

# ACWA Power Sirdarya 1,500MW CCGT Power Plant (IPP) Republic of Uzbekistan



Environmental and Social  
Impact Assessment (ESIA)  
Volume 1 - Non-Technical  
Summary

Prepared for:



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## DOCUMENT INFORMATION

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<b>5Cs PROJECT MANAGER</b>	Eva Muthoni Kimonye
<b>5Cs PROJECT DIRECTOR</b>	Ken Wade

## DOCUMENT CONTROL

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# 1 INTRODUCTION

## 1.1 The Project

The government of the Republic of Uzbekistan aims to modernise and increase the electricity production in the country in order to foster economic growth. As part of this aim, the government plans to develop new gas fired Combined Cycle Gas Turbine (CCGT) plants on two adjacent plots of land near existing power infrastructure at the settlement of Shirin, a border town with Tajikistan. The Project Location is shown in Figure 3-1, herein.

The eastern plot of land has been allocated to ACWA Power for development of a 1,500MW CCGT (2 no. 750MW units) plant (the Project), whilst the western plot is being assessed separately for competitive bids by the IFC (part of the World Bank Group).

The Project is being developed by ACWA Power, through a Project Company, 'ACWA Power Sirdarya LLC' (Tashkent) registered in the Republic of Uzbekistan and with registration number 306900046. ACWA Power Sirdarya LLC has entered into a 25-year Power Purchase Agreement (PPA) with JSC 'National Electric Networks of Uzbekistan'

The Project benefits include:

- **Improved generation efficiency:** the Project will achieve a minimum of 60% efficiency; which is on the upper end of European 'Best Available Technique' expectations. This will increase the overall generation efficiency in Uzbekistan.
- **Increased Carbon Efficiency:** Due to the modernisation and efficiency enhancement, the project will reduce greenhouse gas emissions per kWh of energy generated in Uzbekistan.
- **Improved energy reliability:** The plant represents a major investment in baseload generation capacity in Uzbekistan.

This Non-Technical Summary (NTS) of the Environmental & Social Impact Assessment (ESIA) provides a description of the project, and describes the potential benefits and impacts associated with its construction and operation. It also describes how these will be mitigated. In addition, it provides an overview of the public consultation activities and the approach to future stakeholder engagement; which is delineated in the standalone Stakeholder Engagement Plan (SEP).

The NTS has been prepared for the potential financing of the Project by the European Bank for Reconstruction and Development (EBRD), and other Lenders including DEG and MIGA.

The Project's Environmental and Social Impact Assessment (ESIA) is available in English and Russian <sup>1</sup>.

## 1.2 Background and Rationale

### EXISTING POWER GENERATION INFRASTRUCTURE IN SIRDARYA

The Project site is located in close proximity to the Sirdarya Thermal Power Plant (TPP), which has 10 operational units (3,065MW total capacity) commissioned between 1972 & 1981 and is currently fuelled by a combination of natural gas and fuel oil.

According to official communication from the Ministry of Energy issued on 5<sup>th</sup> June 2020, 4 units at the existing Sirdarya TPP will be decommissioned between 2023-2024. The remaining 6 modernized power units will operate on natural gas only, with a combined total capacity of 1,830 MW. For the purpose of providing a conservative assessment of the potential cumulative impacts; it has been assumed that these 6 modernised units will remain operational, potentially alongside the ACWA CCGT<sup>2</sup>.

### NATIONAL EIA (OVOS)

A National EIA (OVOS) has been prepared by a locally based consultant, "TEP", who have also undertaken all technical due diligence activities (including EIA) on behalf of Uzbekenergo for thermal power projects. The preliminary EIA considered the feasibility of the collective development of a 2,300MW CCGT (with 4 units). It is noted that the same 4 CCGT units that have since been split into the ACWA Power CCGT and the CCGT under IFC tender, although it is likely that the overall power output may be up to 3,000MW.

In addition to the OVOS, a Project specific Stage II EIA was submitted to the State Committee on Ecology and Environmental Protection on 23<sup>rd</sup> June 2020 by 5 Capitals' sub-consultant, Juru Energy (Tashkent), and it was reviewed and approved on 22<sup>nd</sup> July 2020. This allows project construction to go ahead. A Stage III 'Statement on Environmental Consequence' is required to be submitted, and approved, prior to commencement of project operations.

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<sup>1</sup> Please find website link to disclosed E&S documents: <https://www.acwapower.com/en/projects/sirdarya-ccgt/>

<sup>2</sup> However, there are limitations on grid capacity and fuel supply which means that regular operation of the remaining 6 Sirdarya TPP units alongside the ACWA CCGT is unlikely.

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## LENDERS' ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

An *Environmental and Social Scoping Report* was completed on 7<sup>th</sup> May 2020, to identify the likely risks and impacts of the project, and inform the scope of the *Environmental and Social Impact Assessment* (ESIA).

The ESIA was undertaken in line with international requirements<sup>3</sup> (as well as Uzbekistan Requirements), and the objectives of the ESIA include, but are not limited to:

- Provide an overview of the Project design, identification of sensitive receptors in the Project's area of influence and assessment of Project alternatives including Best Available Technique (BAT);
- Assessment of baseline conditions (existing conditions) prior to the development of the Project through review of available data and conducting surveys;
- Assessment of the Project's environmental and social impacts for the construction and operational phases;
- Assessment of Gender Based Violence & Harassment (GBVH) including Sexual Exploitation and Abuse (SEA) risk and impacts during the construction and operational phases of the Project;
- Review of compliance obligations, including applicable Uzbekistan regulations and international regulations and standards as well as international lender requirements;
- To engage with key stakeholders and Project affected people to disclose Project information, study outcomes, gain lay knowledge about the local environmental and social context and seek feedback on Project;
- Determination of applicable mitigation and management measures including monitoring requirements to be implemented in order to avoid or minimise potential impacts and maximise potential environmental and social gains;
- Consideration of alternatives that can be used for the project leading to greater social and environmental gains; and
- Prepare a framework from which the construction, commissioning and operational phases respective environmental and social management systems and plans can be developed and implemented.

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<sup>3</sup> 'International Requirements' includes: EBRD Environmental & Social Policy (2019); Equator Principles IV (2020); IFC & EBRD Worker's Accommodation, Processes and Standards (2009); and ILO Conventions.

In order to comply with the requirements for environmental & social assessment established in Uzbekistan and international good practice, the ESIA has been divided into several volumes as follows:

- **Volume 1:** ESIA Non-Technical Summary;
- **Volume 2:** ESIA Main Text, Tables, Figures and Plates;
- **Volume 3:** ESIA Framework for Environmental & Social Management; and
- **Volume 4:** ESIA Technical Appendices

## 1.3 Related Project Environmental & Social Documents

The Project's Environmental & Social documentation also includes the following, which have been prepared separate to the ESIA:

- Stakeholder Engagement Plan (SEP), Including Grievance Mechanism and
- Livelihood Restoration Framework (LRF).

### 1.3.1 Environmental & Social Due Diligence Assessment and ESAP

In addition to the above, 'WSP' has been engaged on behalf of the lenders to undertake an Environmental & Social Due Diligence Assessment of the Project. An Environmental & Social Action Plan (ESAP) has been prepared alongside this assessment, which delineates required actions in order for the Project to maintain compliance with lender requirements throughout its lifetime. The ESAP is committed under the financing agreements. The ESAP has been developed and is disclosed as part of the package of Environmental & Social documents.

## 1.4 Key Project Information

**Table 1-1 Key Project Information**

<b>PROJECT TITLE</b>	ACWA Power Sirdarya 1,500MW CCGT Power Project
<b>PROJECT DEVELOPER</b>	ACWA Power
<b>PROJECT COMPANY</b>	ACWA Power Sirdarya LLC
<b>OFF-TAKER</b>	JSC National Electric Networks of Uzbekistan
<b>GAS SUPPLY AGREEMENT</b>	JSC National Electric Networks of Uzbekistan and JSC Uztransgaz
<b>EPC CONTRACTOR</b>	China Gezhouba Group International Engineering Co., LTD (CGGC)
<b>O&amp;M COMPANY</b>	First National Operation and Maintenance Co. Ltd (NOMAC)
<b>ENVIRONMENTAL CONSULTANT</b>	5 Capitals Environmental and Management Consulting (5 Capitals) PO Box 119899, Dubai, UAE Tel: +971 (0) 4 343 5955, Fax: +971 (0) 4 343 9366 www.5capitals.com
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## 2 PROJECT SUMMARY

### 2.1 Project Description Summary

The Project is a 1,500MW natural gas fired Combined Cycle Gas Turbine (CCGT) power plant, that will operate independently and offload power to the grid via a shared electrical switchgear station with a future CCGT project (being tendered by IFC), expected on adjacent land.

The main project facilities will include:

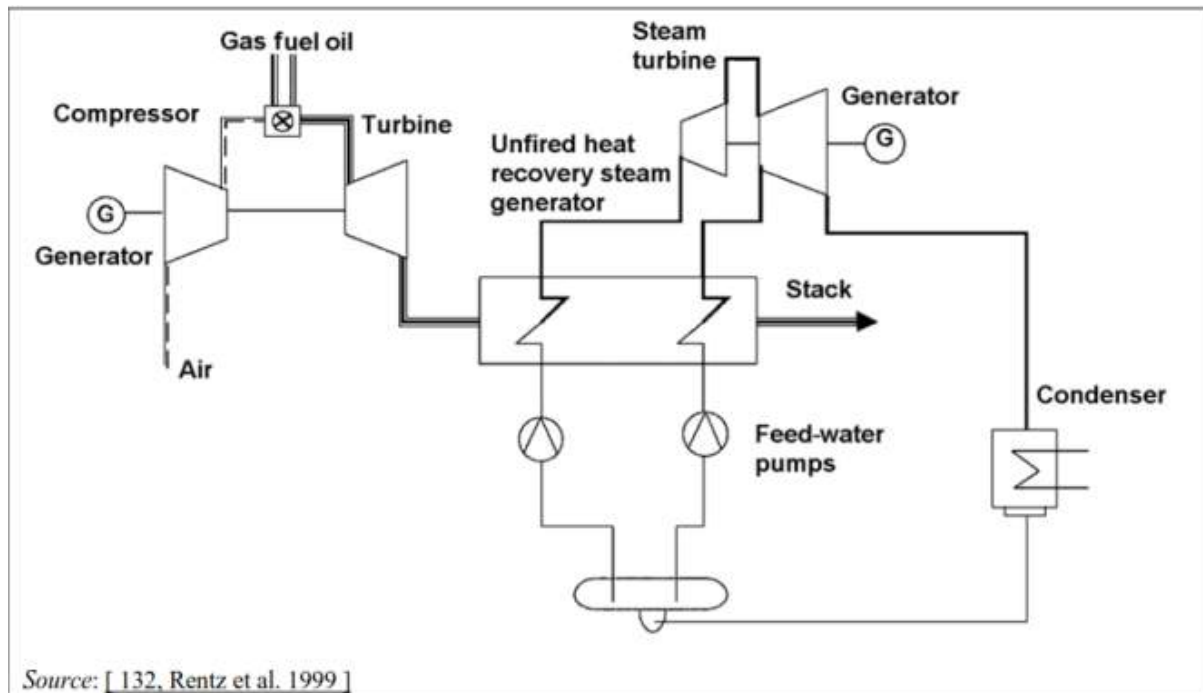
- Power block and stacks including 2 \* Gas Turbines (GT), 2 \* Heat Recovery Steam Generators (HRSG) and 1 \* Steam Turbine (ST);
- Closed Loop Cooling Water system and Open Loop Cooling System;
- Gas receiving terminal;
- Intake and outfall to the YG Canal;
- Water treatment plant;
- Wastewater treatment plants; and
- Ancillary/support facilities (i.e. electrical system, site entrance and security building, laboratory, workshops etc).
- 500/220kv switchgear station; which will be developed by the Project and then transferred to the JSC National Electric Networks of Uzbekistan. This will be a shared facility with the future IFC CCGT plant to be developed adjacent to the Project.

