ESIA

Abour Wind Farm

Abour Energy Company Wind Farm
Abour, Governorate of Tafila - Jordan

Environmental and Social Impact Assessment Report

Project Developer:
Abour Energy Company PSC

December 2016

EXECUTIVE SUMMARY

1. PROJECT DESCRIPTION

1.1 Introduction

Jordan is committed to increasing the share of Renewable Energies (RE) in generation of electricity to 10% by 2020. Major share of RE is to come from Wind Power (1,200 MW) and Solar Power (600 MW).

Abour Energy Company ("AEC") was established in 2013 by Xenel International under the laws of The Hashemite Kingdom of Jordan as a Private Shareholding Company. The purpose of AEC is to develop, own and operate a wind farm project comprising of 15 Vestas V136 / 3.45 MW turbines, having a total installed capacity of 51.75 MW, to be located in the Village of Abour in the Governorate of Tafila. The annual electrical energy to be generated by the wind farm is estimated at 152 GWh. The wind farm will be connected to the 132 kV transmission grid system of National Electric Power Company ("NEPCO").

1.2 Project Components

The Project will comprise:

- 15 x Vestas V136- 3.45 MW wind turbine generators;
- Turbine foundations;
- Existing and new onsite access roads;
- A 33 kV internal grid network using underground cables to connect the 15 wind turbines to the Project substation;
- A Project substation incorporating 2 x 33/132 kV step-up transformers, switchgear, electrical protection, metering, communications and monitoring, and weather and safety protection equipment.

1.3 Project Location

The Project site is located 140 km south of Amman. Communities that are located in the vicinity of the Project site include:

- Town of Tafila: about (8.3) km northwest of the Project site;
- Village of Umm Sarab: about (4.2) km southwest of the Project site; and
- Village of Alayn Al-Byyda: about (8) km west of the Project site.

2. ESIA TERMS OF REFERENCE

The Environmental and Social Impact Assessment ("ESIA") has focused on identifying, analyzing, assessing, and mitigating impacts on the following Valued Environmental Components ("VECs"):

- Public health;
- Occupational health and safety;
- Water resources;
- Socio-economic conditions;
- Archaeology;
- Biodiversity; and
- Traffic.

Socio-economic Conditions

Issue	Construction phase	Operation phase	Decommissioning phase
Employment	√	√	√
Landscape and visual impact and aesthetics	√	√	√
Land use	√	√	√
Business prosperity	√	√	
Stress on infrastructure	√	√	√
Land acquisition and Resettlement	√		
Impact on tourism		√	

Water Resources

Issue	Construction phase	Operation phase	Decommissioning phase
Long term impacts on topsoil and erosion	√	√	√
Wastewater disposal and its impact on groundwater resources	√	√	√

Solid waste and its impact on surface and ground water resources	√	√	√
Water Requirements	√	√	
Floods and rainfall	√	√	

Public Health

Issue	Construction phase	Operation phase	Decommissioning phase
Accidents risks	√	√	√
Ambient air quality (dust)	√		√
Noise	√	√	√
Shadow flickering		√	
Icing/ Ice throw		√	
Aviation & radar		√	
Telecommunication / EMI links		√	
Domestic wastewater	√	√	√
Domestic solid waste	√	√	√
Public Safety	√	√	

Occupational Health and Safety

Issue	Construction phase	Operation phase	Decommissioning phase
Medical care and health Insurance	√	√	√
Domestic wastewater	√	√	√
Domestic solid waste	√	√	√
Ambient air quality (dust)	√		√
Noise	√	√	√
Accidents impact	√	√	√

Shadow flickering		√	
Icing/ Ice throw		√	
Aviation & radar		√	
Telecommunication / EMI links		√	
Personal Protection Equipment (PPE)	√	√	
Availability of Emergency Plan	√	√	

Archaeology

Issues	**Construction phase**
Remaining archaeology	√
List of monuments / remains recorded	√

Biodiversity

Issue	**Construction phase**	**Operation phase**	**Decommissioning phase**
Impact on flora	√	√	√
Impact on Wildlife	√	√	√
Impact on Migratory Birds	√	√	√
Impact on habitats	√	√	√

Traffic

Issues	**Construction phase**	**Operation phase**	**Decommissioning phase**
Transportation of equipment & construction materials	√		
Traffic volume	√	√	√
Impact on roads and	√	√	√

transportation infrastructure			

3. RELEVANT LEGAL FRAMEWORK

3.1 Relevant National Legislation

Laws

- The Environment Protection Law No. 52 Year 2006.
- Renewable Energy and Energy Efficiency Law No. 2 Year 2015.
- General Electricity Law Temporary Law No. 64 Year 2002.
- Traffic Law No. 49 Year 2008.
- General Health Law No. 47 Year 2008.
- The Antiquities Law No. 21, Year 1988 and its amendments.
- Transportation Law (89/2003)
- Agricultural Law No. 13 Year 2015.
- Trade, Industry and Occupation Safety Law No. 16 Year 1953.
- Civil Defense Law No. 18 Year 1999.
- Labour Law No. 8 Year 1996 and its amendments.
- Water Authority Law and its amendments No. 18 Year 1988.
- The Organization of the Natural Resources Affairs Law No. 12 Year 1968.
- Acquisition Law No. 12 Year 1987.
- Compensation Law Year 1987.

Regulations

- The Environmental Impact Assessment Regulation No. 37 Year 2005.
- The Bylaw on Regulating Procedures and Means of Conserving Energy and Improving its Efficiency No. 73 Year 2012.
- Land use planning Regulation No. 6 Year 2007.
- Natural Reserves and National Parks Regulation No. 29 Year 2005.
- Soil Protection Regulation No. 25 Year 2005.
- Regulation of Solid Waste Management No. 27 Year 2005.
- Air Protection Regulation No. 28 Year 2005.
- Groundwater Control Regulation No. 85 Year 2002

Standards

- Jordanian Standard for reclaimed domestic wastewater (JS 893/2006).
- Jordanian Standard for drinking water (JS 286/2008).
- Jordanian Standard for Ambient Air Quality (JS 1140/2006).

Instructions

- Instructions for Protection of Birds and Wildlife and rules covering their hunting No.34 Year 2003.
- Instructions on the Protection of water Resources Year 2012.
- Instructions for Recycling and Handling of Consumed Oils Year 2014.
- Instructions for the Limitation and Control of Noise Year 2003.
- Instructions No. 1 Year 2013 for the prevention of occupational hazards related to health hazards resulting from labour housing units' onsite.

Guidelines

- Guidelines for limiting exposure to time-varying Electric, Magnetic and Electromagnetic fields, issued in accordance to articles (6/b and 48) of the Telecommunication Law.
- Drinking Water Resources Protection Guideline, July 2006.

3.2 International Standards

- IFC Policy and Performance Standards on Social and Environmental Sustainability:
  - IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.
  - IFC Performance Standard 2: Labour and Working Conditions.
  - IFC Performance Standard 3: Resource Efficiency and Pollution Prevention.
  - IFC Performance Standard 4: Community, Health, Safety and Security.
  - IFC Performance Standard 5: Land Acquisition and Involuntary Resettlement.
  - IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
  - IFC Performance Standard 7: Indigenous People, Year 2012.
  - IFC Performance Standard 8: Cultural Heritage.
- IFC Guidance Notes:

  - IFC General Environmental, Health and Safety Guidelines, Year 2007.
  - IFC General Environmental, Health and Safety Guidelines for Wind, Year 2007.
- IFC Operational Policy OP 4.01 Environmental Assessment, October 1998 (Revised April 2013).
- IFC Operational Policy OP 4.04 Natural Habitats, November 1998 (Revised April 2013).

4. SOCIOECONOMIC ASSESSMENT AND MITIGATION PLAN

4.1 Baseline

The baseline socio-economic conditions provide a summary of the relevant socio-economic data and information collected.

- Overview of Project Area: Tafila Governorate, districts, sub-districts, and the administrative structure of Project area;
- Demographics: Population and housing for Jordan in general, and the focus area in particular;
- Medical Provisions: Statistics on hospitals and health care facilities in the area;
- Land use/land use plans and patterns: Including agriculture (types of crops and annual productions), and industrial facilities; and
- Economic Activity: Educational institutions, transportation (road, rail, air), communication and overall economy (i.e. employment and revenue for agriculture and industry).

Introduction

Global energy supply is dominated by fossil fuels, natural gas and oil products. Lacking its own fossil fuel resources, Jordan is highly dependent on imports, costing the country the equivalent of 19.5% of GDP. At the same time, demand for energy in general, and electricity in particular, is growing at an average rate of 7.4% annually since 2004[1].

Jordan is committed to increasing the share of Renewable Energies (RE) to 10% by 2020. The major share of RE is to come from Wind Power (1,200 MW) and Solar Power (600 MW). At the same time, Jordan is committed to adapting the electricity network to address the challenge of increasing electricity demand and fluctuating input from RE. Jordan's Energy Strategy for 2020 is given below in Figure 1-1.

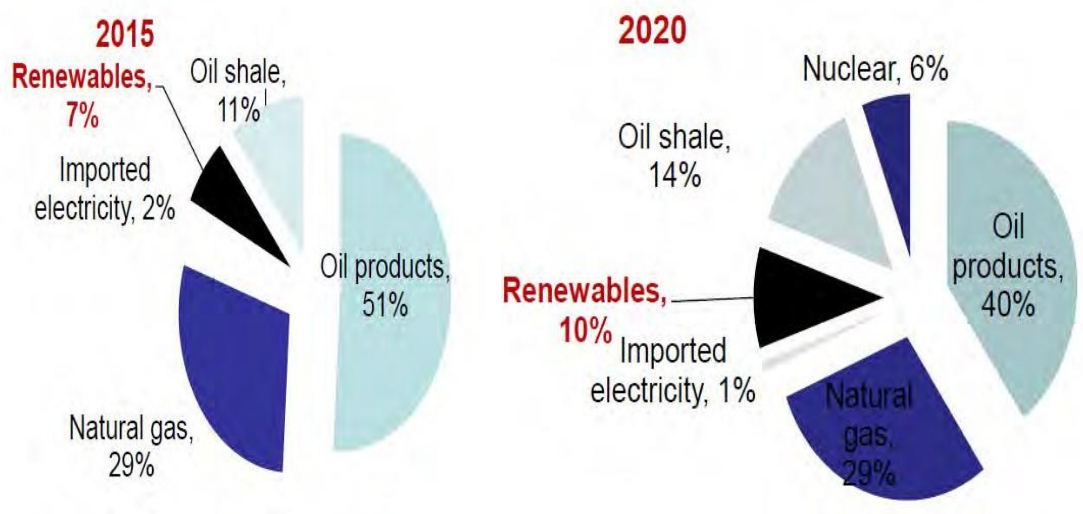

Figure 1-1 Jordan's Energy Strategy for 2020

Proposed Project

Abour Energy Company ("AEC") was established in 2013 by Xenel International under the laws of The Hashemite Kingdom of Jordan as a Private Shareholding Company ("PSC"). The purpose of AEC is to develop, own and operate a wind farm project comprising of 15 Vestas V136 / 3.45 MW turbines, having a total installed capacity of 51.75 MW, to be located in the region of Abour in the Governorate of Tafila (the "Project"). The annual electrical energy to be generated by the wind farm is estimated at 152 million kWh. The wind farm will be connected to the 132 kV transmission grid system of National Electric Power

[1] National Centre for Research & Development/Energy Research Program (NERC)

Company (“NEPCO”). The proposed Project is being developed in accordance with the national energy strategy of Jordan, within the framework of the Renewable Energy and Energy Efficiency Law of 2012, which was enacted for the purpose of diversifying sources for electricity generation and promoting use of renewable energy.

