Operation emissions

Scope 3 emissions from site visits during equipment maintenance.

Emission savings

Yes, as the generation of electricity from zero emission renewable energy sources such as hydro displace the electricity that would be produced from a fossil fuel plant.

Mitigation benefit assessment for whole action:

1	Small reductions in GHG emissions

A5.8.4 Potential Adaptation benefit assessment

Major activity – Project implementation

Construction

No adaptation benefits are foreseen as part of the construction phase.

Operation

Jordan's energy consumption (the majority in urban areas) is currently reliant on fuel imports, which exposes the country to potentially severe disruption to its energy supply, as climate change and extreme weather events may cause physical damage to infrastructure, conflicts in neighbouring countries, etc.

Provision of hydro-pumped storage may reduce dependence on fuel imports. Hence, it may reduce the risk of disruption in energy supply that climate change may cause and ensure consumers retain access to energy. However, water resources in Jordan are scarce, demands for water resources by other sectors (including urban, agriculture and health) are increasing due to population growth, and existing water levels are declining. Thus, using hydro-pumped storage may put further strain on scarce water resources and/or accelerate their depletion.

Adaptation potential

To ensure that this action does not have disbenefits, it is vital that:

- The feasibility study takes into account future climate projections and their impact on the water sector, as well as projections of the level of demand for water resources from other sectors, in order to determine how to minimise the action's negative impacts on water availability
- Construction of the storage facility should be subject to, and comply with, the results of a social and environmental impact assessment (EIA) to ensure that materials and building

[56] EMEP EEA Guidebook 2019 2.A.5.b: https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-5-b-construction/view

processes are resilient to potential damage caused by climate change or extreme weather events that might otherwise give rise to physical damage and disruption to energy supply.

Adaptation benefit assessment for whole action

The single rating below is conditional on the undertaking of measures described under the "Adaptation Potential" section that stakeholders have confirmed can be implemented, so is a 'potential' score.

-1	The action could affect key factors that influence a sector's vulnerability in a way that increases it if conditions are not met.

A5.8.5 Co-benefits assessment

Economic	Social	Environmental
Long term local job creation	Reduced fuel poverty	Improved air quality
Increased energy security	Possible water management	
Revenue from energy generation	Health impacts from improved air quality	
Reduced price volatility for energy services		

A6 Appendices - Key factors that result in sectors having high vulnerability[57]

Sector	Climate sensitivity[58] factors	Adaptive capacity[59] factors
Water	• Initial scarcity of water resources • Need recharge and replenishment of surface water and groundwater reserves • Increases in demand reducing share	• Low income reducing ability to replace traditional water supplies with new methods that require more spending (purchasing drinking water from tanks) • Pipe state (corrosion in drier months during intermittent supply) • Additional storage media such as tanks on top of houses • Rainwater harvesting (RwH) • Purchase of filtered water or use water purification systems • Water storage • Government capacity for water provision • Public awareness • Financial resources • Public strategy
Agriculture	• Crop flowering stage is dependent on temperatures • Crop physiological processes related to growth such as photosynthesis and respiration also need an ideal temperature ("temperature optima conditions") • 70% agriculture is rain-fed = high water dependency (depends on the level of precipitation and on the level of evaporation) • Fodder dependent on crop residue • Health depends on pests and diseases • Crop development depends on season's length for proper assimilation of dry matter • Tuber induction and development depends on water availability • Dependent on soil resources	• Additional storage means • Rainwater harvesting (RwH) • Water storage • Drip irrigation • Planting crops that require less water • Farmers' decisions about when to cultivate, sow and harvest. • Soil water holding capacity

[57] Vulnerability: "The propensity or predisposition to be adversely affected" (IPCC 2014 and 2018)
[58] Climate sensitivity: "The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change" (IPCC, 2014 and 2018)
[59] Adaptive capacity: "The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC 2014 and 2018))

Sector	Climate sensitivity[58] factors	Adaptive capacity[59] factors
Health	• Health dependent on air quality • Health dependent on food quality • Health dependent on water quality • Health dependent on solar ultraviolet radiation's exposure • Diseases spread and transmission depends on vectors' development • Diseases caused by microorganism growing depending on temperature • Pre-existing chronic conditions depend on balance of temperature and humidity levels	• Surveillance • Monitoring • Response to infectious disease • Awareness • Extra support for the communities • Availability of data • Health infrastructure • Trained professionals • Access to care and medication • Education • Guidelines and emergency plans
Biodiversity	• Moisture dependence • Reliance on overall ecosystem's health • Human pressure	• Species capacity to move and migrate • Species evolutionary adaptation (for short life-cycle species) • Species' drought tolerance characteristics • Level of species' diversity • Percentage of vegetation under protection areas
Coastal Zone Management	• Depends on sea level, itself depending on changes in ocean circulation, thermal expansion, land movements • Reliance on water salinity, turbidity, temperature, and disruption of microbiological activity and life cycles of flora and fauna • Species and habitats reliance on sea surface temperature • Absence of diseases depending on water oxygenation levels (lower solubility of O2) • Dependence on pH level • Species' dependence on tidal height and tidal range effects on available light, current velocities, depth and salinity distribution • High rate of endemism defining tolerance to changing climate and invasive species	• Flood diversion channels • Awareness among decision-makers • Awareness among general public • Data availability • Consideration of CC in planning a long-term management plan for coastal areas • Geographically restricted coastline
Urban sector	• Reliance on electricity provision • Reliance on energy availability • Reliance on functioning road network • Interconnection and dependence between these built hard and soft	• Economic resources • Technology • Information • Awareness • Skills

Sector	Climate sensitivity[58] factors	Adaptive capacity[59] factors
	• infrastructures (social, education, health, etc)	• Human resources • Infrastructure (infrastructure age and/or by demand levels exceeding what they were designed to deliver) • Institutional support and governance

Source: Jordan's third National Communication on Climate Change (2014)