Associated facilities will be limited, as the Project benefits extensively from existing gas pumping stations and transmission infrastructure nearby. However, the following additions will be required:

- A short gas pipeline connection to an existing gas supply system (length not confirmed, but approximately 1km);
- A short connection into the pre-existing transmission network. The alignment and full details of the connection are not yet confirmed.

A schematic illustration of a CCGT plant is provided under Figure 3-1, overleaf.

**Figure 2-1 Schematic Illustration of a Combined-Cycle Gas Power Plant**



Source: (Reproduced from LCP BREF, Figure 3.56: Schematic of a combined-cycle power plant with a heat recovery steam generator (HRSG), pp.271)

## 2.2 Project Location

The Project is located approximately 1.9km northeast of the city of Shirin, which is a border town on the Uzbekistan side of the border from Tajikistan. The greenfield site is in close proximity to an existing 3,000MW oil/gas Thermal Power Plant (Sirdarya TPP), located immediately on the border with Tajikistan.

The Project will take water from the nearby Yuzhny-Golodnostepsky (YG) canal. The canals withdraw water from Syrdarya river several kilometers from Bekabad hydro gauge. The Project area heavily depends on the canals for irrigation purposes through a network of irrigation ditches that run through the fields.

The proposed Project location is as shown in the figure below.

**Figure 2-2 Proposed Project Location**



## 2.3 No Project Scenario

The government of the Republic of Uzbekistan through the Ministry of Energy aims to modernise and increase the electricity production in the country to foster economic growth and develop public-private partnership in the country's energy sector. The Sirdarya CCGT project forms part of the Ministry of Energy's plan to increase and modernise electricity production in the country.

The Sirdarya CCGT project also forms part of the Strategy of Action for the Five Priority Development Areas of Uzbekistan (2017 -2021) to introduce new technologies for generating thermal energy as the Project is being implemented as heat recovery in order to generate electricity.

Given the strategic need for the project, the 'No Project' option is unlikely to be a reasonable alternative, as it would not align with the objectives of the Ministry of Energy and the objectives of the Strategy of Action for the Five Priority Development Areas of Uzbekistan (2017 -2021).

In the event of the Project not proceeding, there are three foreseeable alternative 'no-project scenarios' which would not result in a decrease in power generation from the existing situation. These include:

- No Change: The TPP continues its current operations without modernisation and no other power plants in Sirdarya region are developed.
- TPP Modernisation plus the IFC Project: In such a situation the ACWA Power CCGT would not proceed.
- No TPP Modernisation plus IFC Project: In such a situation the ACWA Power CCGT would not proceed.

Depending on the no-project scenario above there are varying impacts associated with: land take, employment and community opportunities/impacts, air emissions/ambient air quality, noise, water use, discharges etc. The expected worst-case scenario for the environment would likely be the 'No TPP Modernisation plus IFC Project' scenario, as there would essentially be an additional environmental impact of the IFC Project on-top of the current situation, as well as impacts of land take.

It is generally expected that the Project option as proposed herein would not result in a worsening of the environment vs. any of the three theoretical no project alternatives outlined above. The only additional factor that the proposed Project includes that is additional to the above no-project options is the need for land take and livelihood restoration.

Given these consequences, the most appropriate alternative is the implementation of the Project on the basis that the mitigation, management and monitoring measures included to this ESIA are observed and adhered to.

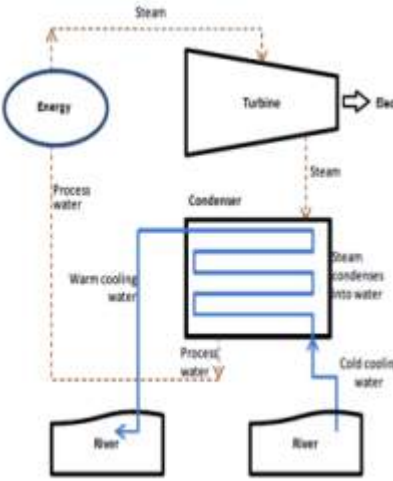
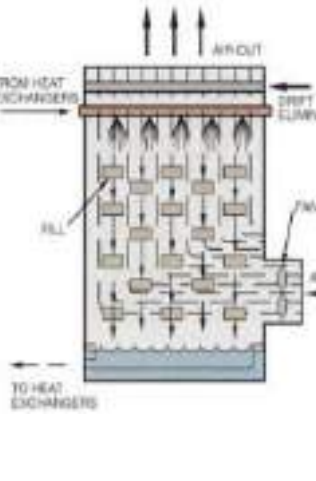

## 2.4 Alternatives Analysis: Cooling Technology

As part of the ESIA, and broader engineering studies, a series of alternatives have been considered in optimising the project's performance; whilst also managing environmental and social risks.

Cooling methods are a particularly key aspect of alternative analysis. Water availability in Uzbekistan (including the Project area) is highly variable, relatively scarce, and a vital resource to the local agriculture. Furthermore, it is possible that regional water scarcity could increase as a result of climate change, although local climate models also predict an increase in river flow (up to 2050 and for the period of the Project's Power Purchase Agreement) due to additional meltwater from glaciers that (in part) feed these rivers.

A range of cooling techniques are available and have been considered in the design of the Project. These include 'Once-Through Cooling'; 'Cooling Towers'; and 'Air-Cooled Condensers'. Schematic illustrations of these techniques are provided below.

Figure 2-3 Example Cooling Methods

		
<p><b>Wet Cooling Methods:</b> Schematic of a once-through cooling system abstracting cool water, and discharging warm water, into a river/water body (such as the YG Canal)</p>	<p><b>Cooling Towers:</b> Schematic representation of a cooling tower with counter-flow design (Reproduced from IPPC, Reference Document on the Application of Best Available Techniques to Industrial Cooling Systems, December 2001).</p>	<p><b>Air-Cooled Condensers:</b> Example of an Air-cooled Condenser of turbine exhaust steam. (Reproduced from IPPC, Reference Document on the Application of Best Available Techniques to Industrial Cooling Systems, December 2001).</p>

The Project has selected Induced Draft Mechanical Cooling Towers using a closed-loop system, as the best way of balancing plant performance, and water consumption. The selection of this solution is based on a range of factors, including: (a) capital costs; (b) water demands; (c) future availability and cost of water; (d) ambient conditions (e.g. air temperature, humidity, wind, and YG-Canal water temperature); (e) fuel costs; and (f) associated environmental and social impacts of each cooling option.

A summary of the key benefits and comparison of the selected option against alternatives is illustrated below.



**Table 2-1 Comparison of Example Cooling Methods**

TECHNIQUE	ABSTRACTION DEMAND	WATER LOSSES	EFFICIENCY	COMMENTS
<b>Air Cooled Condenser</b>	LEAST (Approx. 0.07m <sup>3</sup> /s) <sup>A</sup>	LEAST (Approx. 0.07-m <sup>3</sup> /s) <sup>A</sup>	<b>LOWEST</b>	Results in efficiency impacts, and consequentially, greater fuel consumption and increased carbon intensity (gCO <sub>2</sub> (e)\kWh).
<b>Induced Draft Mechanical Cooling Towers</b> (Proposed Technique)	COMPROMISE (Approx. 0.37m <sup>3</sup> /s) <sup>B</sup>	MINIMISED* (Approx. 0.37m <sup>3</sup> /s) <sup>B</sup>	<b>COMPROMISE</b>	Proposed technique balances water security and efficiency, taking into account local water resource context. <b>*By adopting a Zero Liquid Discharge technique, the abstraction demand has been decreased from 0.64m<sup>3</sup>/s, to 0.37m<sup>3</sup>/s (42.5% reduction).</b>
<b>Once-through Cooling (OTC)</b>	MOST (Approx. 57m <sup>3</sup> /s) <sup>C</sup>	LEAST (Approx. 0.07m <sup>3</sup> /s) <sup>A</sup>	<b>HIGHEST</b>	Highly vulnerable to erratic flows in YG Canal, and risk that plant shutdown is required is insufficient flow is available to meet abstraction requirement.
<p>A: Based on Water Balance Diagram provided under Project documentation, excluding cooling tower flow.</p> <p>B: Based on Water Balance Diagram, provided under Project documentation.</p> <p>C: WSP estimate using GTPRO aligned with 701JAC.2015 GT in 2 + 1 configuration with temperature rise +3°C..</p>				

## 2.5 Alternatives Analysis: Best Available Techniques (BAT)

BAT is a concept which requires that available techniques (i.e. technology and operational practices) are adopted to prevent, or minimise emissions or impacts on the environment. The European Commission produces *Best Available Technique Reference Documents* (or BREF Notes) which contain BAT conclusions for specific industries and define emission limits, referred to as 'BAT AELs' (BAT Associated Emission Limits), as well as other performance criteria, such as efficiency.

BAT conclusions for Large Combustion Plants (LCPs) – of which the Project falls under – were published in August 2017<sup>4</sup>, and the accompanying BREF document was published in

<sup>4</sup> Conclusions on Best Available Techniques (BATs) for Large Combustion Plants (LCPs), Commission Implementing Decision (EU) 2017/1442, 31 July 2017.

December 2017<sup>5</sup>. The Project is considered to materially reflect BAT, given the particular location and characteristics. In particular:

- **Energy Efficiency:** The project will achieve a Net Electrical Efficiency of >60%; which is at the top end of BAT (54 – 60.5% for new CCGTs)
- **NOx Emissions:** The Project will comply with BAT-AELs for NOx throughout its operation. During combined-cycle operation; the design includes **Selective Catalytic Reduction (SCR)** – a technique for reducing NOx emissions – to ensure compliance with BAT AELs.
- **CO Emissions:** The Project will comply with BAT-AELs for CO throughout its operation.
- **Cooling Tower Drift Losses,** which are losses from the Cooling Towers, will be limited to <0.1% in line with BAT.
- **Water Reduction Measures,** further to the selection of Induced-Draft Mechanical Cooling Towers, the project has further reduced the abstraction demand through the use of a Zero Liquid Discharge (ZLD) system. In principle, the main benefit of the ZLD is the avoidance of effluent discharge into the YG Canal, and a reduction in the abstraction demand of the plant

The requirement to implement the Project in line with BAT is incorporated within the Project Documents and ensured through the Environmental & Social Action Plan; which also requires regular independent audits to verify that the plant is operating in line with BAT.

## 2.6 Land Ownership and Land Use

According to the 1998 Land Code of the Republic of Uzbekistan, all land in Uzbekistan is State property and permits for use of land are granted and monitored by the State through the rayon and oblast administrations. The Project will be awarded land via a Land Lease Agreement.

### LAND USE

The Project plot is 84Ha in area including the common switchyard, to be shared with the future IFC CCGT. The Project plot also includes sufficient space for Carbon-Capture-Storage (5.625ha), in the event that it becomes viable to retrofit in future<sup>6</sup>.

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<sup>5</sup> Joint Research Centre (JRC) Science for Policy Report, *Best Available Techniques (BAT) Reference Document for Large Combustion Plants*, EUR 28836 EN, December 2017.

<sup>6</sup> Viability studies will be undertaken on a 5-year basis throughout the Project's operation in line with the ESAP.

However, the land has been entirely in use by local farmers for agricultural purposes, primarily rice and vegetable cultivation. Therefore, there will be impacts to livelihoods that will be carefully managed, and compensated, in accordance with international best practice (see Section 4.12 herein for further details). This will be guided by a project-specific *Livelihood Restoration Plan* that will be prepared in line with the *Livelihood Restoration Framework*, which has also been disclosed as part of the financial close E&S package.

## 2.7 Project Construction & Commissioning

Construction and commissioning will be the responsibility of China Gezhouba Group International Engineering Co. Ltd (CGGC, the EPC Contractor). There is an existing EPC contract in place that includes requirements related to environmental and social compliance. All temporary construction working areas and facilities will be located within the Project footprint including EPC Contractor accommodation facilities. It is expected that the EPC Contractor will engage several Sub-Contractors and there will be a peak workforce of approximately 2,160 workers.