Electricity Generation in Jordan

In 2012 total electricity generation in Jordan was 16,595 GWh and was made available to 99% percent of a population of 6.4 million. Natural gas was the primary fuel used for the generation of 90% of generated electricity in 2009. However, due to disruptions to the natural gas supply from Egypt in recent years, natural gas accounted for only 20% of electricity generation in Jordan in 2012; the balance of electricity generation requirements was shifted to costly liquid fuels, such as heavy fuel and distillate oil. It is estimated that relying on heavy and distillate oils as primary energy sources raised the cost of electricity generation alone (excluding transmission and distribution) to as high as 18 US cents/kWh. It is important to note that with the completion of the receiving LNG terminal at the Port of Aqaba in 2015, imports of natural gas to Jordan was resumed and substantial savings are being made in the cost of electricity generation. Peak historical and forecasted (MW) electricity demand in Jordan (according to the 2012 NEPCO Annual Report) is shown in below in Figure 1-2 .

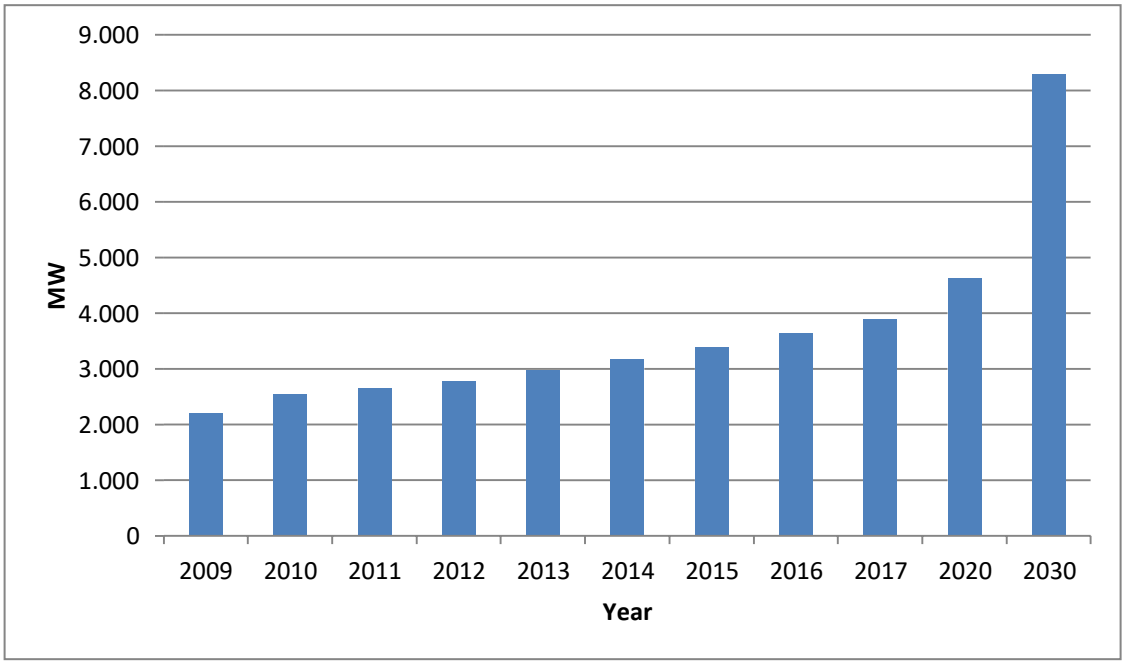

Figure 1-2 Electricity Peak Demand in Jordan

Project Background

To address its dependence on foreign supply of fossil fuels, Jordan's Ministry of Energy and Mineral Resources ("MEMR") embarked on an aggressive program to increase the country's use of domestic renewable energy sources with the enactment of the Renewable Energy and Energy Efficiency Law of 2012.

Jordan has the 8th largest oil shale reserves in the world. Currently, the government has started to implement a comprehensive strategy for oil shale development. This is due to many factors such as the dramatic rise of the global oil prices in recent past (notwithstanding the sharp decreases in oil prices at the time of writing of this report) which has directly affected the government's budget and Jordan's GNP and the willingness of interested investors and companies that have approached MEMR to exploit oil shale for producing crude oil and for power generation (*MEMR, 2015*).

In addition to developing locally available oil shale as a primary energy source for electricity generation, another objective of the program is to increase contributions from renewable energy sources, such as wind and solar, from 1% in 2012, to 7% by 2015, and 10% by 2020. The driving force behind the development of renewable energy projects is MEMR's "Investment Opportunity in Renewable Energy Projects in Jordan" initiative.

In November 2013, Jordan Wind Power Company ("JWPC"), the first major wind farm project in Jordan with a capacity of 117 MW achieved financial close. This project deploys 39 Vestas wind turbines, each with a capacity of 3.0 MW, and was commissioned in the fourth quarter of 2015.

The 50 MW wind farm of Abour Energy Company ("AEC") is another example of the drive by MEMR to capture domestically available sources of energy. When completed in 2019, this Project will contribute approximately 152 GWh of electrical energy to the interconnected system of NEPCO.

Project Components

The Project will comprise:

- 15 x Vestas V136- 3.45 MW wind turbine generators;
- Turbine foundations;
- Existing and new onsite access roads;
- A 33 kV internal grid network using underground cables to connect turbines to theProject substation;
- A Project substation incorporating 2 x 33/132 kV step-up transformers, switchgear,electrical protection, metering, communications and monitoring, and weather and safety protection equipment.

Wind Turbine Generator

Overview

The Vestas V136 is a 3.45 MW three-bladed upwind pitch-regulated variable speed-wind turbine designed for medium wind speed sites. It combines a gearbox with an asynchronous generator and full power conversion to aid grid compliance. It has a 136 m rotor and will be supplied with a tower allowing a 112 m AGL hub height, certified to withstand IEC Class 1B/2A site conditions. The turbine design life is 20 years. Figure 1-6 below identifies its various external (dark blue) and internal (light blue) components.

Figure 1-6 Vestas V136 Wind Turbine

SCOPING AND ESIA TERMS OF REFERENCE

Introduction

The Environmental and Social Impact Assessment is an assessment of the possible impact – positive or negative – that a proposed project may have on the natural, social and economic environments.

The legal system in Jordan includes the requirements and instructions for protecting the environment, so that the project owner takes the responsibility for any project impact that is likely to affect the environment. These requirements fall within the framework of the legal system. These include requirements to conduct environmental assessment procedures which are necessary to prevent the negative effects on the environment and improve the economic efficiency of the project.

The Scoping Stage is the first stage of the ESIA conducted by the consultant and it marks the start of the ESIA study. In this stage stakeholders have the opportunity to participate in the ESIA process and to be introduced to the Project. One of the main purposes of the Scoping Stage is to get the public and the regulatory authorities involved in the course of the ESIA and to denote their concerns about the Project in a formal manner.

Scoping

Objectives

The following are some of the main objectives of the scoping stage:

- Identify key environmental issues to be included in the assessment.
- Identify legal requirements and framework for the Project through its life.
- Identify relevant component studies to establish the appropriate baseline for the area of the Project.
- Finalize the proposed Terms of References (TORs).

Methodology

The following methodology was used to fulfil the above-mentioned objectives:

- Decision was made by the Ministry of Environment (MoEnv) to conduct a Scoping Session for the purpose of the ESIA in accordance with MoEnv / ESIA regulations for the Project.
- A list of potential and relevant stakeholders was prepared by MoEnv.

- Invitation letters were issued by MoEnv. The letters included the date and place of the Scoping Session (December 28th, 2015 at the Holiday Inn Hotel - Amman).

Scoping Session

The Scoping Session was held in Amman at the Holiday Inn hotel on December 28th, 2015. Invited stakeholders including organizations from the public and private sectors in addition to NGOs attended this session. A list of the scoping session attendees is provided in Annex I.

The session consisted of the following activities:

- Presentation about the Project activities, components and locations, was given by the ESIA team leader Eng. Hamed Ajarmeh (Al-Rawabi Company). The presentation highlighted details of the Project and the need for identifying potential interactions between the Project activities and the Valued Environmental Components ("VECs").

- The participants were then asked to review the legal requirements and the proposed TORs (which were shown in the second part of the presentation) and provide any necessary legal requirements and suggest TORs changes or additions.

- The participants were provided with a special form to write down their concerns about the Project as a function of the following VECs and they were given the right amount of time needed to do so:

  - ✓ Public health;
  - ✓ Occupational health and safety;
  - ✓ Water resources;
  - ✓ Socio-economic conditions;
  - ✓ Archaeology; and
  - ✓ Biodiversity.

- All forms were collected from the participants by the MoEnv representative and a copy of the forms was provided to the ESIA consultant to prepare the Scoping Report and to carry out the ESIA.
- Photos from the scoping session is presented below in Figure 2-1, Figure 2-2 and Figure 2-3.

Figure 2-1 Scoping Session

Figure 2-2 Scoping Session

Figure 2-3 MoEnv Representatives

ESIA Scope of Work

The ESIA will include the following stages:

- Relevant Baseline: Component studies will be launched to enable describing the relevant existing environmental conditions.
- Assessing: This will include evaluation of interactions between the Project activities and all related environmental components.
- Impact Management: An environmental management plan (EMP) including mitigation measures and monitoring programs will be produced.
- Reporting: ESIA main and EMP draft reports will be provided for the purpose of review by MoEnv.
- Reviewing: Reviewing the reports is the responsibility of MoEnv.
- Finalizing the report and submitting the final version to MoEnv after incorporating required remarks to the draft reports.

ESIA Valued Environmental Components

The ESIA will be focused on identifying, analyzing, assessing, and mitigating impacts on the following VECs:

- Public health;
- Occupational health and safety;
- Water resources;
- Socio-economic conditions;
- Archaeology;
- Biodiversity; and
- Traffic.

The following tables present the issues resulting from the proposed TORs and Scoping Session. The tables are presented as a function of VECs. Each VEC will be titled in a separate chapter, where issues related to it will be assessed.

Table 2-1 Socio-economic Conditions

Issue	Construction phase	Operation phase	Decommissioning phase
Employment	√	√	√
Landscape and visual impact and aesthetics	√	√	√
Land use	√	√	√
Business prosperity	√	√	
Stress on infrastructure	√	√	√

Land acquisition and Resettlement	√		
Impact on tourism		√	

Table 2-2 Water Resources

Issue	Construction phase	Operation phase	Decommissioning phase
Long term impacts on topsoil and erosion	√	√	√
Wastewater disposal and its impact on groundwater resources	√	√	√
Solid waste and its impact on surface and ground water resources	√	√	√
Water Requirements	√	√	
Floods and rainfall	√	√	

Table 2-3 Public Health

Issue	Construction phase	Operation phase	Decommissioning phase
Accidents risks	√	√	√
Ambient air quality (dust)	√		√
Noise	√	√	√
Shadow flickering		√	
Icing/ Ice throw		√	
Aviation & radar		√	
Telecommunication/EMI links		√	
Domestic wastewater	√	√	√
Domestic solid waste	√	√	√
Public Safety	√	√	

Table 2-4 Occupational Health and Safety

Issue	Construction phase	Operation phase	Decommissioning phase
Medical care and health Insurance	√	√	√

Domestic wastewater	√	√	√
Domestic solid waste	√	√	√
Ambient air quality (dust)	√		√
Noise	√	√	√
Accidents impact	√	√	√
Shadow flickering		√	
Icing/ Ice throw		√	
Aviation & radar		√	
Telecommunication/EMI links		√	
Personal Protection Equipment (PPE)	√	√	
Availability of Emergency Plan	√	√	

Table 2-5 Archaeology

Issues	Construction phase
Remaining archaeology	√
List of monuments / remains recorded	√

Table 2-6 Biodiversity

Issue	Construction phase	Operation phase	Decommissioning phase
Impact on flora	√	√	√
Impact on Wildlife	√	√	√
Impact on Migratory Birds	√	√	√
Impact on habitats	√	√	√

Table 2-7 Traffic

Issues	Construction phase	Operation phase	Decommissioning phase
Transportation of equipment & construction materials	√		
Traffic volume	√	√	√
Impact on roads and transportation infrastructure	√	√	√

Scope of Work of the Components Studies

Water Resources

Objectives

- To determine information regarding water resources, hydrology, geology, topography and soil in relation to the Project;
- To assess impacts of Project activities on water resources; and
- To propose mitigation measures and prepare mitigation plan.

Methodology

- Collecting the available data about geological, topographic, soil characteristics of the Project area;
- Collecting the available data about the meteorology and climate of the Project area such as: daily rainfall from the rainfall stations distributed within the Project area;
- Description of the water resources in the Project area and groundwater flow regimes;
- Determination of water availability, quality and Project water requirements;
- Assessing the potential impacts of the Project activities on water resources (i.e. potential impacts on groundwater quality and quantity); and
- Proposing proper mitigation measures to minimize/avoid the negative impacts and necessary monitoring program as part of the Environmental Management Plan to protect valleys and water resources.

Socio-Economic Conditions

Objectives

- To assess the impact of Project activities on the socio-economic conditions; and
- To propose proper mitigation measures to enhance positive impacts of the Project and to reduce the negative ones.

Methodology

- Collecting data through literature survey and field surveys and visits to local municipalities and governmental organizations and members of the public in the study area. The data will cover primarily the issues relevant to the Project;
- Based on the above findings and using the information about the Project assess potential impacts of Project activities on the socio-economic conditions (e.g. land use, visual impacts); and
- Propose mitigation measures to reduce the negative impacts and to enhance the positive impacts.

Resettlement Policy Framework and Plan

As a safeguard, the Resettlement Policy Framework ("RPF") sets the basis for a subsequent Resettlement Action Plan ("RAP"). It will be prepared according to NEPCO's resettlement policies. It is noted that due to the remote location of Project site (being away from any farm land or commercial activity) it is not anticipated that there will be any resettlement for the implementation of the Project; however, for the record and for the sake of completeness of the ESIA, the overall procedure and requirements are outlined below. The objective of a resettlement study is to prepare a RPF for a project, in accordance with NEPCO's resettlement policies. These are:

- Involuntary resettlement should be avoided, or minimized where unavoidable;
- Where resettlement is unavoidable, resettlement plans and activities should be seen and executed as development programs;
- Resettled persons should be provided with sufficient investment resources and opportunities to share in project benefits;
- Displaced persons should be meaningfully consulted and allowed to participate in planning and implementation of resettlement programs;
- Displaced persons should be compensated for their losses at full replacement cost, within three months of confiscation date, according to the Compensation Law of 1987 and its Amendments;
- The resettled persons should be assisted with the move and provided with support during the transition period; and
- Resettled persons should be assisted with their efforts to improve, or at least restore, their former living standards and income earning capacities.

Depending on the location of the project, as well as its components or routes, the project may require resettlement of a number of households that would be directly or indirectly affected by the project. These households would be affected through potential loss of resources, as land would be confiscated for the purposes of this project or any of its components requiring clearance of land. All people affected in this manner may be defined as potentially displaced and will have to be identified and accounted for.

According to the Compensation Law of 1987, valuation methods include the following steps:

- Provision of public benefit from such a project;
- Assessment of replacement values of confiscated land and any attachments; and
- Establishment of compensation rates for all assets to be confiscated.

Compensation requires negotiation and communication with affected stakeholders. Consultation with affected communities will be necessary. Such consultation will explain the nature of the project and its expected effects and benefits on the surrounding environment and residents. A brief leaflet about the project may be distributed to the villagers in Arabic explaining the project and describing of the project's safety factors. In addition, a survey questionnaire in Arabic language may be distributed to allow locals to voice their opinions and concerns regarding the project.

The RAP will include the following:

- Eligibility Criteria for Displaced Persons;
- Legal Framework;
- Entitlement Delivery;
- Implementation Process;
- Funding Arrangements;
- Consultation and Participation;
- Grievance Redress and Dispute Resolution Procedures;
- Monitoring of Confiscation and Compensation; and
- Budget.

Archaeology

Objectives

- To identify and assess potential impacts on archaeology and cultural heritage - upon available information- resulting from the construction and operation of the Project; and
- To define the necessary mitigation measures to minimize potential impacts on archaeological sites and cultural heritage within the Project area.

Methodology

- A review of the available data will be conducted;
- An archaeologist will investigate the Project area and the survey will be conducted on foot for the parts where no previous information is available; and
- A mitigation plan will be proposed to avoid and/ or reduce negative impacts of the project on the historic sites.

Biodiversity

Objectives

This is to satisfy the interest of basic planning for the area and to highlight any environmental concern that may arise upon the implementation of the proposed Project on the existing biological conditions. Specifically, the study aims to:

- Conduct the baseline field surveys of flora, fauna and avifauna in the Project area;
- Identify and list all flora, fauna and avifauna species, and related habitats;
- Identify and locate all protected, endangered or rare plants, animals and avifaunal species and habitats;
- Recommend appropriate mitigation measures to reduce (and monitor, if appropriate) such impacts to flora, fauna, avifauna, bats and habitats; and
- Ensure compliance with existing national and/or international protection requirements.

Methodology

In order to meet the objectives and scope of this study, different methods will be used to assess the existing biological environment aspects along the Project area and to evaluate the expected impacts on these aspects. These methods will include the following:

- Literature Survey: In this part, the survey team will collect and review the available data about the biological environment in the Project area. Data collection will be achieved through library search for the available references on the biodiversity or any related biological aspects. References from institutions that are working in this field will be used.

- Field Work Survey: This survey is to complete and update the literary collected data. Different techniques will be used in the field to assess the biological environment:
  - ✓ Conducting field survey of flora of the proposed Project area;
  - ✓ Conducting an avifauna survey in the proposed Project area;
  - ✓ Conducting a mammal and bats survey in the proposed Project area; and
  - ✓ Conducting a reptile survey in the proposed Project area.

The study will correlate the target biological environment aspects with their physical environment units. The effects of the predicted impacts that would occur for these physical environment units according to the Project activities on the biological environment aspects in the Project area will be examined.

Traffic Study

Objectives

- To identify the alternative access routes to the proposed Project area; and
- To assess impacts of Project activities on traffic.

Methodology

- Describe the roads network in the Project area;
- Determine expected transportation movements to and from the wind farm and each individual wind turbine sites during all phases of the Project;
- Assess potential impacts of the Project activities on the used roads network; and
- Propose mitigation measures to reduce negative impacts and discuss possible alternatives.

Noise

Objectives

- To establish baseline noise levels;
- To identify potential noise sources and impacted areas relevant to Project activities;
- To assess and understand the causes of such impacts; and
- To propose proper mitigation measures to protect the public and employees from such impacts.

Methodology

- Monarch 322 Data logging Sound Level Meter, intended for general-purpose measurements of sound pressure levels in industrial and environmental applications, was used. The standard compliance of the instrument is IEC651 Type 2, ANSI S1.4 Type 2;
- Noise level meter was used for one week (continuous monitoring) around the Project site to identify baseline levels;
- A numerical model was used to predict noise levels as function of distance from defined sources; and
- Based on that affected zones, impacts were identified and type of mitigation measures will be proposed.

Air Quality (dust)

Objectives

- To establish the baseline data for dust emissions (TSP, PM10 and PM2.5). Such values will be compared to local air quality standards and specifications;
- To identify potential dust sources and impacted areas relevant to Project activities;
- To assess and understand the causes of such impacts; and
- To propose proper mitigation measures to protect the public and personnel from such impacts.

Methodology

- Establish the baseline data for (TSP, PM10 and PM2.5). Such values will be compared to local air quality standards and specifications;
- Air quality analyzers were used for 20 days around the Project site to monitor (TSP, PM10 and PM2.5) to identify baseline levels; and
- Impacts were identified and type of mitigation measures will be proposed.

Landscape and Visual Impact

Objectives

- To identify landscape designations and visual receptors within the study area;
- To assess and understand potential impacts; and
- To propose proper mitigation measures to minimize any impacts.