## 2.8 Project Operations

The operational workforce is expected to include approximately 40 people for First National Operation and Maintenance CO. Ltd (NOMAC\_O&M Company). The workers will be required to make arrangements for their own accommodation facilities which will most likely be located in Shirin town or Bayavut District.

## 2.9 Project Milestones

Based on the details provided by ACWA Power and Appendix C of the PPA (Project Implementation Schedule), the following timeline is currently in place for the Project.

**Table 2-2 Key Project Milestone/Timeline Dates**

MILESTONES	DATE
Limited Notice to Proceed (LNTP)	October 2020
Notice to Proceed (NTP)	October/November 2020
<b>From PPA (Appendix C)</b>	
Scheduled Early Power Unit 1 Commercial Operation Date (for GT in open cycle)	[25 – 28]* months after Financial Closing
Scheduled Early Power Unit 2 Commercial Operation Date (for GT in open cycle)	[29 - 32]* months after Financial Closing
Scheduled Project Commercial Operation Date (Combined Cycle)	36 months after Financial Closing

\* Depending on final selection of gas turbine manufacturer and on the date the Financial Closing occurs.



### 3 STAKEHOLDER CONSULTATIONS

Stakeholder identification and consultations for the ACWA Power CCGT Project have been conducted during the Scoping and ESIA Stage. Separate consultations related to livelihood restoration are also being undertaken as part of the livelihood restoration planning process. The stakeholder identification process has identified impact based, interest based and decision-making stakeholders.

The methods used for the on-going stakeholder engagement process include meetings, emails, telephone calls and letters with national, regional and local authorities. These were however somewhat disrupted by the current COVID-19 pandemic. Public consultations and meetings were also held between 28th May and 5th June 2020 as shown below:

- Bayavut District
  - 28th May 2020: This meeting was attended by 12 people from Sarmich community and 6 farmers.
- Shirin Town
  - 28th May 2020: This meeting was attended by 15 participants, including 7 City Council Deputies.
  - 5th June 2020: This meeting was attended by 30 participants and targeted the youth, unemployed and low-income families.

As a result of the public assembly restrictions due to the outbreak of COVID-19 pandemic and in coordination with Bayavut and Shirin administrations Juru Energy and 5 Capitals prepared Project specific brochures that were distributed to the local communities in the Project area on 5<sup>th</sup> August 2020. The brochures included Project information, expected positive impacts including negative impacts during construction and operation and outlined the provisions of the grievance mechanism.

On 2<sup>nd</sup> July 2020, Juru Energy was invited to organise a Zoom video conference meeting with eight (8) women from Sarmich and Julangar communities in Bayavut. The video conferencing call was organised by Bayavut district Head of Investment Department.

The table below provides a summary of the consultation conducted to date.

**Table 3-1: Summary of Stakeholder Consultation**

CONSULTATION ON TARGET GROUP	PARTICIPANTS	MAIN AGENDA	ISSUES RAISED BY PARTICIPANTS
<b>Bayavut District</b>			
<b>Directly Affected Communities</b>	Deputy mayor, Head of investment department Farmers, local communities	<ul style="list-style-type: none"> <li>General overview of the CCGT construction: <ul style="list-style-type: none"> <li>Purpose, nature and scale of construction</li> <li>Timeline and schedule of construction</li> </ul> </li> <li>Impacts of CCGT <ul style="list-style-type: none"> <li>Positive (e.g., opportunities for new job placements, cheaper electricity and etc)</li> <li>Negative (noise, air pollution, and etc.)</li> <li>Measures for negative impact mitigation</li> <li>Safeguard measures (that will be taken to reduce impact on environment and communities)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Compensation plans for the farmers that will lose their land due to the Project development.</li> <li>Concerns were raised on whether there will be enough water in the canal to support the operation of the new CCGT and the existing Sirdarya TPP.</li> <li>Plans for the Project to improve the social infrastructure or build new infrastructure in the Project area such as schools, kindergartens.</li> <li>What safety measures will be implemented by the Project?</li> <li>Will the Project offer employment opportunities for local experts?</li> </ul>
<b>Targeted Groups</b>	Women	<ul style="list-style-type: none"> <li>Open Discussions, Questions and Answers</li> </ul>	<ul style="list-style-type: none"> <li>Plans for the Project to help unemployed women in Bayavut district.</li> <li>Clarifications on whether the graduates from the College of Energy will be provided with job opportunities in the ACWA Power plant after completion of their studies</li> </ul>
<b>Shirin Town</b>			

CONSULTATION ON TARGET GROUP	PARTICIPANTS	MAIN AGENDA	ISSUES RAISED BY PARTICIPANTS
<b>Directly Affected Communities</b>	Mayor, Head of investment department, city council deputies' local communities, farmers	<ul style="list-style-type: none"> <li>General overview of the CCGT construction: <ul style="list-style-type: none"> <li>Purpose, nature and scale of construction</li> <li>Timeline and schedule of construction</li> </ul> </li> <li>Impacts of CCGT <ul style="list-style-type: none"> <li>Positive (e.g., opportunities for new job placements, cheaper electricity and etc)</li> <li>Negative (noise, air pollution, and etc.)</li> <li>Measures for negative impact mitigation</li> <li>Safeguard measures (that will be taken to reduce impact on environment and communities)</li> </ul> </li> <li>Open Discussions, Questions and Answers</li> </ul>	<ul style="list-style-type: none"> <li>Clarification on how much fuel will be saved as a result of the development of the new CCGT compared to the Sirdarya TPP.</li> <li>Type of fuel that will be used by the Project.</li> <li>Efficiency of the boilers and where they will be manufactured from.</li> <li>Clarifications on whether there are any plans to develop wind energy in the area based on the wind speed.</li> <li>What impact will the ACWA Power Project have on the local infrastructure and will the Project be involved in any social infrastructure development projects?</li> <li>Will ACWA Power be involved in construction of both the new and future IFC CCGT Projects and will these two Projects be located on the 75 hectares of land?</li> <li>Will the Project provide employment to the local communities?</li> </ul>

CONSULTATION ON TARGET GROUP	PARTICIPANTS	MAIN AGENDA	ISSUES RAISED BY PARTICIPANTS
<b>Targeted Groups</b>	Low income families Unemployed Youth		<ul style="list-style-type: none"> <li>• Clarification on the total area allocated for the Project construction.</li> <li>• Provide further details on the efficiency of the Project.</li> <li>• Clarification on what will happen to the farmers who will lose their land.</li> <li>• Clarification on whether there are any plans to establish industrial facilities that will provide technical support to the Project.</li> <li>• How many workers will be required for the project and what will be the skill/experience requirements?</li> </ul>
<b>Consultations Conducted through telephone calls</b>	With 8 of the directly impacted farmers	<ul style="list-style-type: none"> <li>• Land use (i.e. how long have the farmers used the land, income generated from farming etc)</li> <li>• Legal aspects, such as notification on the termination of their land lease agreements, whether they have been contacted by the local administration on valuation and compensation, presence of agricultural plants on the farm at the moment.</li> <li>• Their future plans following the loss of agricultural land (if any).</li> <li>• Presence of existing sites on their farms that might be of cultural importance.</li> </ul>	<ul style="list-style-type: none"> <li>• All the eight farmers responded that farming was their single source of livelihood and mostly rely on their family members and relatives as a source of labour in the farms.</li> <li>• The majority of the farmers have been using the land for more than 5 years and they expressed concern that if moved to another farm it would take them between 3-5 months to cultivate vegetables and grains and 3-5 years for fruit trees.</li> <li>• The farmers stated that they only use the land for agricultural purposes.</li> <li>• Seven (7) out of the eight (8) farmers stated that at the time of consultation they had not received any written or verbal communication/notification</li> </ul>

CONSULTATION ON TARGET GROUP	PARTICIPANTS	MAIN AGENDA	ISSUES RAISED BY PARTICIPANTS
			<p>about the termination of their lease agreement.</p> <ul style="list-style-type: none"> <li>• The local administration had not contacted the farmers regarding land valuation or the compensation process.</li> <li>• None of the farmers had been offered alternative land for farming.</li> <li>• Three out of the eight farmers have higher education diploma but stated that they would likely use the compensation money to start other businesses.</li> <li>• The farmers stated that they did not have any sites on their land which they considered of cultural importance.</li> </ul>

## 4 SUMMARY OF MAIN ENVIRONMENTAL & SOCIAL IMPACTS

### 4.1 Air Emissions and Ambient Air Quality

The Project is located in a relatively rural area of Uzbekistan close to the border of Tajikistan which exhibits similar land use practices, primarily relating to arable agriculture. The surrounding area in Uzbekistan has a slightly more industrialised and commercial land use, which includes the city of Bekabad (approximately 12 km to the east of the Project site), as well as the nearby Sirdarya TPP.

Overall there are few points source emission points locally, but this notably includes the TPP, which primarily emits a combination of NO<sub>2</sub>, CO and occasionally SO<sub>2</sub> to the local airshed. It is possible that local farming practices may also contribute to local air quality impacts, including for Ammonia (NH<sub>3</sub>) and fine particulates (such as PM<sub>2.5</sub>), particularly where there is fertiliser application and poor manure management. Such impacts may be seasonal. There is a limited amount of transport and as such an expected commensurate low level of vehicle emissions to the airshed.

The ESIA collated secondary data over a 5-year period from Bekabad and other regional town Gulistan (monitored by the governments Uzhydromet stations). This included thrice daily measurements for certain air quality parameters. In addition, the ESIA process for the Project has collected specific data via regular monitoring over a 7-day period as well as longer term diffusion tube monitoring over a 3-week period (for several parameters).

The collected data indicates that the airshed at the Project site itself has minimal influence from pollutants and is not considered to be degraded in both the short term or long term versus national and lender standards. This is further corroborated by other data collected from the future IFC CCGT project site during the winter of 2019. Data from Bekabad indicates that there are measurable levels and occasional exceedances of NO<sub>2</sub> throughout the year, which is somewhat expected due to the industrialised nature of the land use in this area. Data for Gulistan indicates much lower levels of pollutants (similar to the Project area measurements), which is also expected given the similar land use patterns (besides the presence of the TPP in Shirin town).

Project impacts to air quality are expected during the construction, commissioning and operational phases, and will be managed through mitigation, with on-going monitoring. The construction impacts will primarily include localised dust emissions and some gaseous emissions from construction vehicles and equipment. Some of these impacts may be discernible at local

receptors, in proximity to the works, although many (particularly for dust) can be well managed via the implementation of good practice construction methods.

Commissioning and operational impacts will primarily relate to the combustion of natural gas (the only fuel), which will result in the primary emission and dispersion of oxides of nitrogen (NO & NO<sub>2</sub>) and carbon monoxide (CO) to the local airshed. ACWA Power have committed to meeting the Best Available Techniques (BAT) guidelines established by the European Union BREF document for Large Combustion Plants (2017). The Project also includes firing with Low NO<sub>x</sub> burners and the use of Selective Catalytic Reduction (SCR) to minimise NO<sub>x</sub> emissions. Slippage of ammonia (NH<sub>3</sub>) may also arise from the use of ammonia in the SCR plant for the Project. Operational impacts have been modelled using the US-EPA approved AERMOD 7 software for both simple and combined cycle modes on natural gas fuel, using data provided by the EPC Contractor and local meteorological data. The modelling has considered the Project scenario in combination to the proposed TPP modernisations and other scenarios for the potential cumulative impacts of the future IFC CCGT (as a high-level assessment) with the Project and in combination with the TPP modernisations.

In regard to Project only impacts for the primary operational regime using combined cycle, there are predicted to be minimal impacts at receptors for both NO<sub>2</sub> and CO. For instance, at the worst affected receptor, there will only be an increment of 0.7µg/m<sup>3</sup> of NO<sub>2</sub> (1.7% of the most stringent Uzbekistan standard). Based on local meteorological data for 3-years the worst case 1-hour average concentration at a receptor may provide an increment of 24.0µg/m<sup>3</sup>, at the worst affected receptors (28.3% of the Uzbekistan 1-hour standard). Impacts at other receptors and for longer duration averaging periods are less. Impacts for simple cycle operations (if used) also have reduced concentrations from the combined cycle predictions.