The above objectives can be achieved according to the following guidance:

- Guidelines for Landscape and Visual Impact Assessment: Third Edition (*The Landscape Institute with the Institute of Environmental Assessment, 2013*); and
- Visual Representation of Wind farms Good Practice Guidance (*Scottish Natural Heritage, 2007*).

Shadow Flickering

The effect of shadow flickering will be assessed by studying the distances of nearest residential areas or economic activities from the proposed locations of the wind turbines. The direction and extent of shadow will be estimated for different seasons of the year; where possible, modelling software will be used. However, the final aim is not to force unacceptable shadow effect with flickers on people and economic activities.

Relevant National Legislation

Laws

- The Environment Protection Law No. 52 Year 2006.
- Renewable Energy and Energy Efficiency Law No. 2 Year 2015.
- General Electricity Law Temporary Law No. 64 Year 2002.
- Traffic Law No. 49 Year 2008.
- General Health Law No. 47 Year 2008.
- The Antiquities Law No. 21, Year 1988 and its amendments.
- Transportation Law (89/2003)
- Agricultural Law No. 13 Year 2015.
- Trade, Industry and Occupation Safety Law No. 16 Year 1953.

- Civil Defense Law No. 18 Year 1999.
- Labour Law No. 8 Year 1996 and its amendments.
- Water Authority Law and its amendments No. 18 Year 1988.
- The Organization of the Natural Resources Affairs Law No. 12 Year 1968.
- Acquisition Law No. 12 Year 1987.
- Compensation Law Year 1987.

Regulations

- The Environmental Impact Assessment Regulation No. 37 Year 2005.
- The Bylaw on Regulating Procedures and Means of Conserving Energy and Improving its Efficiency No. 73 Year 2012.
- Land use planning Regulation No. 6 Year 2007.
- Natural Reserves and National Parks Regulation No. 29 Year 2005.
- Soil Protection Regulation No. 25 Year 2005.
- Regulation of Solid Waste Management No. 27 Year 2005.
- Air Protection Regulation No. 28 Year 2005.
- Groundwater Control Regulation No. 85 Year 2002

Standards

- Jordanian Standard for reclaimed domestic wastewater (JS 893/2006).
- Jordanian Standard for drinking water (JS 286/2008).
- Jordanian Standard for Ambient Air Quality (JS 1140/2006).

Instructions

- Instructions for Protection of Birds and Wildlife and rules covering their hunting No.34 Year 2003.
- Instructions on the Protection of water Resources Year 2012.
- Instructions for Recycling and Handling of Consumed Oils Year 2014.
- Instructions for the Limitation and Control of Noise Year 2003.
- Instructions No. 1 Year 2013 for the prevention of occupational hazards related to health hazards resulting from labour housing units' onsite.

Guidelines

- Guidelines for limiting exposure to time-varying Electric, Magnetic and Electromagnetic fields, issued in accordance to articles (6/b and 48) of the Telecommunication Law.
- Drinking Water Resources Protection Guideline, July 2006.

International Standards

- IFC Policy and Performance Standards on Social and Environmental Sustainability:
  - ✓ IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
  - ✓ IFC Performance Standard 2: Labour and Working Conditions
  - ✓ IFC Performance Standard 3: Resource Efficiency and Pollution Prevention
  - ✓ IFC Performance Standard 4: Community, Health, Safety and Security
  - ✓ IFC Performance Standard 5: Land Acquisition and Involuntary Resettlement
  - ✓ IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
  - ✓ IFC Performance Standard 7: Indigenous People, Year 2012
  - ✓ IFC Performance Standard 8: Cultural Heritage
- IFC Guidance Notes
- IFC General Environmental, Health and Safety Guidelines, Year 2007
- IFC General Environmental, Health and Safety Guidelines for Wind, Year 2007
- IFC Operational Policy OP 4.01 Environmental Assessment, October 1998 (Revised April 2013)
- IFC Operational Policy OP 4.04 Natural Habitats, November 1998 (Revised April 2013)

Overview of Project Area

The Tafila Governorate is bordered by the Karak Governorate to the north, the Ma'an Governorate to the east and south, and the Aqaba Governorate to the south. The governorate constitutes 2.5% of the area of Jordan with a population of 96,291 inhabitants as per the general census of population and housing results for 2015. In other words, 1.01% of Jordan's population lived in the 37 towns and villages across the governorate of Tafila in 2015, making it the least populated governorate in Jordan.

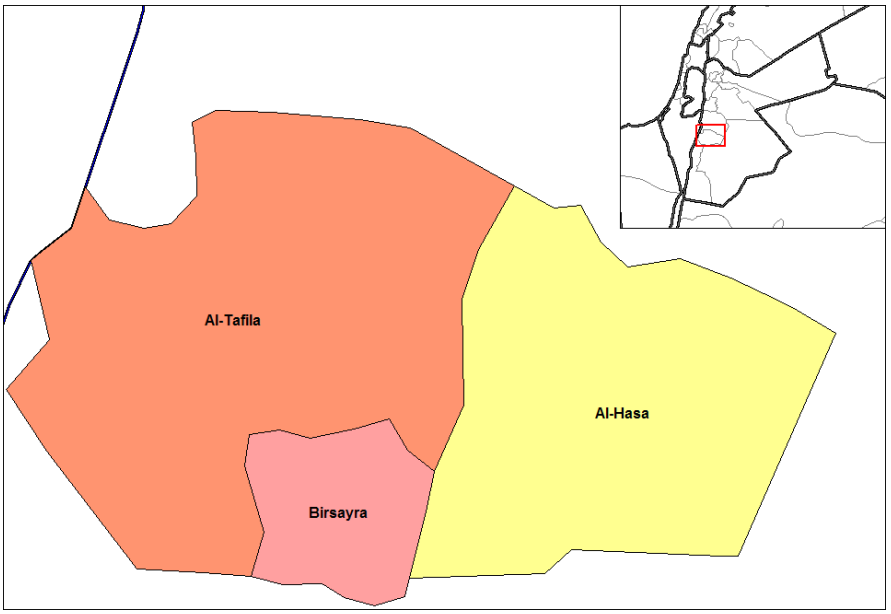

Figure 4-1 Tafila Governorate Districts

The governorate lies on an area of 2,209 km^2, and is divided into three main districts. Those are Qasabet Al Tafila, Bussaira and Al Hasa districts, as illustrated in Figure 4-1. The total number of communities within the three districts is 37, out of which 27 communities are located within Qasabet Al Tafila district, eight communities within Bussaira district and two within Al Hasa district.

The Project site lies within Al Abour community, which is located within Qasabet Al Tafila district. Other communities that lie in the vicinity of the Project site as shown in Figure 1-7 earlier, and include the following:

Table 4-1 Communities Adjacent to the Project Site

Community	District	Estimated Distance from AEC Project Site
Tafila town	Qasabet Al Tafila	8.3 km northwest of the Project site
Umm Sarab	Bussaira	4.2 km southwest of the Project site
Alayn Al-Byyda	Qasabet Al Tafila	8 km west of the Project site

Tafila governorate is also divided into four administered municipal boundaries. These include Greater Tafila Municipality, Al Hareth Ibn Al Omair Municipality, Al Qadessiah Municipality, and Al Hasa Municipality. Figure 4.2 below illustrates the municipal boundaries of Tafila governorate, the district boundaries, and indicates the location of the Project area.

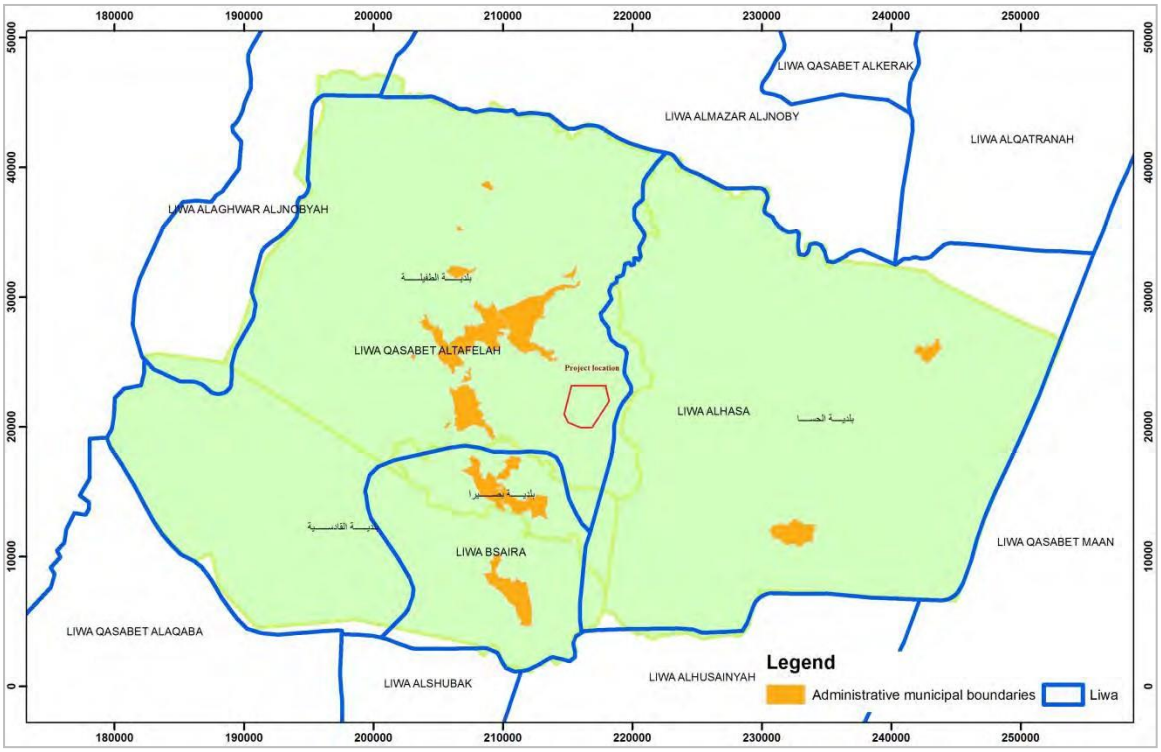

Figure 4-2 Tafila District, Municipality and AEC's Project Area Boundaries

As shown in Figure 4.2 above the AEC's Project area lies in the Abour community within the boundaries of Qasabet Al Tafila district. The area of the Project is considered relatively distant from any community clusters within either Qasabet Al Tafila District or Bussaira District.

Demographics of the Area

Population

According to the results of the general census of population and housing for 2015, the population of Jordan was 9,531,712 in 2015. The governorate of Tafila is considered the least populated of the 12 Jordanian governorates with a population of 96,291 in 2015. Table 4.2 below illustrates the relative size of Tafila governorate within Jordan. Around 1.01% of the national population lives within Tafila. The population density of the area as per 2015 results is 43.5 persons/km^2, illustrating the sparse nature of the area.

Table 4-2 Population, Area and Population Density in Tafila and Jordan

Governorate	Population	%	Area (km^2)	Population density (capita/km^2)
Tafila	96,291	1.01	2,209	43.5
Jordan	9,531,712	100	88,794	107.3

Source: Department Of Statistics (2015)

The Tafila Governorate as mentioned earlier is subdivided into three districts. The number of families recorded in all three districts is 19,296 which is considerably low in comparison to the number of families within the remaining 11 governorates of Jordan ranging between 865,339 families in Amman and 28,641 in Ma'an. Based on the population statistics of 2015, the average family size is nearly 5 persons. It is important to mention here that there are approximately 6,183 non-Jordanians living in Tafila, forming about 0.21% of all foreigners staying in the country.

Table 4-3 below provides key demographic indicators for the three districts of Tafila Governorate based on data from the Department of Statistics for the year of 2015.

Table 4-3 Population of Tafila's 3 Districts in 2015

Indicator	Qasabet Al Tafila	Bussaira	Al Hasa
Population	60,803	25,245	10,243
Males	32, 023	13,013	5,355
Females	28,780	12,232	4,888
Households	12,481	4,972	1,843

In general, the gender breakdown for all three districts shows a slightly higher ratio of males to females. Abour community in particular has a 1:3 ratio of females to males, with the male rate being dominant. The population of Abour is 69, consisting of only 19 families (i.e., an average family size of 3.6 people) which is lower than the Governorate's family size average. Table 4.4 below presents the population of all 37 communities found in the Tafila Governorate illustrating those within each district.

Table 4-4 Population of Tafila Governorate by Locality, (DoS, 2015)

District	Sub-district	Community	Population	Community	Population
Tafila	Tafila	**Alayn Al-Byyda***	**10,448**	Barbietah	175
		Ies	9,787	Liban	43
		Aimeh	2,582	Harier	42
		Sanfahah	454	Ezhaigah	15
		Namteh	62	Zabdah	65
		Abu Banna	1,247	Sirah	255
		Shaidham	946	Jeser El-Shohada'	161
		Erhab	708	Nokhah	292
		IDhba'ah	49	Arafah	1,098
		Majadel	885	Abel	747
		Swaimie'	771	Al Ma'atan	15
		Afra	39	Erwayyem	1,866
		Abour	**69**	**Tafila***	**27,559**
		Tal'et Hussain	453		
Bussaira	Bussaira	Bussaira	10,587	**Umm Sarab***	**744**
		Al Qadessiah	8,604	Dana	31
		Ghranadal	4,680	Lahtha	10
		Al Rashadeiyah	516	Qarqour	73
Hasa	Al Hasa	Al Hasa	8,084	Al Jarf	2,159

**** communities adjacent to the Project area***

Source: Department of Statistics

Employment

Workforce in Jordan includes all economic active citizens above the age of 15 years old. Such force has reached about 32.2% of all Jordanians above the age of 15. Since Jordan has a young population, it is also expected that this work force will increase rapidly in the future. The distribution of the labor force for Jordan during the period from 2012 and 2014 was divided between nine different occupations as shown in Table 4.5 below.

However, due to the nature of the Tafila Governorate, the majority of work is distributed between phosphate mining industries, agriculture and tourism sector activities.

Table 4-5 Relative Distribution of Employed Jordanians

Occupation	2014		2013		2012	
	Female	Male	Female	Male	Female	Male
Legislators, Senior Officials & Managers	1.8	0.4	1.6	0.5	1.8	0.4
Professionals	60.0	17.2	57.4	17.5	55.9	18.3
Technicians & Associate Professionals	13.5	6.0	14.1	6.3	14.2	6.6
Clerks	6.7	4.5	8.4	4.9	8.3	5.8
Service Workers, shop & Market Sales Workers	7.9	34.4	8.9	34.5	8.8	33.0
Skilled agriculture, forestry & fishery workers	0.2	1.7	0.4	1.8	0.4	1.7
Craft & Related Trades Workers	3.2	16.8	3.3	16.3	2.9	15.9
Plant Machine Operators & Assemblers	0.0	13.5	0.1	13.1	0.0	12.4
Elementary Occupations	6.6	5.4	5.9	5.1	7.8	6.0
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Department Of Statistics

On the other hand, unemployment rate in Jordan was 12.9% in 2014 and was reported by the Department of Statistics to have reached 13.6% in the fourth quarter of 2015. For males it reached 11%, and for females 22.1% demonstrating that unemployment among females is much higher than for males. This is usually attributed to social status, cultural habits, as well as education levels. The estimated unemployment rate of Tafila Governorate was 21.1% in total, 13.4% for males and 28.9% for females. Table 4.6 below illustrates the unemployment rate by governorates in Jordan for the year 2013/2014.

Table 4-6 Unemployment Rates Among Jordan's Workforce 2013/2014

GOV.	AMM	BAL	ZAR	MAD	IRB	MAF	JER	AJL	KAR	TAF	MAN	AQA
Male	8.7	12.9	12	14.2	10.4	12.3	20.4	9.7	12.5	**13**	14.1	14.1
Female	19	20.4	21.9	23.2	26.5	24.9	22.3	27.2	25	**28.9**	19.1	21.3

In late 2005, the Royal Decree was issued to establish the Tafila Technical University in Alees, on the road connecting Tafila with high desert way. The location of this university is not far from the Abour site: only about 5 km, and the number of enrolled students exceeded 6,000 in 2016. The university consists of five schools as follows:

-College of Engineering

-College of Arts

-College of Business

-College of Educational Sciences

-College of Science

In addition, there are research and service centers, such as the Languages Center, Community Services, Training and Consultancy and Energy and Oil Shale. The latter is the most important since it is related to this Project; this College was established in 2009 due to the fact that the southern region is rich with renewable energy, such as wind, and oil shale resources. It may be worth investigating the possibilities of cooperation between this center and the AEC's wind Project in order to benefit from the laboratories and workshops at the university for testing and maintaining certain parts or components. On the other hand, senior engineering students may have short training during their study in the Project and/or nearby renewable energy projects.

Housing and Utilities

Housing in Jordan varies from small apartments to large villas. The total number of housing units in Jordan was estimated to be 1,221,055 in 2004 and approximately 1,900,000 in 2015, including marginal houses used to accommodate refugees in the country. Whereas, in Tafila governorate alone, the total number of housing units was 16,785 in 2004 and increased to approximately 20,000 in 2015. Further details on housing types within Tafila are provided in Table 4-7 below.

Table 4-7 Distribution of Housing Units in Tafila Governorate in 2004 and 2015

Type of Housing	2004	2015
Conventional (House, Apartment, Villa)	16,209	19,420
Mobile (Tent)	236	283
Marginal (Barracks)	2	8
Business Establishment	12	19
Under Construction	326	365
Total	16,785	20,095

Source: Department Of Statistics

The cost of living in Jordan is increasing rapidly, but is still lower than industrially developed nations in the MENA area. Living in Tafila or its suburb is not very costly due to the fact the rents are much less than in the central and northern regions, although electricity and water retail prices as well as petroleum products are the same everywhere in Jordan.

The inflation rate in 2016 was 5.6%. According to the Government of Jordan, the retail prices of petroleum products as of February 2016 are as follows: unleaded gasoline (90) 0.580 JD per liter, super unleaded gasoline (95) 0.745 JD per liter, diesel 0.440 JD per liter, kerosene 0.440 JD per liter, and LPG 7.00 JD per cylinder (*Source: MEMR, 1-7-2016*).

Medical Provision

The standard of health care centers in Jordan is among the best in the region. Tafila is served by one governmental hospital with a capacity of over 100 beds, and over 20 health centers as shown in Table 4.8.

There is one central hospital which is administered by the Medical Services of Jordan Armed Forces. But there is a plan to construct a new hospital by the Ministry of Health in the near future. It is worth noting that according to the recent census in 2015 more than 90% of the citizens in Tafila are having full health insurance.

In terms of employment in the health sector as of 2014, there were 600 employees at health centers in the Tafila Governorate, with an average of 27.3 employees for each health care center. Table 4-8 below illustrates Tafila Governorate medical facilities.

Table 4-8 Distribution of Medical Facilities in Jordan and Tafila

Indicator	Tafila	Jordan
Total Hospital Number	1	104
Total Hospital Beds	106	12,497
MOH Comprehensive Health Centers	6	98
MOH Primary Health Centers	11	377
MOH Peripheral Health Centers	6	202
MOH MCH Centers	17	677
MOH Dental Clinic	15	397
Pharmacy	14	2,298

Source: Ministry of Health - Annual Statistical Report 2014

The classification of medical human resources within the Tafila Governorate compared to that of Jordan is presented in Table 4-9 below.

Table 4-9 Medical Human Resources at MOH in Jordan and Tafila

Personnel	Tafila	Jordan
Doctors	91	19,655
Dentists	20	6,881
Pharmacists	17	12,215
Nurses	50	18,454
Legal midwives	40	2,762
Others	182	3,179

Source: Ministry of Health - Annual Statistical Report 2014

Land Use

Large areas of the Tafila Governorate are identified as agricultural or rural land and classified as first, second and/or third degree. Other land use patterns within Tafila Governorate is a mixture of protected areas, nature reserves, existing mining areas, and proposed areas for phosphate mining, copper and manganese The AEC's wind

farm Project area is located in an area classified as an agricultural area as per MoMA's classification.

Agriculture

The total area of suitable land for agriculture in Jordan is about 10% of the total area of Jordan. Only 31% of suitable land (3% of all land) is used for agriculture due to the scarcity of water resources. Jordan is considered as one of the three poorest countries in water resources in the world. A comparison of green land use in the Tafila Governorate to that of Jordan in 2014 is shown in Table 4-10.

Table 4-10 Comparison of Green Land Use in Tafila and Jordan in 2014

Governorate	Total area	Irrigated planted land area	Non-irrigated planted land area	Designated as forest land area	Grazing land reserves
Tafila	2,253,500	20,409	27,018	114,570	20,000
Jordan	88,747,500	1,021,863.5	2,266,857	1,305,490	741,700

Source: Ministry of Agriculture

It should be noted that land designated as forest land is not necessarily covered with forests. Table 4-11 below shows the distribution of planted areas in dunums (thousands of square meters) in Tafila Governorate and in Jordan in 2014. Planted areas in Tafila Governorate are compared to Jordan, highlighting irrigated land as compared to non-irrigated land.