When considering the Project + TPP Modernisations baseline and baseline, all Project impacts are predicted to be in compliance with applicable standards for NO<sub>2</sub>; on combined cycle and simple cycle. The overall impact of the TPP modernisations will reduce the concentrations of pollutants in the airshed at the majority of receptors, although there will be certain receptors that receive slightly increased concentrations of pollutants due to the location of the proposed CCGT. For hourly and 8-hour mean concentrations of CO, there are no exceedances of the relevant standards. Exceedances of the 24-hour and monthly mean standards are predicted; however, these are due to the high baseline concentrations assumed for the area of the Site. The predicted short-term CO process contribution concentrations are all below 10% of the relevant standards and are therefore considered to be insignificant.

For ammonia (NH<sub>3</sub>), the long-term project process contribution concentrations at receptors were predicted to be well below the annual standard of 40µg/m<sup>3</sup> with main impact being a process contribution of 0.05µg/m<sup>3</sup> at the worst affected receptors (0.12% of the Uzbekistan 1-

hour standard). Such impacts are considered to be insignificant. The same is apparent for other modelled averaging-periods.

A scenario considering the Project + TPP Modernisations + Future IFC CCGT + Baseline was also conducted. This considered a similar design for the Future IFC CCGT as per the ACWA Power CCGT, although slightly higher emission rates were applied in alignment with the WBG/IFC EHS Guidelines for Thermal Power Plants. The locations of future IFC CCGT stacks were also assumed be placed in alignment with those of the ACWA Power project based on the expectation of the gas pipeline alignment and connection point. All annual average results were predicted to be in compliance with applicable standards, although there were short-term exceedances for worst case 1-hour averaging periods at two (2) receptor location for NO<sub>2</sub>, which are predicted to only occurs for up to a total of 15-hours a year assuming the worst-case meteorological conditions. Taking into account conservative assumptions in modelling and stringent nature of the Uzbekistan ambient air quality standards, this is unlikely to be noticeable or result in health impacts. It is noted that the contribution of pollutant concentrations from the Project + Future IFC CCGT remain fairly limited at receptors for these scenarios, but are increased slightly from the ACWA Power CCGT alone. When considering the modernisation of the TPP in combination with the ACWA CCGT project, the overall change in annual average concentrations of NO<sub>2</sub> is slightly reduced in the majority at all receptors (although this is by a small amount), with primary predicted improvements and a small number of worsening concentrations for shorter term averaging periods. Impacts related to CO are similar as the ACWA CCGT alone due to the limited contribution in the airshed.

## 4.2 Noise and Vibration

### 4.2.1 Noise Observations and Baseline Survey

Field observations and review of satellite imagery have identified some noise sources up to 2km from the site, including the existing Sirdarya TPP, a railway line to the south of the TPP and road to the north of the canal (intermittent sources depending on train and vehicle use respectively). Other sources identified during the field surveys included periodic noise from farm equipment and tractors during the day and from fauna such as crickets and frogs during the night when the animals seem to make the most noise.

Noise monitoring was undertaken for 24hrs during the weekdays and weekends at eight locations around the Project area and close to local receptors. Noise in the area was typically observed to be low-level and quiet with occasional periodic sounds from vehicles, agricultural practices and human activity. The existing Sirdarya TPP was not particularly discernible, even during calm periods. Noise levels tended to increase at night-time with the sounds of crickets and frogs (this is a natural influence and not anthropogenic).



The baseline survey results show that there were occasional exceedances of noise recorded during the weekdays and weekends for both night and day when compared to Uzbek standards and WHO guidelines. These exceedances were recorded at monitoring locations near residential areas west, north east, south and south east of the Project site. There is no identifiable trend with regard to the noise patterns or characteristics which are largely dependent on the activities in the local area including the presence of fauna such as crickets and frogs.

No noticeable vibrations were encountered at any time during the site visits or site survey undertaken to date. A specific vibration survey was not undertaken.

Construction activities are expected to result in temporary and short duration increases in the noise (and some vibration) levels at receptors emanating from activities at the Project site, access road and the laydown areas; dependant on the type of works being undertaken. Noise will be generated by construction and propagated to the surrounding areas via a range of processes. This has been assessed under guidance by BS 5228-1:2009 for the 'Code of Practice for Noise and Vibration on Construction and Open Sites'. The assessment predicts a maximum increase of noise of up to 19.2dB(A) from the existing baseline at farm houses south of the site (receptor 7). Such noises will primarily be noticeable due to the relatively quiet nature of the existing background noise at this location. Other receptor locations, Receptor 6 (a fuel filling station south of the Project site) and Receptor 10 (the nearest point of a cluster of residential properties to the east) are predicted to have significant noise impacts during the construction phase, but to a lesser extent of Receptor 6. The highest noise impacts are expected during the mechanical and installation works. Mitigation and management measures have been stated in the ESIA (Volume 2) to ensure noise (and vibration) impacts are reduced where possible.

Operational noise impacts have been assessed using modelling software IMMI2020, to assess the potential impacts at the nearest noise sensitive receptors. The model considers the Simple Cycle and Combined Cycle scenarios and the calculations have undertaken for the Project, future IFC Project and the combined noise levels (Project + future IFC Project).

The modelling study predicts process contribution noise levels for the Project and adjacent future IFC Project (i.e. the specific noise levels from these power plants, without existing baseline) to be in compliance with Uzbek SanPiN No. 0325-16 optimal sound levels, as well as the WHO noise standards (as referenced by the World Bank's EHS Guidelines) of 55dB(A) during the day and 45dB(A) at night at all noise sensitive receptors (commercial and residential) during both simple and combined cycle operations.

The modelled noise scenario of the ACWA Power CCGT Project in combination with the existing baseline does not increase the existing noise levels by more than 3dB(A) at any receptors, although it is noted that there are instances where the overall noise levels (e.g. the background noise + the Project's noise) are in excess of applicable standards, it is attributed

to the higher existing baseline noise levels at those locations. In such cases, the addition of the Project specifically will only have a minor impact on the noise levels at the respective receptor locations.

The cumulative noise scenario of the ACWA Power project + the future IFC CCGT Project predicts an increase of the noise baseline by up to 3.2dB(A) at one receptor location (Receptor 7, a residential area south of the Project site) during the daytime. Such a noise impact is expected to be noticeable.

The assessment considers that the noise impact from the ACWA Power CCGT project alone (with the current plant arrangement and design mitigation) could be acceptable as there is limited additional impact above the baseline. However, depending on the future IFC Project design and its location, mitigation measures may be required for this future project specifically to reduce the cumulative noise impact to align with applicable standards/guidelines.

### 4.3 Water Resources and Water Environment

The Project site is located close to Shirin town where the Dustlik and Yuzhny-Golodnostepsky (YG) canals separate from the Farhad derivation canal. The canals withdraw water from Syrdarya river several kilometers from Bekabad hydro gauge. The Project area heavily depends on the canals for irrigation purposes through a network of irrigation ditches that run through the fields.

#### Water Availability

A water supply assessment report has been prepared by a consultant for the Project. This report presents river and canal flow patterns, water levels, water temperature and flow velocities that are available between 1975-2018 from data recorded by the Uzhydromet water gauge station.

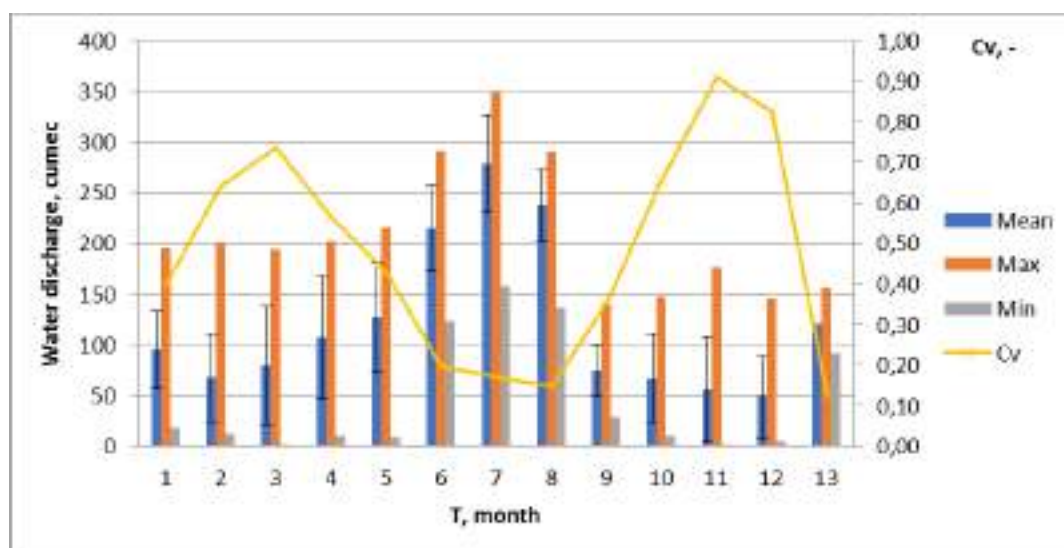
The table below shows the monthly mean, maximum and minimum water discharge of YG canal for the 1976-2013 period. The Cv-coefficient of variation indicates the ration of the standard deviation to the mean.

**Table 4-1 Monthly water discharges to YG canal for 1976-2013 period (CUMEC)**

	J	F	M	A	M	J	J	A	S	O	N	D	ANNUAL
Mean	95,4	67,8	79,2	107,4	126,7	214,8	278,6	237,7	74,7	67,1	56,2	49,1	121,1
Max	195	201	194	202	216	291	349	290	141	148	177	145	156
Min	18,0	12,0	0,4	9,5	8,8	123,0	157,5	136,0	28,7	9,5	0,2	4,9	92,1
Standard deviation	38,3	43,5	58,3	60,6	54,2	42,6	48,4	35,2	26,4	44,1	51,1	40,6	15,4
Cv coefficient of variation	0,40	0,64	0,74	0,56	0,43	0,20	0,17	0,15	0,35	0,66	0,91	0,83	0,13

Source: Juru Energy – compiled from Estimated by data of YG canal administration

**Figure 4-1 Monthly water discharges to YG canal for 1976-2013 period (Cv – standard deviation from mean)**



Source: Juru Energy – compiled from Estimated by data of YG canal administration

Please refer to details on water availability due to future climate impacts in the climate section of this NTS.

### Project's Water Requirement

Under normal circumstance, the Project will abstract **0.37m<sup>3</sup>/s** (1,324m<sup>3</sup>/h); a very small proportion of the YG Canal flow (see Table below). Under 'extreme worst case' incidents of insufficient flow (which are rare and likely to be related to purposeful reduction in flow by the YG-Canal operators, for instance, during maintenance, or reduced water demand), the Project's abstraction remains <10% of the available flow.