Table 4-11 Distribution of Planted Areas in Jordan and Tafila in 2014

Crop	Tafila (dunums)		Jordan (dunums)	
	Irrigated	Non-irrigated	Irrigated	Non-irrigated
Fruit Trees	2,690	1,590	157,632	170,998
Grain Crops	0	15,130	56,902	702,330
Vegetables	185	0	520,760	32,883
Olive Trees	1,230	9,550	284,299	584,411

Source: Ministry of Agriculture

It is also worth noting that the total area of fruit and olive farms in Tafila was 42,210 km^2 in 2011, out of which more than 31 km^2 were olive farms.

The agricultural sector contributed 3% to 4% to Jordan's GDP in 2013 and used about 60% of the water resources in Jordan in the same year, as per the National Water Strategy. Such contribution can be boosted by irrigation and technological advancement in farming methods and the use of other water resources such as treated wastewater in irrigation.

According to the National Water Strategy, wastewater collection and treatment services were provided to about 63% of the population in 2014, producing about 137 MCM of treated wastewater annually of which 125 MCM is being reused primarily in agriculture. However, reused wastewater for agricultural purposes is currently not used in Tafila Governorate.

In Jordan, natural grazing lands, as well as barley and hay production from grains and legumes, comprise the main forage production which maintains livestock during winter. In Tafila Governorate, livestock included 111,219 heads of sheep, 36,270 heads of goats, and 108 cows at the end of 2014, according to the Department of Statistics agricultural surveys.

Industry

According to the Ministry of Industry and Trade, industry in Jordan is divided into two main types:

- The Manufacturing (converting) Sector: includes leather and footwear manufacturing, chemical industry, plastic industry, IT industry, furniture industry, food industry, packaging industry, engineering products, etc. This Sector contributes about 18% of Jordanian GDP.
- The Mining Sector: contributes about 2% of Jordanian GDP.

Data obtained from the Ministry of Industry and Trade (*Report of industrial Statistics for the first three quarters of 2010*) shows that the value of national exports for the first nine months of 2010 was 3,100 million dinars, while the value of industrial exports was 2,752 million dinars. Thus, the industrial exports constituted approximately 890% of the total national exports for the first nine months of 2010. The latest official document published by the Ministry of Industry and Trade covers the first half of 2014, and shows the above two figures to be 2,540 million dinars for all exports, and 2,178 million dinars for industrial exports, respectively.

The number of workers in the industrial sector, according to DoS, in 2008 was 193,708. Out of which, 8,090 were working in the extractive industries sector and 171,776 workers in the manufacturing sector while 13,842 workers in the sector of electricity and water supplies. According to the latest figures from DoS in 2014, those numbers

were 8,369 employees in the extractive industries, 201,075 in the manufacturing sector, and 7,786 in the electricity and water supply sectors.

The number of workers in both industrial and artisan enterprises registered in the chambers of industry in the Kingdom for the three first quarters of 2010 was 137,778. Those classified to work in craft and installations were 26,647 while the remaining 111,131 workers were working in industrial plants. In the latest report issued for the first half of 2014, those numbers were 162,582 in total, with 32,140 in crafts and installations, and 130,442 in industrial establishments.

Table 4-12 Industrial Activities in Tafila Governorate

Type	Number
Mining and Cement	6
Food & Beverage	34
Textiles & Clothing	22
Wood Industry for Construction	14
Copying and Printing	1
Non-metal & Glass Products	18
Metal & Metal Electroplating Products	30
Furniture Manufacturing and Assembly	15
Construction & Building Assembly	6
Automotive Mechanics, Location and Trade	91

Source: Ministry of Industry and Trade

A new industrial zone is under construction in Tafila, on the way to the Desert Highway, close to Jurf Al-Darawish. This project is supported under the arrangement of the Gulf Grant, and financed by the Saudi Development Fund. It is expected that the required infrastructure (water pipelines, main sub-station and buildings) to be completed before the end of 2018. This new industrial city will mainly host small and medium industries.

Tourism

In recent years, the Jordanian tourism business development has been the focus of study and research. In the analysis of tourism, economists emphasize economic effects of tourism on the economy. The speedy growth of tourism causes an increase

of household incomes and government revenues through multiplier effects, improvements in the balance of payments, and growth of the tourism industry. This industry makes a substantial contribution to the Jordanian economy. Employment in the tourism cluster, including direct and indirect employment, was estimated at approximately 49,096 in 2015. This was also witnessed in Tafila Governorate as it depends on domestic tourists who visit the hot water springs and the natural reserves in the Governorate

Tourism development in Jordan is aided by the existence of many internationally well-known landmarks, including Petra and the Dead Sea, among others. In Tafila Governorate, there are only a few sites popular among tourists. One of these is the Afra Mineral Spa. In addition to its therapeutic value, the Spa is situated next an old Byzantine Church dating back to the sixth century. A total of 28,794 visitors were registered during the first nine months of 2015, with 1,861 non Jordanians. In comparison, for the same period during 2014, 32,633 visitors were registered, of which about 1,001 were non Jordanians. This indicates an average decrease of approximately 11.8% for the total number of visitors, but an increase of 18% in non Jordanian visitors.

Another historical site is the Sala'a Castle which is located about 15 km southwest of Afra Spa and about 1 km west of Ain Al Baidaa. The castle overseas Sala'a traditional village and is built using mud and stone and surrounded by fruit and olive trees.

One area in Tafila region reflecting a special kind of tourism, namely "ecotourism", is the Dana Reserve. It was established in 1989 as the largest and first natural reserve in Jordan. Its total area is about 300 square kilometers and is located near the Al-Qadesiya area. It constitutes the only reserve containing all four biodiversity geographical regions, namely the Mediterranean, Irani-Torani, Arab desert, and Sudanese regions. It is considered home to about 800 plant species, three of which exist only in Dana Reserve. The Reserve contains lodging locations within its Guest House, Al-Rummana Camp and Finan Lodge. In 2010 the number of visitors to each lodging location reached 3,273, 4,097 and 6,500, respectively.

Economic Activity

The following section presents some key indicators on services and utilities within Tafila Governorate. Where possible, the indicators are compared to their conditions in Jordan and other governorates.

Education

The main general educational providers in Jordan are the Ministry of Education (MoE), the private sector, in addition to the Armed Forces, which in its turn provides remote

areas in the country with educational services. The United Nations Relief Agency (UNRWA), on the other hand, provides educational services to Palestinian Refugees in Jordan.

In Jordan, there are four educational levels:

I. Kindergarten (2 years);

II. Basic education (10 years);

III. Secondary education (2 years); and

IV University education (as per requirements of the degree).

The Ministry of Education (MoE), which administers vocational and academic education from kindergarten through secondary education, is the primary source of baseline data for those demographics. The Ministry of Higher Education and Scientific Research (MoHESR) supervises education in Jordanian universities and community colleges, and is the main source of statistics for this sector. Figure 4-3 below illustrates the percentages of schools as per their supervising authority.

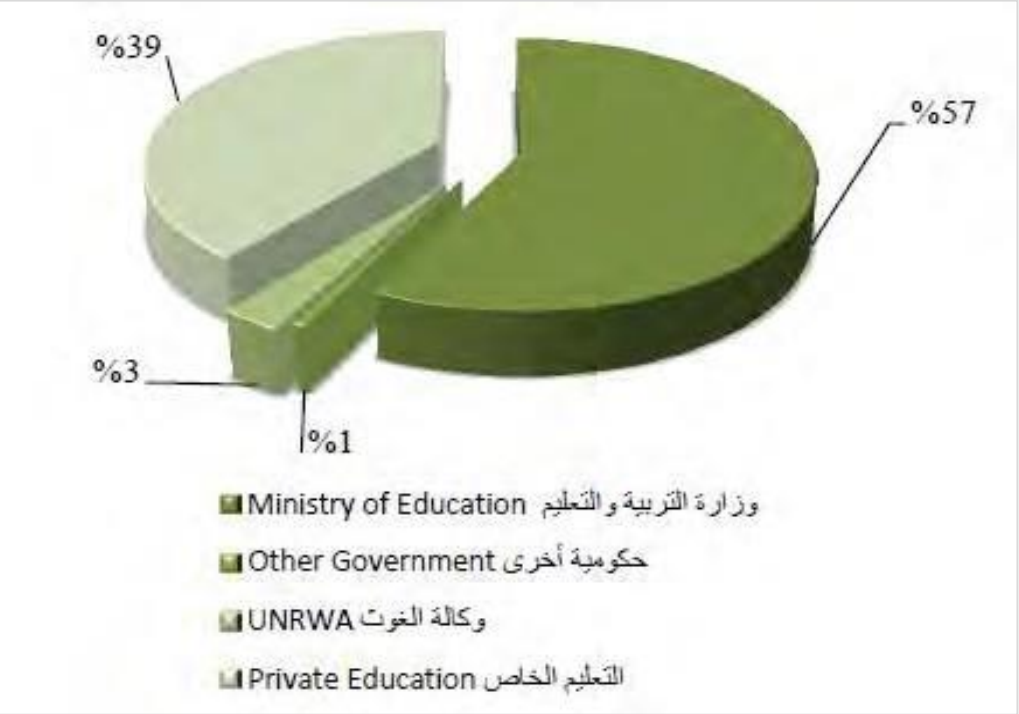

Figure 4-3 Schools According to Supervising Authority

The following table includes various statistics on students in educational institutions, whether governmental or private, according to several characteristics, as well as statistics on Jordanian students abroad. This is based on the latest publication for the Ministry of Education, which covers the years 2012/2013.

Table 4-13 Education Indicators in Jordan for the Years 2012-2013

Average No. of Students per Class Unit	**25.12**
Average No. of Students per Teacher 2010-2011	15.7
Percentage of Females among Students 2010-2011	49.2%
Percentage of Female School Teachers to Total Teachers 2010-2011	67.28%
Percentage of Students in Basic and Secondary Stages of Total Population 2010-2011	25.2%
Percentage of Rented School Buildings of Total School Buildings 2010-2011	36.5 %

Whereas the classification of Jordanian teachers according to the education level provided is presented in Figure 4.4 below.

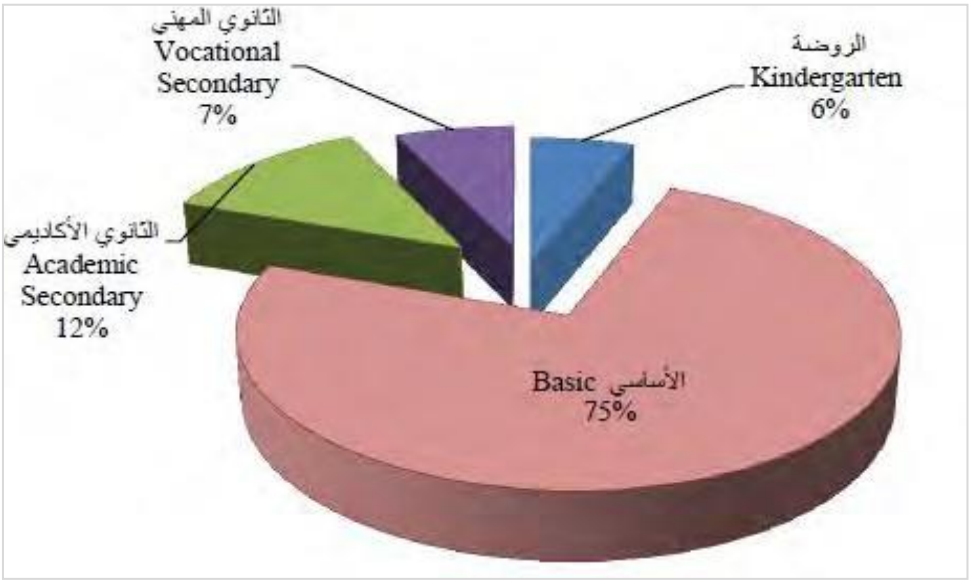

Figure 4-4 Teachers According to Education Level

As for the Tafila Governorate, the distribution of schools, teachers and students, in Tafila in 2011-2012 are shown in Table 4-14, Table 4-15, Table 4-16 and Table 4-17.

Table 4-14 Schools in Tafila Governorate According to Gender

	Total
Male	41
Female	7
Co-ed	100

Table 4-15 Schools in Tafila Governorate by District, Level and Gender

Directorates	Kindergarten			Basic.			Secondary		
	Male	Female	Co-ed	Male	Female	Co-ed	Male	Female	Co-ed
Tafila	0	0	14	16	1	48	13	5	11
Bussaira	0	0	4	7	1	20	5	0	3

Table 4-16 Teachers in Tafila Governorate by District, Level and Gender

Directorates	Kindergarten		Basic		Secondary	
	Male	Female	Male	Female	Male	Female
Tafila	0	82	405	894	217	231
Bussaira	0	19	146	297	71	59

Table 4-17 Students in Tafila Governorate by District, Level and Gender

Directorates	Kindergarten		Basic		Secondary	
	Male	Female	Male	Female	Male	Female
Tafila	912	831	7825	7519	1376	1358
Bussaira	291	258	2759	2620	442	447

Furthermore, a Royal Decree was issued to establish Tafila Technical University (TTU) on the 17th of January 2005. The TTU, which currently contributes to the development of higher education in Jordan includes seven colleges. These are: Engineering, Science, Business, Education, Arts, Student Affairs, and Scientific Research and Graduate Studies.

The number of TTU students at the beginning of 2016 was approximately 6,000 students, spread over different programs: Bachelor's Program; Two-Year Intermediate Diploma Program; Higher Diploma Program; and Master's Degree Program.

The number of faculty members has recently reached 237, while the number of the administrative staff was 631. At present the TTU campus is witnessing a construction boom in the area in buildings, facilities and infrastructure, where a number of laboratories, centers, halls, classrooms, restaurants and administrative departments are going to be relocated.

Engineering workshops with the latest machinery and equipment will be also relocated to the new buildings. Moreover, an integrated sport complex is being constructed; it is the largest and first of its kind in all Jordanian universities. Another building is being constructed for the Computer Center, the Department of Admission and Registration and the library. A new complex of halls and classrooms is being constructed as well.

Transportation

The transport sector is a very important sector of the economy in Jordan. It serves the national economy essentially along the Aqaba-Amman corridor; it also plays an important role on a regional level in transport goods and passengers to and from the neighboring countries (Syria, Iraq, Saudi Arabia, Egypt and, potentially, Israel and Palestine). The transport infrastructure in Jordan can be summarized as follows:

- One sea port (Aqaba) located on the Red Sea;
- Two railway corporations, the Aqaba Railway Corporation (ARC) which transports phosphate and other mining product from the mines to the port of Aqaba and the Jordan Hijaz Railway Corporation (JHRC) which is not in operation for the time being;
- A road network totaling 7,200 km in 2012; and
- Three international airports (Queen Alia international, Amman International, and King Hussein International).

Air Transportation

Jordan has three airports; two of them are in Amman (Queen Alia International Airport and Amman Civil Airport); the third is King Hussein International Airport in Aqaba. Table 4-18 shows air traffic levels in 2014 for all the three airports.

Table 4-18 Airport Traffic During 2014

Queen Alia International Airport movement during 2014

Aircraft Movement			Passenger Volume			Air Cargo Movement (Ton)			Mail Movement (Ton)		
Arrival	Departure	Total	Arrival	Departure	Total	In- bound	Out-bound	Total	In- bound	Out-bound	Total
36578	36547	73125	3489902	3599200	7089102	57699	36184	93883	1350	1196	2546

Amman / Marka Civil Airport during 2014

Aircraft Movement			Passenger Volume			Air Cargo Movement (Ton)		
Arrival	Departure	Total	Arrival	Departure	Total	In-bound	Out-bound	Total
3147	3129	6276	20793	20746	41539	0	0	0

King Hussein International Airport/ Aqaba during 2014

Aircraft Movement			Passenger Volume			Air Cargo Movement (Ton)		
Arrival	Departure	Total	Arrival	Departure	Total	In-bound	Out-bound	Total
2150	2152	4302	77918	85457	163375	1625	732	2357

Source: Civil Aviation Regulatory Commission

Maritime Transportation

Aqaba city has the only port in Jordan. Most of the imported and exported cargo is transported through this port. In addition, this port is used for passengers traveling by ship in and out of the country. Table 4-19 represents handling of Jordanian goods and transit movement via Port of Aqaba during 2014.

Table 4-19 Jordanian Goods and Transit Movement via Port of Aqaba

Number of Vessels	Jordanian Goods			Transit Goods			Total of Handling
	Imported	Exported	Total	Imported	Exported	Total	
1664	8667282	3195704	11862986	450059	107508	557567	12420553

Source: Statistics, Ministry of Transport, 2014

Land Transportation

The road network in Jordan has progressed in terms of design, construction and maintenance. In 2013, the total length of the network in Jordan was about 7,299 km, including the three types of roads which are highways, secondary and village roads. Table 4-20 illustrates the length of roads for Tafila and Jordan as per their type. These are the latest official numbers posted by the Ministry of Public Works and Housing.

Table 4-20 Length of Roads in Jordan and Tafila

Particulars	Tafila	Jordan
Highway (km)	161	2,651
Secondary (km)	31	1,894
Village (km)	44	2,754
Total (km)	**220**	**7,299**

There are two main highways connecting north and south of Jordan. These are the Dead Sea Highway (Highway 65) and the Desert Highway (Highway 15). In order to go to Tafila from the Desert Highway, Highway 60 west at Jurf Al Darawish route should be taken. The Desert Highway also serves as the main route through Jordan to the Sea and it used to transport good.

In 2013, 1,263,754 vehicles were operating in Jordan. The number and type of vehicles operating in Tafila is presented below.

Table 4-21 Number and Type of Vehicles in Tafila

Type of vehicle	Tafila
Total no. of passenger cars	2,260
Private	1,921
Public	339
Buses	23
Private companies	2
Public companies	21
Total no. of trucks	5,660
No. of privately-owned trucks	5,243
Oil tankers companies	9
Private companies	5
Public companies	4
Total no. of trucks & trailers	911
Private	436
Public	475
Other vehicles	790

The railway system in Jordan runs approximately 452 km. Railway transport is not currently an effective mode of transportation in Jordan but the country aims to expand the system by integrating it with neighboring countries. A planned light railway system is under consideration, and would connect the capital Amman to Zarqa, the second largest city in Jordan. It will be designed mainly for passenger transportation.

Railway transport in Jordan is managed by Jordan Hejaz Railway Corporation and the Aqaba Railway Corporation. Jordan will be developing a modern, reliable freight railway network, linking the nation's key cities (the national capital, Amman, and major industrial cities such as Mafraq and Zarqa) to the country's gateway port, the Port of Aqaba, and the largest phosphate mine, Shidiya Mine. The network will also connect with the railways of Saudi Arabia and Syria (and onward to Turkey and Europe in the future) as well as important markets in Iraq. (*Source: Ministry of Transport, Future Projects, Jordan National Railway Project*)

Telecommunications

Jordan has a highly developed communications infrastructure. Jordan's telecom infrastructure is growing at a very rapid pace and continually being updated and expanded. Jordan's telecom industry remains the most competitive in the Middle East. Communications in Jordan occur across many media, including telephone, radio, television, and internet.

According to statistics issued by the Telecommunications Regulatory Commission in late 2014, the following are main characteristics of the sector:

- 377,208 land line subscriptions, which is declining due to the higher penetration and cheaper rates of mobile telephones.
- Mobile penetration in Jordan reached 146% at the end of the first half of 2014, with 10.691 million subscriptions, compared with 78% (4.343 million subscriptions) in 2006.
- Internet users reached 5.4 million users by the end of 2014, with penetration exceeding 70% - a high figure for the region. Internet usage more than doubled from 2007 to 2013, with the rapid growth expected to continue. Jordan has more internet start-up companies than any other country in the Middle East. The Jordanian government has recently announced that the sales tax on computers and internet connection would be removed in order to further stimulate the Information and Communication Technology (ICT) industry in Jordan.

Economy

Jordan is considered as an upper middle-income country with a population of 6.5 million, without accounting for refugees and foreign residents (estimated to be less than 3 million), and a per capita GDP of approximately US$4,800 in 2014. Approximately 60% of the population is young and under 20 years of age, being mostly students or trainees.

The country has limited natural resources. Potash and phosphate are its main export commodities. Agricultural land is limited due to the scarcity of water. Jordan is among the world’s five poorest countries in terms of available water resources. Services account for more than 70% of the gross domestic product and absorb more than 75% of the workforce. As one of the most open economies of the region, Jordan is well integrated with its neighbors through trade, remittances, foreign direct investment, and tourism, and especially has strong links to the Arab Gulf states.

As a result of its open economy and high degree of regional integration, Jordan is vulnerable to the political, economic and social volatility of the region. The political upheaval that swept the Arab region has had a significant impact on Jordan, taking the form of economic shocks as well as inspiring domestic demands for stronger citizen voice, greater accountability and improvements in living conditions.