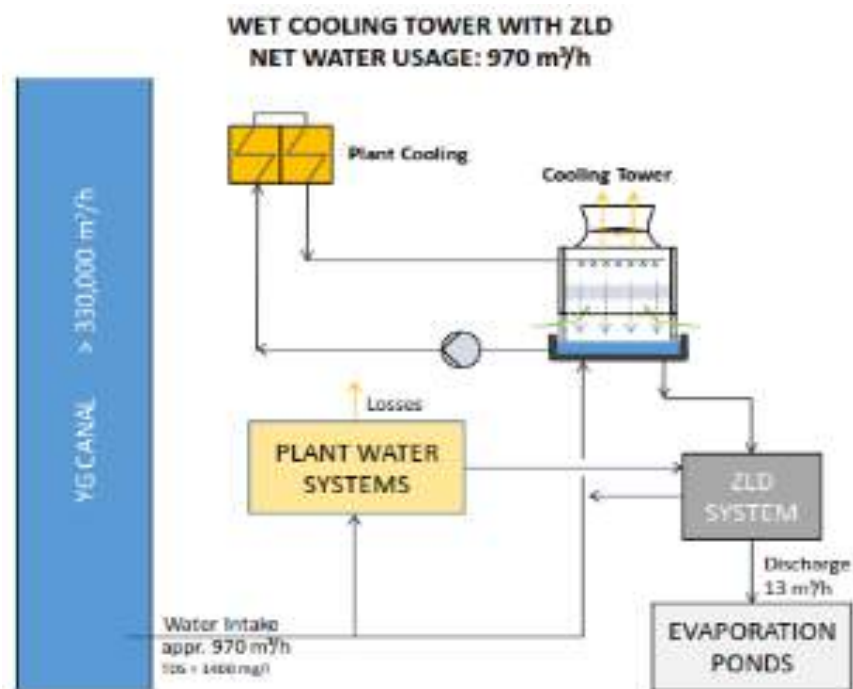
**Table 4-2 YG Canal Flow Rates**

PARAMETER	YG CANAL FLOW (m <sup>3</sup> /s)	PROJECT'S ABSTRACTION (m <sup>3</sup> /s)	PROPORTION (%)
Monthly mean water discharge (mean) (1976 – 2013)	121.1	0.37	0.3%
Monthly mean water discharge (max) (1976 – 2013)	156		0.2%
Monthly mean water discharge (min) (1976 – 2013)	92.1		0.4%
Extreme minimum water discharge <sup>7</sup> (Past 20 years)	5*		7.4%*

The Project has achieved a lower abstraction requirement by adopting a **Zero Liquid Discharge (ZLD)** design (besides treated sanitary wastewater effluent), an example of which is illustrated below, together with indicative water flows throughout the plant. The zero liquid discharge concept allows for the treatment and re-use of water in the plant. In addition, the closed loop cooling tower system selected for the Project (as outlined earlier in this NTS) also provides benefits to reduce water consumption (by reducing water losses vs other types of systems).

<sup>7</sup> Based on data obtained from historic Uzhydromet station gauge records, the extreme minimum flows indicated in the table (above) were mainly observed in the 1970-80s, whereas for the past 20 years, monthly minimum water discharge has not fallen below 5m<sup>3</sup>/s. It is also noted that: (a) the occurrence of canal flows <5m<sup>3</sup>/s tend to occur in November and December – possibly due to the absence of irrigation demand during this period; and (b) the occurrence of these minima may be the result of maintenance works, which have to be carried out during the non-vegetation period.

Figure 4-2 Example Zero Liquid Discharge Concept



### Aquatic Biodiversity

The ecology surveys identified low abundance of fauna and flora but consultations with local community members who fish in the canal revealed that there are two endemic fish species in the Sirdarya river which feeds into the YG canal (*Barbus brachycephalus* and *Aspiolucius esocinus*) which are listed in the Uzbekistan Red Book as endangered and as Vulnerable under the IUCN Red List.

### Construction Impacts & Management

During construction dewatering effluent will be managed through settlement pond(s) to reduce suspended sediments and to allow for the aeration of the dewatering before it is discharged into the canal. Silt curtains will also be deployed along the intake and outfall work areas to protect adjacent waters from suspended sediments.

It is not clear at this point whether the construction water will be sourced from the canal, site boreholes or supplied from neighbouring towns. The EPC Contractor will be required to engage licensed suppliers and obtain relevant permits (if required) to ensure that the Project demand for water does not create a shortage for local communities or an increase in the price of water. If boreholes will be drilled on site or sourced from the canal, the EPC will also be required to apply for relevant permits and adhere to the required usage limits set within the permits

Construction activities will also require for the re-routing of irrigation ditches that run through the Project site to other neighbouring farms which will lead to temporary water disruption to these farms which could potentially impact irrigated crops. These impacts will be managed

through consultations with the Makhalla Committee, Water-users association and the Hydrogeological and Land Reclamation Inspection body (HLRI).

Impacts relating to the commissioning and operational phases of the Project will include water consumption which will be minimised through re-use of water where possible. The main concept will be to re-use Cooling Tower Blow down, Boiler Blow down and Condenser blowdown flow streams via demineralization system, as a result reaching zero liquid discharge to the canal, other than the rain water and sanitary waste water streams. The breakdown of the monthly expected raw water use and re-use is provided in volume 2 of the ESIA.

Construction and operational phase impacts will be managed and mitigated in accordance with the measures included in the ESIA and any other additional requirements set by the regulator and Project lenders.

## 4.4 Terrestrial Ecology

With reference to the IFC PS 6 Habitat Classification, the project site can be broadly classified as "Modified Habitat" due to the extensive agricultural practices and activities. The largest part of the Project site is used for the rice, wheat, cotton, clover, barley and other crops. In addition, some of the farms have fruit trees such as mulberry, apple trees and willow grapes. These crops and trees can also be observed in the farms neighbouring the proposed Project site. The Project site is also located in an area with industrial, commercial and residential development including the canal to the south and there are no ecologically protected sites near the proposed Project site.

The site walkovers included three seasonal (winter, spring and summer) ecological surveys at representative locations within the Project site in order to identify the fauna and flora species within the Project site. During the surveys, no flora species under the IUCN Red List or the Red book of Uzbekistan were identified. The limited fauna species observed are common to the area and not listed in the IUCN Red List or Uzbek Red book while the 29 avifauna species identified are all listed as of Least Concern under IUCN Red List.

Construction works will result minimal loss of natural habitat in the Project footprint including the switchyard which is used for agricultural purposes. Impacts during construction may result in the disturbance and direct mortality of fauna due to the removal of all the vegetation and use of heavy plant. Given that this is a modified habitat (agricultural land), these impacts are expected to be minimal. Such impacts can potentially be mitigated by implementing good practice construction techniques at the site.

The operational phase is not expected to result in further direct impacts to terrestrial ecology at or around the Project site which will be fenced and along the routing areas of associated facilities. No exotic or alien plant species will be used in the landscaping of the site and any

unused areas with soil covering will be allowed to restore naturally. The use of herbicides will not be permitted on the Project site or laydown areas.

## 4.5 Soil, Geology and Groundwater

Top soil samples at six (6) locations within the Project site and one (1) at a control location outside the Project site were collected by a certified laboratory. The soil quality results were compared to the Dutch Soil Quality Standards and the concentrations indicate that no inorganic and heavy metals parameters were above the standards.

Groundwater samples were also collected from existing wells at two survey locations within the Project site. Sulphates in both wells were above the UZ State Standard 950:2011 norms and so was cadmium and lead in well №2. When compared to the Dutch groundwater intervention values, all the heavy metals were below the established limits.

The construction works have potential to affect soil quality and potentially impact groundwater quality prior to mitigation. In such cases, the impacts will be limited to isolated areas and there is a limited potential for widespread soil pollution. Such potential impacts may result from spills and leaks of hazardous liquids and materials, inadequate waste & wastewater management, as well as any impacts relating to importation of contaminated fills to the site which will be managed through a Project specific CESMP.

During the operational phase, potential risks to soil & groundwater will be managed and mitigated via the design of effective materials and waste storage areas and implementation of an effective processes for handling hazardous materials and Waste Management Plan, such impacts are typical for construction, commissioning and operation of this kind and can be readily managed by the effective implementation of a CESMP CoESMP and OESMP respectively. An Emergency Response Plan (ERP) and Spill Response Contingency Plan will also be prepared to ensure that in the highly unlikely event of a significant spill, any affected area can be isolated and restored effectively without delay.

## 4.6 Solid Waste and Wastewater Management

The Project will generate elements of waste during all phases. A large amount of waste is expected to be generated during construction and will include various items of packaging and waste construction materials (amongst many other types). Most of this will be non-hazardous and can be easily managed via typical good practices, including segregation for re-use and/or recycling where feasible. Hazardous wastes will likely be generated in much smaller quantities and will include: used fuel containers, spent paint cans, lubricant cans and oil cans, vehicle/plant maintenance wastes. These hazardous waste materials will need to be temporarily stored inside impermeable bunded areas (with other controls) in accordance with



the mitigation and management measures stated in the ESIA. Specific and careful waste management practices by licensed contractors (at licensed facilities) will need to be ensured and monitored by the Project parties to avoid environmental or human exposure to such wastes.

Sanitary wastewater generated during construction will be stored in septic tanks prior to removal by a licensed wastewater contractor for treatment. The commissioning phase activities (including hydrotesting, steam blowing and chemical cleaning) will generate other streams of wastewater that may contain a small number of residues (e.g. heavy metals, oils and greases, acid cleaning water). These will be neutralised before they are sent to the evaporation pond (or possibly re-used in the commissioning process). No discharge of construction or commissioning wastewater will be discharged into the YG canal (besides possible groundwater dewatering as outlined above).

During operations, there will be relatively small quantities of solid waste arising from planned maintenance works, administration facilities and activities of the employees which are not directly associated with the power generation processes. Waste segregation for re-use or recycling of solid wastes will be undertaken where practical. Hazardous wastes such as wastewater treatment sludge, used filters mediums, used chemicals etc. will be generated in small volumes but on an on-going basis during operations. These hazardous waste materials will be temporarily stored inside impermeable bunded areas (or sumps) in accordance with the design and stated mitigation & management measures in the ESIA before being transported to hazardous waste management facilities in Sirdarya region.

Sanitary wastewater will be collected and treated in a dedicated sanitary treatment plant on-site where the effluent will be either used for irrigation or discharged into the canal via the outfall after treatment. Besides stormwater runoff, this will be the only effluent stream discharged outside of the plant, as other industrial process effluents will be treated and then evaporated.

## 4.7 Traffic and Transportation

The Project anticipates to use ports in Kazakhstan for heavy cargo equipment originating from different parts of the world. Land transportation across different country borders and highways in Uzbekistan will be used for standard cargo up to 20 tonnes and heavy cargo with low beds of up to 600 tonnes. Tashkent airport will also be used for delivery of lightweight cargo and urgently required materials to site before they are transported to the Project site via road.

Construction activities will likely result in an increase of the numbers of movements of Heavy Goods Vehicles (HGV) and other vehicles for the delivery of heavy plant, equipment, materials or Project's staff transportation. This will be more noticeable in the immediate project area and along key access routes (due to relatively low existing traffic flows locally) and will vary over



the course of construction, in accordance to the phases of construction, the demand for materials and transportation of construction personnel to and from the site. Increase of vehicle movement will also pose a risk to the local communities who are not accustomed to the high traffic and may lead to accidents involving humans and livestock.

Hence, careful management of traffic via the design and implementation of a Traffic Management Plan (TMP) will be adopted to ensure the efficient and safe movement of all vehicles within & outside the boundaries of the site.

Transportation impacts during the operational phase of the Project are not expected to be significant, as the operation of the CCGT Project will require a relatively lower number of commuting operational staff, and lower frequency periodic removals/deliveries as part of the operation and maintenance programme. However, there will be safety risks associated with the transport of chemicals and other hazardous materials and removal of hazardous wastes from the Project site. It will be necessary for the Project to engage the selected suppliers to ensure that processes are in place for effective responses to be made in the event of emergency situations and to reduce the likelihood of such events from occurring.

## 4.8 Archaeology and Cultural Heritage

Site visits and consultations undertaken to date confirm that there are no surface features of potential archaeological importance identified within the Project footprint. It is also expected that the existing agricultural activities would have already exposed any near surface archaeology if it had been present. Consultations to date have not identified any other forms of intangible heritage on the land or in the immediate Project vicinity.

Albeit a very low risk, the potential for encountering buried archaeological remains or artefacts during excavation and earthworks activities cannot be completely ruled out, and as such the ESIA sets out that a 'Chance Finds Procedure' shall be prepared to establish appropriate management protocols in the unlikely event of uncovering any archaeological or cultural finds.

Consultations with the Ministry of Culture of the Republic of Uzbekistan revealed that the closest cultural site to the Project site is the Monument of Amir Temur which is located approximately 700m south east of the Project site. Other sites of cultural importance in close proximity to the Project site include Monument of Mother (1.6km east) and Monument of Alisher Navoi (2km north west). It is not expected that there will be any impacts to these monuments as a result of the Project.

During the operational phase of the project, there will be no further excavations at the Project sites so there is no risk of uncovering any further historical finds at that stage. There are also no expected impacts to other tangible or intangible cultural assets and heritage.

## 4.9 Landscape and Visual Amenity

Based site observations and review of satellite imagery, the wider Project area is relatively rural and dominated by a patchwork of fields intersected by hedges, fence lines and irrigation channels/canals. Community residential clusters are present within the landscape and are sporadic within the landscape. The nearby border towns of Shirin (and Bekobod to the east) present larger more urbanised zones.

The landscape also includes a specific industrial component linked to the existing Sirdarya TPP. In particular the three stack structures of the TPP tower above the landscape and can be seen from many kilometres as vertical intrusions to the viewshed (including from Tajikistan). Other taller structure such as the power blocks and associated transmission lines are also visible. In particular the transmission lines run to the north from the TPP in two primary corridors, intersected by the proposed Project site. As such views to the site are somewhat already impacted.

The development of the Project will include the construction of buildings and stacks which will take place steadily over the construction period and transform this area of the landscape resulting in major land use changes. It is also expected that the construction of the future IFC TPP will lead to further development and landscape change, which will be a cumulative impact to both landscape character and visual amenity. Those receptors mostly affected by the visual impacts will be those that have direct (and partial) views across the existing site. Current views in the area are however somewhat limited by the presence of hedgerows and trees, which will remain in place around existing residences. Therefore, it will be the above ground features of the proposed CCGT that will be mostly in view (e.g. stack structures and taller elements of the power block).

Differences at night-time will also be discernible where lighting is required for Project operations, however, mitigation measures have been included in the ESIA to limit these effects.

During colder and drier periods, there may also be a visual impact linked to steam plumes from the cooling towers, which will tend to rise vertically from the cooling blocks.

## 4.10 Climate Affairs

### Climate Change Impact Assessment

Uzbekistan is expected to experience higher temperatures resulting from climate change. Already, measurements of seasonal temperatures by district show that the average annual temperature has increased in Uzbekistan by 0.29°C since 1951. Furthermore, based on a comparison of data from 1951 – 1980, against 1978 – 2007, data shows that the number of days with temperatures lower than -20°C has declined by more than 50%.

The ESIA has averaged outputs from “8 Global Climate Models” with use of MAGIC/SCENGEN5.3 (Climate Scenarios Generator for Vulnerability and Adaptation Assessments), indicate the following potential climatic changes:

- Air temperature will continue to increase in accordance with current trends, increasing by 1.0 – 1.4°C by 2030. The probability of heat waves in the future will increase along with retention of cold waves due to climate warming.
- Precipitation changes are more uncertain than temperature changes. The medium-impact scenario indicates an increase in precipitation of about 48mm/yr in the desert and steppe zones; an increase of 42mm/yr in the piedmont zone; and a decrease of about 10mm/yr in the highlands zone.
- Aridity is also expected to increase – despite an increase in precipitation overall – most notably in the Western Uzbekistan region. Projects indicate a potential decrease of 2-5% water flows in the Sirdarya Basin; coupled with a potential increase in irrigation water demand.

The design of the project's cooling demand has been minimised; and as an overall of the potential flow of the Y-G Canal, is <0.5% under normal conditions. Even under the most limited conditions over the past 20-years, the water requirement has remained <10% of the available flows; and will continue to remain low under the projected future climate change impacts on water availability within the Sirdarya Basin (expected to decrease by 2-5% by 2050).

### **Project's Greenhouse Gas Emissions**

Greenhouse gas emissions linked to the construction phase will primarily be generated by stationary combustion sources for electrical supply (e.g. temporary Diesel Generators) and site-based vehicles and other equipment powered by liquid fuel. These will be located around the site in EPC and sub-contractor administration & office areas, as well as being mobile in the site area, or for transportation to/from the site. Such equipment will be fuelled by either diesel or unleaded petrol. The expected amount of diesel consumption for the entire construction phase of the Project is expected to be approximately 684,214 litres with a total GHG emissions of 1837.299 tonnes CO<sub>2</sub>e. Electricity consumption will be approximately 6,605,515.20kw/h which will be sourced from the national grid with total GHG emissions of 4,849 CO<sub>2</sub>e per year.

The Project's primary greenhouse gas emissions source will be from the combustion of natural gas fuel, which will be on-going in large quantities for the duration of the Projects' lifespan. The predicted greenhouse gas emissions during the different years of the operational phase are as shown in the table below.

**Table 4-3 GHG Emissions During the Operational Phase of the Project**

CONTRACT YEAR	PERIOD FUEL CONSUMPTION	ALL GHG EMISSIONS	CARBON INTENSITY
N	GJ-AS PER THE PPA	TONNES CO <sub>2</sub> EQ	G/KWH CO <sub>2</sub> EQ
e1	6,471,020	363,377	488
e2	25,885,561	1,453,591	486
1	112,167,245	4,324,960	338
2	112,228,499	4,327,385	339
3	104,532,044	4,030,380	340
4	112,941,864	4,354,686	340
5	113,063,558	4,359,474	340
6	100,775,207	3,885,548	341
7	113,274,799	4,367,629	341
8	113,032,958	4,358,218	341
9	112,871,491	4,352,284	340
10	100,457,003	3,873,279	341
11	113,071,266	4,359,652	341
12	113,211,727	4,365,388	342
13	101,841,205	3,926,590	342
14	113,441,573	4,373,993	343
15	113,556,496	4,378,295	343
16	104,432,414	4,026,560	338
17	113,114,776	4,361,631	341
18	113,071,266	4,359,652	341
19	96,636,370	3,726,022	342
20	113,441,573	4,371,929	342
21	113,934,263	4,393,268	343
22	106,027,711	4,088,064	343
23	112,586,036	4,341,009	340
24	112,969,112	4,356,067	341
25	101,703,535	3,921,436	342

Since the GHG emissions for the Project are above 100,000 tonnes/year, the Project Company will publicly disclose the annual GHG emissions in line with the Equator Principles requirements.

The ESIA (volume 2) has also assessed the climate physical risk and climate transition risk relating to vulnerability of the Project to climate change. The Project is expected to operate for 25 years and ACWA Power has advised that changes in water levels are not expected to pose a challenge in water availability. In addition, water availability for the Project is guaranteed by the off-taker during the period of operation and any changes in flow will be subject to the PPA.

## 4.11 Socio-Economics

The Project will be instrumental in providing additional, more stable, power generation capacity, which will give rise to various socio-economic benefits and will be a key driver to the modernisation of the power sector in Uzbekistan. In addition, the Project will provide various positive socio-economic benefits such as direct employment creation, which will further stimulate the local economy via the multiplier effect. In addition, to the direct monetary impact of employment created during construction, there also exists the potential for the Project to promote the dissemination of construction skills from expatriate workers into the local labour force.

The development of the Project will lead to lease termination for farmers who have previously leased the agricultural land where the Project will be located which could lead to loss of income where livelihood restoration processes are not effectively implemented. This will be managed through the implementation of a Project specific Livelihood Restoration Plan (LRP-ongoing) in alignment with the disclosed Livelihood Restoration Framework (LRF).

The water flows in irrigation channels going through the site to other surrounding farms have the potential to be temporarily disrupted if works at site commence before they are re-routed. Communities and farmers using the access unpaved roads currently dissecting the site may be required to drive/walk longer distances to reach their destination once the Project site is fenced. However, this impact is not expected to sever routes completely as other access points around the site will be available.

ACWA Power and Air Products & Chemicals have signed a Memorandum of Understanding with the Ministry of Energy of Uzbekistan to develop and implement a training program to bolster the technical expertise of students and professionals at one or more colleges in Uzbekistan including the College of Energy in Shirin (local to the Project). The proposed training programme intends to equip potential graduates with the tools and knowledge required to support the local supply chain for the utilities and chemicals sectors in Uzbekistan.

## 4.12 Livelihood Restoration

The Project is being developed on land that is owned by the Government of Uzbekistan, but that has been leased over long-term durations to local farmers.

The Project footprint and switchyard will affect 8 farmers with legal lease agreements, one (1) farmer without a legal lease agreement and 3 farmers who are renting land from one of the affected farmers. Shirin Municipality also owns land to the south of the site which will be impacted by the construction of the intake and outfall. A fuelling gas station to the south of the Project site will also be impacted by the construction of the intake and outfall which will temporary affect the gas supply to his fuelling gas station.

With regards to the associated facilities, it has been established that two (2) farmers (who are already impacted by the Project footprint) will be impacted by the routing of the gas pipeline including one (1) piece of land belonging to Shirin Municipality which is currently not under any use. The Project access road will affect seven (7) farmers while the number of farmers who will potentially be impacted by the overhead transmission lines is still being assessed

Chapter 6 of the SanPin № 0350-17 national regulations requires the establishment of a health protection zone (HPZ) around a new thermal power plant with a radius of 500m around each air emissions stack structure. As a result, 5 Capitals via Juru Energy have written a letter to the Ministry of Health in Uzbekistan to determine the implication of this requirement on neighbouring farms and whether the farmers located within a 500m radius can continue with their agricultural activities during the operations of the Project. If agricultural activity is not permitted in the HPZ, eight (8) farmers affected by the Project footprint will lose additional land and one (1) additional farmer will be affected. A response from the Agency of Sanitary and Epidemiological Wellbeing (under the Ministry of Health) was received on 25<sup>th</sup> August 2020 stating that farming activities can continue in the SPZ territory. The Agency instructed that further consultations between the Project and the Veterinary Committee should be undertaken in order to determine if the committee had additional veterinary and sanitary requirements for the Project.

A response was received from the Veterinary Committee on 14<sup>th</sup> September 2020 stating that the clarifications requested regarding the HPZ were beyond their mandate and they had forwarded the letter to the Ministry of Agriculture for further clarifications and guidance. No response has been received from the Ministry of Agriculture and consultations are still ongoing.

The scope of work under livelihood restoration is detailed in the Project specific Livelihood Restoration Framework (LRF) and the subsequent Livelihood Restoration Plan which is being prepared separate to this ESIA.

## 4.13 Stakeholder Engagement & Grievance Mechanism

A separate Project specific Stakeholder Engagement Plan (SEP) has been prepared, which sets out the strategy and plan in regard to such engagements during the pre-construction, construction, commissioning and operational phases. The scope of the SEP is to specify the methods to efficiently manage and facilitate future engagements with stakeholders through various stages of the Project lifecycle.

This SEP has been prepared to align with applicable requirements of EBRD's Environmental and Social Policy and PRs, Equator Principle 5 and Equator Principle 6 that describes Stakeholders Engagement and Grievance Mechanism respectively, and the IFC Performance Standards, with particular relevance to IFC Performance Standard 1 on "Assessment and Management

of Environmental and Social Risks and Impacts"; which describes the stakeholder's engagement requirements in more depth.

The SEP prepared for the Project has identified both impacted and interested parties. The SEP details specific actions to be taken in regard to engaging with identified stakeholders at different stages of the Project. The methods proposed have been optimised for the specific stakeholders to ensure inclusivity and engagement in a culturally appropriate manner.

The SEP also includes the detailed grievance mechanism, which will be available to both Project workers and external parties. The grievance mechanism will be available to receive complaints or other concerns/comments and can be accessed for free, with no retribution to users. If necessary, methods have been inbuilt to retain the anonymity of the aggrieved. The responsibility and accountability of the grievance mechanism remains with the Project Company, but the implementation of the mechanism may be made by the EPC Contractor and O&M Company respectively during construction and operations.

The ESIA, LRF and SEP documents will be disclosed to identified stakeholders and will also be made available for download at the ACWA Power website.

## 4.14 Labour and Working Conditions

An Occupational Health and Safety Management Plan will be prepared at the start of the construction and commissioning phase to address the H&S risks that occur on a construction site. These will include physical risks such as traffic on site, working at height, movement of heavy machinery, excavations, scaffolding etc. other risks may include handling of fuels, chemicals, paints and solvents, noise and emissions from machinery and generators etc.