The regional political upheaval impacted Jordan economically through two factors:

(i) the sharp drop in natural gas supplies from Egypt led to a surge in Jordan's current account and fiscal deficits; and

(ii) the Syrian conflict which led to a large influx of refugees is further straining Jordan's difficult fiscal position. Equally important is the instability in the region as a whole.

Recent reports confirmed that Jordan's economy has been on a path of recovery for the last 5 years. In 2015, the growth ratio was about 2.4% and according to the IMF forecasts, economic growth may touch 3% in 2016. But still there are worrying negative trends, such as increasing public debt and significant decrease of money transfer from Jordanians working in the Gulf States.

Unfortunately, unemployment rate is also rising. Foreign employment is estimated over 800,000 working in the construction, agriculture and services sectors. Moreover, annual foreign direct investment (FDI) inflows fell 36.6% in 2015. Lower investments, which are attributed to external factors mainly the armed conflicts in the neighbouring Arab countries, contributed to the reduced growth rate. The main economic indicators in Jordan for 2014 are shown in Table 4-22 and Table 4-23.

Table 4-22 Main Economic Indicators

Indicator	Value
Growth rate of GDP at fixed producer prices	3.1%
Growth rate of GDP at current producer prices	6.6%
Total production at fixed prices	11,147.6 Million JDs
Total production at current prices	25,194.5 Million JDs
Inflation rate	5.0%
GDP per Capita (JD)	3,876.00
Trade balance (Goods Only)	-3,000 Million JDs

Table 4-23 Average Growth Rates in Fixed Prices

Sector	Rate
Agriculture	7.6%
Industry	
- Mining Industry	27.6%
- Other Industry	1.5%
- Energy (water & electricity)	3.3%

Construction	6.8%
Trade, Restaurants, and Hotels	3.7%
Transportation and Communications	1.6%

Public debt (91.7% of GDP at the beginning of 2016) is continuing to rise due to an increase in the debt being accumulated by the electricity and water entities, while the debt of the central government declined. There is a targeted program to correct the situation with the IMF and the Ministry of Finance will strictly follow agreed action plan. This new program is necessary to anchor government commitments to reforms, and increase confidence in the economy as well as to bridge the gap in the balance of payments. But still more effort should be focused on improving:

(i) Investment climate;

(ii) Labour market reforms; and

(iii) Governance which is currently under discussion to be targeted in the near future with the help from IMF.

In this regard and during the past few years, the GoJ made some progress in addressing the aforementioned challenges, these include:

(i) Reducing fuel subsidies by eliminating government subsidies on fuel for cars; and

(ii) Gradually increasing retail prices of electricity and water for almost all categories of consumers except the 1st two segments of residential consumers.

After serious disruptions of natural gas supply from Egypt, the cost-recovery strategy for NEPCO has been successful and this was achieved by increasing electricity tariffs since 2013 by 15% on yearly basis. LNG imports started in 2015 to substitute for liquid fuels used in power generation plants. At present about 85% of the generated electricity is by firing LNG in thermal power plants.

The costs and impacts of Syrian refugees are very high and caused serious difficulties for concerned authorities and hosting communities. The GoJ is suffering from lack of available resources and international aid. Hosting increasing number of Syrian refugees are being mitigated by the National Resilience Plan 2014-2016 and Jordan Response Plan 2016-2018 which includes priority responses to mitigate the impact of the Syrian crisis on Jordan and on host communities.

We can conclude that GoJ policies are in the right direction to support macroeconomic stability. The 2016 budget targets are appropriate, with a forecasted deficit reduction by 1% from 2015, in addition to efforts to reduce the growth rate of debt. The monetary stance remains a strong point and has been stable in recent

years, with a rebound in foreign currency reserves. Fixing and pegging the local currency (Jordanian dinar) to the US dollar has helped in controlled inflation expectations and provided a measure of fiscal stability.

Viewpoint 1: Tafila Highway	
 **Figure A-1 Existing view from Viewpoint 1 (180^{O} field of view): The Agriculture building is located in the north of AEC wind farm. The selected viewpoint is a Highway**	
Visual Baseline Assessment	
Viewpoint Information	Coordinates : 30.797500N 35.700250E Elevation : 1291 m View : WSW
Description	• Nearest turbine is approximately 280 m (T14) to the south of this viewpoint; • Represents typical and accessible views of highway users. The view of AEC wind farm from the viewpoint is given in the Figure A-1 above. As it is shown in the figure, the observers at the viewpoint which is on SW of the wind farm will be able to observe the turbines of wind farm. The closest turbine of AEC wind farm is turbine T14 at a distance of 280m. The movement and form of the turbines will not create contrast with the baseline characteristics of the view.
Key visual sensitivities	• Strong rural character, with agricultural land; • The concentration of native vegetation on small areas.
Overall inherent sensitivity	The overall sensitivity of receptors from this point is considered to be medium, due to on the primary transport road.

Viewpoint 2: Hussein Agricultural Station	
 **Figure A-2 Existing view from Viewpoint 2 (180^{O} field of view): Hussein Agricultural Station is located on north east of AEC wind farm.**	
Visual Baseline Assessment	
Viewpoint Information	Coordinates : 30.791465N 35.717725E Elevation : 1217 m View : SW
Description	• Nearest turbine is approximately 1030m (T12) to the W of this viewpoint; • Represents typical and accessible views of personnel and visitors. The view of AEC wind farm from the viewpoint is given in the Figure A-2 above. As it is shown in the figure the observers at the viewpoint which is on NE of the wind farm will be able to observe the turbines of wind farm. The closest turbine of Abour WF is T12 at a distance of 1,217m to the viewpoint.
Key visual sensitivities	• Strong rural character; • An “un-built” skyline.
Overall inherent sensitivity	The overall sensitivity of receptors from this point is considered to be low.

Viewpoint 3	
 **Figure A-3 Existing view from Viewpoint 3 (180^{O} field of view)**	
Visual Baseline Assessment	
Viewpoint Information	Coordinates : 30.781269N 35.672693E Elevation : 1271 m View : E
Description	• Nearest turbine is approximately 900m (T11) to the NE of this viewpoint; • Represents typical and accessible views of minor access road users. The view of AEC wind farm from the viewpoint with a view direction of E is given in the Figure A-3 above. T11 is closest turbine of Abour WF to the viewpoint at a distance of 1,271 m respectively.
Key visual sensitivities	• Strong rural character; • An 'un-built' skyline.
Overall inherent sensitivity	The overall sensitivity of receptors from this point is considered to be low.

Viewpoint 4	
 **Figure A-4 Existing view from Viewpoint 4 (180^{O} field of view**	
Visual Baseline Assessment	
Viewpoint Information	Coordinates : 30.797145N 35.684761E Elevation : 1237 m View : NE
Description	• Nearest turbine is approximately 810m (T13) to the E of this viewpoint; • Represents typical and accessible views of road users. The view of AEC wind farm from the viewpoint with a view direction of NE is given in the Figure A-4 above. T10 is the closest turbine to the viewpoint at a distance of 810 m.
Key visual sensitivities	• Strong rural character; • An 'un-built' skyline.
Overall inherent sensitivity	The overall sensitivity of receptors from this point is considered to be low.

Viewpoint 5 : Tafila Town	
 **Figure A-5 Existing view from Viewpoint 5 (180^{O} field of view): At-Tafilah is located on north of AEC wind farm.**	
Visual Baseline Assessment	
Viewpoint Information	Coordinates : 37.197612E 36.961210N Elevation : 1237m View : SE
Description	• Nearest turbine is approximately 6,300m (T3) to the SSW of this viewpoint; • Represents typical and accessible views of residents and visitors; • The bases of four of the turbines will be screened by foreground vegetation and changes in landform. The observers at the viewpoint are able to view AEC wind farm as can be seen in Figure A-5 above. The closest turbine of Abour WF to the viewpoint is T13at a distance of 6,300m.
Key visual sensitivities	• Minaret of mosque • Strong rural character • An “un-built” skyline
Overall inherent sensitivity	The overall sensitivity of receptors from this point is considered to be low, due to distance.

Mitigation Measures

Regarding the visual impacts and necessary mitigation measures, visual impacts of minor and below are considered as not significant, as this is the level at which changes would be clearly perceived. Since the visual impacts at the viewpoints in this study are classified negligible to minor, no mitigation measures are proposed.

Impact on Tourism

Due to its remote location, the proposed AEC wind farm will not affect the tourism in the area. However, it will be a destination for some categories of the community: students from different stages will visit the site to understand how wind energy converted to clean electricity with zero emissions. It could become a destination for students from educational facilities throughout Jordan, which should help contribute to domestic tourism, and making the area more known throughout Jordan.

Land Acquisition and Resettlement

It is not anticipated there will be any resettlement necessary for the implementation of Abour Energy wind farm; all needed parcels of lands for the Project have already been leased from the private owners under 22-year land lease agreements. Some additional parcels of land will be leased in the near future for construction of some of the access roads within the existing overall coordinates of the Project site. However, for the sake of completeness of the ESIA, if there were to be any resettlement, the procedure and requirements were previously outlined (see section 2.5.3), for the record.

Mitigation Measures

Following the assessment of the socio-economic aspects and impacts throughout the Project phases (i.e. construction, operation and decommissioning), mitigation measures for certain socio-economic aspects were recommended in order to reduce or eliminate their potential impacts. These include the following aspects.

Employment

- It is highly recommended to give priority to qualified local contractors to execute some of the construction works related to the Project such as site preparation.
- It is highly recommended to give priority to qualified local people in recruitment for skilled and non-skilled jobs in the Project.
- Local staff should undergo technical training by the developer and the EPC contractor in order to improve their technical capacity, and increase their attractiveness as potential workers on other similar projects in the region.

Business prosperity

- It is recommended that the Project workers and related staff get supplies, food and beverages, and spare parts (to the extent available) from local stores.
- It is recommended to use local vehicle maintenance workshops during all phases of the Project.
- It is recommended to encourage local young entrepreneurs to establish small businesses that could be awarded small service contracts during operations such as security, simple maintenance, and janitorial services.

Stress on Infrastructure

- Strict instruction shall be given to the drivers in this Project to comply with the rules of road traffic (internal and external).
- To protect the roads, the trucks that will be used for construction and equipment transporting should have a gross weight within the axial permissible load.

Monitoring

AEC will track and monitor the impact on the following quantitative socio-economic indicators:

- Local employment (disaggregated by male/female, village origin, and type of post);

edouin participation in Project;

- Households/persons resettled and assisted in the resettlement;
- New training and skill levels;
- Traffic accidents;
- New community development projects;
- Changes in local incomes;
- New income generation activities and initiatives associated with t