Health and safety risks to the site workforce will be managed effectively through specific risk assessments, development of appropriate method statements and procedures, emergency and disaster planning and the communication of specific health and safety planning requirements and training sessions.

The working conditions and labour accommodation will also comply with Uzbekistan laws as well as ILO requirements and UN conventions to which Uzbekistan is signatory to. The EPC Contractor labour camp will be located on the Project site. The requirements will additionally be met in regard to working conditions of site workforce and such conditions will be managed through effective Project planning, and the implementation of a grievance mechanism to ensure that workers can openly air their complaints or anonymously, without fear of being dismissed, should they consider conditions to be unsafe or culturally damaging or in instances where they experience Gender Based Violence & Harassment (GBVH). The Project will also be required to develop and implement Human Resources Policy (and related procedures), Retrenchment Plan and Human Rights Policy, GBVH policy etc.



An OHSMP will also be prepared at the start of the operation phase to address relevant H&S issues for workers during the routine management, maintenance and possible emergency scenarios that could arise on the Project site.

In accordance with the ESIA and ESAP, a *Staffing Plan* as well as an *Influx Management Plan* will be prepared in advance of commencement of construction to proactively manage the potential impacts associated with the construction workforce.

## 4.15 Community Health, Safety and Security

All construction Projects have potential risks relating to public safety that could arise, particularly in regard to the use of high-powered equipment, heavy construction plant, excavations, transportation amongst others, including fire and pollution releases. Public risks during construction have the potential to result in isolated incidents, which could be of a devastating magnitude to a person or group of people in the wrong place at the wrong time. Risks that could be experienced include worker influx and disease (such as COVID-19, HIV AIDS) Gender Based Violence and Harassment (GBVH), Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) and transportation impacts, as traffic will increase on public roads to deliver materials and equipment to the Project site in order to manage traffic related impacts (including safety risks to other road users). The Project will develop a Worker Influx Management Plan to manage the potential risks associated with worker influx in the Project area.

The EPC Contractor and O&M Company will prepare a SEA & SH Prevention and Response Action Plan which will put protocols and mechanisms in place to address the risks of SEA/SH and how to address any allegations that may arise. Other plans during construction phase will include a Traffic Management Plan for implementation on-site and the access road; and an Emergency Preparedness and Response Plan'.

Furthermore, security staff will be onsite during both the operation and construction phase. Given that the security at the site will be armed, the security arrangements will be guided by UN Code of Conducts for law enforcement officials, the IFC's Good Practice Handbook on the Use of Security Forces: Assessing and Managing Risks and Impacts IFC's and the UN Basic Principles on the use of Force and Firearms by law enforcement officials.

Processes for a third-party grievance mechanism have been established in the standalone Stakeholder Engagement Plan (SEP) for public and other stakeholder complaints.

## 4.16 Human Rights Impact

As a member of the United Nations, Uzbekistan supports and implements all the main international instruments of the United Nations relating to the protection of human rights and



freedoms, including UN Universal Declaration of Human Rights, Human Rights Council Resolution No. 30/15 on human rights and preventing and countering violent extremism, Convention on the Elimination of all Forms of Discrimination against Women among others.

Under the UN Human Rights Guiding principles, the majority of Project related risks will be managed in accordance with labour and working conditions to avoid forced and child labour, whilst also non-discriminating and providing equal opportunities for employment. Such instances pose risks will need to be managed under mitigation and management controls set out in the 'Labour and Working Conditions' Section of the ESIA.

Indigenous people (or groups) have not been identified in the Project area and as such, provisions for safeguards for such people have not been considered. Other impacts to communities will be managed as set out above and as per the 'Community, Health, Safety and Security' section of the ESIA.

## 5 ENVIRONMENTAL & SOCIAL MANAGEMENT & MONITORING

Volume 3 of the ESIA provides a framework for the development of the Environmental and Social Management System (ESMS) for the construction, commissioning and operational phases of the Project. The framework has been developed to ensure that all Environmental & Social impacts identified for both construction, commissioning and operational phases are appropriately identified and controlled through the development of a robust construction, commissioning and operational phase ESMS.

Both the construction, commissioning and operational phase of ESMS will need to incorporate mitigation and monitoring requirements established within Volume 2 of the ESIA as well as requirements set out by the State Committee on Ecology and Environmental Protection and the Lenders.

The primary documents guiding the environmental and social management of the construction, commissioning and operational phases will be the Construction Environmental and Social Management Plan (CESMP), Commissioning Environmental and Social Management Plan (CoESMP) and Operational Environmental & Social Management Plan (OESMP) respectively.

### 5.1 Independent Auditing and Monitoring

The Project will be subject to periodic independent monitoring in accordance with the requirements of the lenders, including Equator Principle 9. The scope of the independent audits will include the implementation of the project ESMS and will evaluate on-site activities and

documented controls and monitoring efforts, with respect to the Project's compliance obligations.

## 6 CUMULATIVE IMPACTS

The assessment of cumulative impacts with reference to this Project relate to cumulative impacts upon specific receptors as a result of the proposed project and existing impacts from other local facilities (as captured as part of the baseline). In addition, the future IFC CCGT Project on adjacent land (as an expected future development) has also been included to this assessment in the relevant sections of the ESIA (and as outlined herein).

## 7 TRANSBOUNDARY IMPACTS

The Project is located approximately 1.4km from the Tajikistan Border, and as such, the Environmental and Social Impact Assessment has had to carefully consider the range of impacts, and determine whether transboundary impact will occur. This has included modelling for air quality and noise impacts, as well as considerations of impacts where the Project's area of influence includes parts of Tajikistan.

The only foreseeable transboundary impacts may relate to ambient air quality, as most other impacts do not extend over the border. With specific regard to air quality:

- The modelling of impacts from the Project will not result in significant ambient air quality impacts across Uzbekistan's borders. This has been demonstrated by numerical modelling following Good Industry International Practice.
- Specifically, the modelling outputs show that there is expected to be a slight reduction in NO<sub>2</sub> concentrations at receptors in Tajikistan due to the modernisation of the power system, which is predicted for long and short-term modelled periods.

It is noted that water impacts (such as use of water from the YG Canal) are only applicable to Uzbekistan (and not Tajikistan) due to the water from this canal only being available for users in Uzbekistan.

In conclusion, the Project will not result in any significant transboundary environmental impacts and will not trigger ESPOO Convention Criteria.

## 8 PROJECT CONTACT INFORMATION

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## APPENDIX 1 - ANALYSIS OF BEST AVAILABLE TECHNIQUES

Investment in the Project by EBRD requires that the CCGT complies with BAT where possible. The Project falls under the scope of the EU Industrial Emissions Directive (IED)<sup>8</sup>, Annex I, as follows.

### Energy Industries

#### COMBUSTION OF FUELS IN INSTALLATIONS WITH A TOTAL RATED THERMAL INPUT OF 50MW OR MORE

The ACWA CCGT will comprise a Large Combustion Plant (LCP), which is defined in Article 28 of the IED as “any combustion plant with a total rated thermal input which is equal to or greater than 50MW, irrespective of the type of fuel used”. There are a number of exclusions from the scope of LCP, such as gas turbines and engines used on offshore platforms; however, no such exclusion apply to the Project.

The IED defines minimum requirements for LCP under the special provisions laid down in Chapter III and mandatory maximum Emission Limit Values (ELVs) in Annex V.

Since the publication of the IED, what constitutes Best Available Techniques (BAT) – i.e. technology and operational practices to prevent, or minimise emissions or impacts on the environment - has evolved, and as such, the performance levels required to demonstrate BAT have also evolved.

The European Commission produces Best Available Technique Reference Documents – or BREF Notes – which contain BAT conclusions for specific industries and define emission limits associated with BAT AELs (BAT Associated Emission Limits). New BAT conclusions for LCP were published in August 2017 and the accompanying revised BREF document was published in December 2017. These documents effectively update the performance requirements set out under the IED, and generally follow a 4-year review cycle.

The key issues for the implementation of IED LCP using gaseous fuels are:

- Emissions to Air; and,
- Energy Efficiency.

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<sup>8</sup> The Industrial Emissions Directive ('IED'), 2010/75/EU.

In relation to the broader BAT considerations relating to technology selection; the Project's choice of technology (including cooling technique), is considered to be justified, reasonable and materially aligned with BAT; taking into account the country-specific constraints, demands and power sector experience. Further information on the technology selection is provided under the Project ESIA.

## Emissions to Air

Based on the selected technology, IED LCP are required to implement particular BAT techniques and meet specific standards for emissions to air of Nitrogen Oxides (NO<sub>x</sub>) and Carbon Monoxide (CO), as defined in the BREF Note. These techniques and standards are detailed under the Tables 9 and 10, together with their applicability and current design-compliance.

### NITROGEN OXIDES (NO<sub>x</sub>) EMISSIONS

In order to prevent or reduce NO<sub>x</sub> emissions to air from the combustion of natural gas in gas turbines, BAT is to use one, or a combination of, the techniques provided overleaf:

**Table A-1 – BAT Techniques for NO<sub>x</sub> Emission Abatement, Project Applicability & Compliance**

TECHNIQUE	GENERALLY APPLICABLE	ADOPTED AT PROJECT?	COMMENT
Advanced Control System	Yes	Yes	The Project is utilizing latest advanced technology, state of the art JAC-Class Gas Turbines.  Advance Control systems for the Gas Turbine and water-steam cycle is being applied for the Project.  <b>Compliant with BAT.</b>
Water / Steam Addition	Yes	No	<b>Not relevant</b> to the Project, due to the use of Dry Low NO <sub>x</sub> (DLN) burners.
Dry Low-NO <sub>x</sub> Burners (DLN)	Yes	Yes	For new GTs, DLN burners are BAT. These have been included in the Project.  <b>Compliant with BAT.</b>
Low-load Design Concept	Yes	Yes	The Project requires emissions levels performance from a load range of 45 to 100%.  <b>Compliant with BAT.</b>

Low-NO <sub>x</sub> Burners (LNB)	Yes*	No	<b>Not relevant</b> , for the same reason as DLN. The Project will use DLN burners.
Selective Catalytic Reduction (SCR)	Yes	Yes	SCR has been included; and designed to ensure compliance with BAT AELs in relation to NO <sub>x</sub> .  <b>Compliant with BAT.</b>
<b>Note:</b> * Not applicable to simple-cycle operation of CCGT.			

The applicable BAT AELs are summarised under the Table below:

**Table A-2 – BAT NO<sub>x</sub> AELs Compared Against Project Performance**

APPLICABLE BAT AEL	AEL NO <sub>x</sub> MG/NM <sup>3</sup>		PLANT PERFORMANCE (NO <sub>x</sub> MG/NM <sup>3</sup> )	BAT COMPLIANT?
	YEARLY AVERAGE	DAILY AVERAGE OVER SAMPLING PERIOD		
From 'Early Power Commercial Operation Date', i.e. OCGT Operation. New OCGT	15 - 35	25 - 50	30 (32.5*)	<b>Yes</b>
From 'Project Commercial Operation Date', i.e. Full CCGT operation New CCGT, >50MW(th)	10 – 30	15 - 40	30 (32.5*)	<b>Yes</b>
<b>Notes:</b> For plants with a net electrical efficiency (EE) greater than 55 %, a correction factor may be applied to the higher end of the BAT-AEL range, corresponding to [higher end] x EE / 55, where EE is the net electrical efficiency of the plant determined at ISO baseload conditions. * Note: 32.5mg/m <sup>3</sup> accounts for adjustment due to plant efficiency.				

**In conclusion, the Project will achieve 30-40mg/Nm<sup>3</sup>, in line with BAT AELs for NO<sub>x</sub>.** This will be through the EPC Contract (Performance Guarantees) and will be met through the use of advanced GT technology, Secondary Abatement using SCR as necessary; in conjunction with the BAT control techniques for NO<sub>x</sub> as detailed in the table above.

## CARBON MONOXIDE (CO) EMISSIONS

In order to prevent or reduce CO emission to air from the combustion of natural gas, BAT is to use one, or a combination of, the techniques provided in the table below.

**Table A-3 – BAT Techniques for CO Emission Abatement, Project Applicability & Compliance**

TECHNIQUE	GENERALLY APPLICABLE	ADOPTED AT PROJECT	COMMENT
Optimised Combustion	Yes	Yes	The Project will include advanced combustion control systems which will manage the process to ensure maximised combustion of natural gas for heat output. This will also have the effect of ensuring controls on CO generation. <b>Compliant with BAT.</b>
Oxidation Catalysts	Yes	No	Not applicable since the CO emission levels are even lower than the limitations by EU and Local norms. Compliance has been included within the design and construction documents (Performance Guarantees). <b>Compliant with BAT.</b>

As an indication, the yearly average CO emissions for new CCGT  $\geq 50\text{MW(th)}$  is  $<5\text{-}30\text{mg/Nm}^3$ . For plants with a net electrical efficiency (EE) greater than 39 % (as is the case for the Project, a correction factor may be applied to the higher end of this range, corresponding to [higher end]  $\times \text{EE}/39$ , where EE is the net electrical energy efficiency or net mechanical energy efficiency of the plant determined at ISO baseload conditions. **In conclusion, the Project will be capable of meeting the BAT ELVs for CO.**

## Energy Efficiency

The IED LCP are required to implement particular 'Best Available Techniques' and meet specific standards for energy efficiency, as defined in the BREF note. These techniques and standards are detailed below, including their applicability reviewed in relation to the Project.

**Table A-4 – BAT Techniques for Energy Efficiency**

TECHNIQUE	GENERALLY APPLICABLE	ADOPTED AT PROJECT?	COMMENT
Combustion Optimisation	Yes	Yes	The Project will include advanced combustion control systems which will



TECHNIQUE	GENERALLY APPLICABLE	ADOPTED AT PROJECT?	COMMENT
			manage the process to ensure maximised combustion of natural gas for heat output. <b>Compliant with BAT.</b>
Optimisation of the Working Medium Conditions	Yes	Yes	The Power Purchase Agreement (PPA) for the project sets a limit to achieve a Net Electrical Efficiency of 60% which is in line with BAT Guidelines (54 – 60.5%).  The methods by which this will be achieved will be established via the further design process; however, many applicable methods are available for selection. <b>Compliant with BAT.</b>
Minimisation of Energy Consumption	Yes	Yes	
Pre-heating of Combustion Air	Yes	N/A	
Fuel Pre-heating	Yes*	Yes	Fuel Gas conditioning and heating is being applied as per the optimized highly efficient and low NOx emissions either for Combined Cycle operation through HRSG Economizer water and for Simple cycle through a radiator type of cooler, gained heat from GT Compressor cooling system.  includes fuel-reheating, which is conducted in the gas compressor and filtration compound. <b>Compliant with BAT.</b>
Advanced Control System	Yes	Yes	The Project is likely to include advanced combustion control systems which will manage the process to ensure maximised combustion of natural gas for heat output. <b>Compliant with BAT.</b>
Feed-water Pre-heating using Recovered Heat	Yes	Yes	Feed water pre-heating system is applicable for the Project. <b>Compliant with BAT.</b>
Heat Recovery by Cogeneration (CHP)	Yes <sup>A</sup>	No	The Project is being implemented as heat recovery in order to generate electricity but not for district heating as per the Off-taker requirement.  Such CHP systems are only applicable in case of demand from the Client. <b>Not applicable to Project.</b>
CHP Readiness	Yes <sup>A</sup>	Yes	The Project is being implemented as heat recovery in order to generate electricity but not for district heating as per the Off-taker requirement. Such CHP systems are only

TECHNIQUE	GENERALLY APPLICABLE	ADOPTED AT PROJECT?	COMMENT
			<p>applicable in case of demand from the Client</p> <p>However, this can be incorporated into the design and there is space to fit additional CHP equipment.</p> <p><b>Not applicable to Project.</b></p>
Flue Gas Condenser	Yes <sup>a</sup>	N/A	<p>Can be included as part of Project if used for a closed loop district heating system.</p> <p><b>Not applicable to Project.</b></p>
Heat Accumulation	Yes <sup>a</sup>	N/A	<p>Can be considered if the Project is used in CHP mode.</p> <p><b>Not applicable to Project.</b></p>
Wet Stack	No	NA	<p>Only applicable to combustion plant fitted with wet Flue-Gas Desulphurisation (FGD). Not relevant to a gas fired plant.</p> <p><b>Not applicable to Project.</b></p>
Cooling Tower Discharge	N/A	N/A	<p>The release of emissions to air through a cooling tower and not via a dedicated stack. Only applicable to units fitted with wet FGD where reheating of the flue-gas is necessary before release, and where the unit cooling system is a cooling tower.</p> <p><b>Not applicable to Project.</b></p>
Fuel Pre-drying	No	NA	<p>Only applicable to the combustion of biomass and/or peat.</p> <p><b>Not applicable to Project.</b></p>
Minimisation of Heat Losses	No	NA	<p>Only applicable to solid-fuel-fired combustion units and gasification / IGCC units.</p> <p><b>Not applicable to Project.</b></p>
Advanced Materials	Yes	Yes	<p>The proposed JAC class Gas Turbines incorporate Advanced Material in order to operate at higher temperature for improved turbine efficiency.</p> <p><b>Compliant with BAT.</b></p>
Steam Turbine Upgrades	N/A	N/A	<p>The CCGT will be a new bespoke system and not requiring upgrades to improve efficiency from commissioning.</p> <p><b>Not applicable to Project.</b></p>

TECHNIQUE	GENERALLY APPLICABLE	ADOPTED AT PROJECT?	COMMENT
Super Critical and Ultra-Supercritical Steam Conditions	N/A	N/A	Not applicable to CCGT. <b>Not applicable to Project.</b>
Combined Cycle	Yes	Yes	The Project is designed to operate in Combined-Cycle mode, with minimum Open-Cycle operation (limited to Early Power Phase whilst the CCGT infrastructure is constructed and commissioned). <b>Compliant with BAT.</b>
<b>Notes:</b> ^ Applicable within the constraints associated with the local heat and power demand.			

The BREF Note provides numerical guidelines on Net Electrical Efficiency (%), which has been compared against the Project.

**Table A-5– BAT Guideline Values for Net Electrical Efficiency (%)**

PLANT	APPLICABLE BAT GUIDELINE	BAT ELECTRICAL EFFICIENCY (%)	PROJECT NET ELECTRICAL EFFICIENCY (%)	BAT COMPLIANT
ACWA CCGT	CCGT >600MW(th), New Units	54 – 60.5	≥60 <sup>^</sup>	Yes
<b>Notes:</b> ^ PPA required >60% Net Electrical Efficiency.				

## Conclusion

Overall, it can be seen that the Project conforms to the guideline Electrical Efficiency values presented in the BREF Note. In general, the Project's efficiency characteristics are 'competitive' within the market and representative of modern, high-efficient technology.

The Project will comply with BAT-AELs for NO<sub>x</sub> and CO, throughout its operation.

## APPENDIX 2 - CARBON CAPTURE STORAGE (CCS) READINESS REVIEW

### Carbon Capture and Storage Assessment

The Directive on the geological storage of carbon dioxide (Directive 2009/31/EC) (the Carbon Capture and Storage (CCS) Directive) in the Official Journal of the European Union and came into force on 25 June 2009.

This Directive requires operators of all combustion plants with an electrical capacity of 300 megawatts (MW) or more (and for which the construction / operating licence was granted after date of the CCS Directive) have assessed whether the following conditions are met:

- Suitable storage sites for carbon dioxide (CO<sub>2</sub>) are available;
- Transport facilities to transport captured CO<sub>2</sub> to the storage sites are technically and economically feasible; and
- It is technically and economically feasible to retrofit for the capture of CO<sub>2</sub>.

### Space Requirements

For CCGT units with post-combustion CO<sub>2</sub> capture an indicative CCS space requirement of 1.875ha for 500MW is considered the minimum appropriate size. This would mean that for the Project, the space requirement would be 5.625ha. It is noted that future feasibility and environmental assessment for CO<sub>2</sub> Capture and Storage will need to be undertaken before the construction of the CCS.

### Technical Feasibility of Retrofitting

Several CO<sub>2</sub> capture technologies currently exist and at the time that this is required to be retrofitted the choice of potential technologies could be greater. The best of the currently available technology options is the capture of CO<sub>2</sub> from flue gases which is post-combustion CO<sub>2</sub> capture via chemical absorption using amine solvents.

For the Project, there would be scope to duct the flue gases from the stack to the gas cooling system of the CO<sub>2</sub> capture plant. This can be done in one of two ways. Firstly, including in the design the connection point from where the final flue gases could either be diverted to stack or gas capture plant. Secondly, this could be retrofitted afterwards but would require the plant to be down whilst it is reconfigured to divert the flue gases.

## Storage

From available information, it appears that facilities for the production of gas are not in close proximity to the proposed project site. However, the gas fields themselves are not detailed publicly and given the distance to the production facilities, an assessment would need to be performed as to the gas-field's economic viability as well as other technological suitability aspects, to determine the overall suitability for the storage of CO<sub>2</sub> along with any other alternative locations

## Transport

Transport from the Project site of any captured CO<sub>2</sub> would need to be by onshore pipeline given the volume generated would be far more than what could be comfortably transported by road or rail and the site is not near to any large water way to allow for offshore transport. Another negative with regards to road or rail transport would be that the significant numbers of journeys would have deleterious effects on the local environments through emissions from vehicles, dust from vehicle movements, noise from vehicle movements and other general disturbances and risks to communities through greater road traffic.

There would also be additional hazards associated with the transport of the CO<sub>2</sub> in that it will have to be compressed and cooled to maintain it as a liquid. Operators of the proposed pipeline will need to understand the mechanisms, hazards, consequences and probabilities of pipeline failures in pipelines conveying CO<sub>2</sub> in order to ensure safe design, commissioning and operation.

## Transport route

Typically, the proposed pipeline route can be in an up to 1 km wide corridor for the first 10 km off the site (where options to alter the route will be more limited) and a much wider 10km corridor after this. However, given the location of the project, it is not considered that there is sufficient land access nearby for a suitable corridor to be chosen for a pipeline. There are a number of technical considerations; as well as planning and national-approval considerations; that would require careful analysis if/when CCS is implemented in future.

## Economics

As part of a carbon capture feasibility assessment the likelihood that carbon capture will be economically feasible within the power station's lifetime covering retrofitting of capture equipment, transport and storage should be considered.

This economic consideration should include the efficiency penalties that arise from the operation of the carbon capture equipment from:

- Significant consumption of electricity through the operation of plant and machinery as well as pumps and blowers.
- Post-combustion CO<sub>2</sub> capture technology using amine solvent requires steam to regenerate the liquid amine solvent.
- Substances such as NO<sub>2</sub>, particulate matter and SO<sub>2</sub> have a detrimental effect on the CO<sub>2</sub> capture technology. The effects range from reduction in efficiency (lower capture rates) to the generation of solids which require filtration and addition of makeup liquid amine solvent.

## Conclusions

Should the economic assessment show that CCS is appropriate for the project; then from a technological viewpoint during its lifetime, this can be implemented. However, there are potential barriers to its implementation which would need further consideration as part of a wider feasibility study. These considerations are:

- The site, and surrounding areas, has allocated space for the inclusion of the carbon capture equipment pending future feasibility.
- A suitable means of geological storage will be required to be located should the Shurtan Gas fields not be suitable at the time of the retrofitting of the power plant with CCS.
- The EPC contractor can be notified during the procurement process to allow for the space for the retrofitting of key ductwork and ancillary equipment to support carbon capture or these can be retrofitted at a later point.
- The land restrictions with regards to a corridor for the pipeline to the storage location prior to retrofitting of the CCS system.