Jazan Integrated Gasification Combined Cycle (IGCC) Project Kingdom of Saudi Arabia

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

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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
AGR	Acid Gas Removal
AP	Air Products
ASU	Air Separation Unit
EIA	Environmental Impact Assessment
EPO	Environmental Operating Permit
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
GAMEP	General Authority for Meteorology and Environmental Protection
GER	General Environmental Regulation
GFU	Gasification Unit
GRM	Grievance Redressal Mechanism
HSFO	High Sulphur Fuel Oil
IGCC	Integrated Gasification Combined Cycle
JCPDI	Jazan City for Primary and Downstream Industries
JEC	Jazan Economic City
NTS	Non-Technical Summary
OESMP	Operational Environmental & Social Management Plan
RCJY	Royal Commission for Jubail and Yanbu
RO	Reverse Osmosis
SAES	Saudi Aramco Environmental Standards
SARU	Soot Ash Removal Unit
SRU	Sulphur Recovery Unit
TPH	Total Petroleum Hydrocarbons
VOCs	Volatile Organic Compounds
VR	Vacuum Residue

1 INTRODUCTION

This document is the Environmental and Social Impact Assessment (ESIA) Non-Technical Summary (NTS) for the 3,800 MW Integrated Gasification Combined Cycle (IGCC) Power Plant (the Project). The Project is in Jazan Province in the south west of the Kingdom of Saudi Arabia. The IGCC is a dual fuel fired power plant with a primary gasifier feedstock of vacuum residue (VR) and secondary high sulphur fuel oil (HSFO) both of which are used to produce syngas to fire the gas combustion turbines. Alternatively, the power plant can be operated on ultra-low sulphur diesel as a fuel source.

ACWA Power, Air Products (AP), and Saudi Aramco have signed a Head of Terms for a Joint Venture to own and operate the IGCC Power Plant.

The IGCC power plant and an adjacent Refinery was initially developed by Saudi Aramco in Jazan Economic City (JEC). The Refinery and IGCC Projects were designed initially to comply with the National Environmental Regulations and Standards applied by GAMEP (General Authority for Meteorology and Environmental Protection, formerly PME) and Saudi Aramco's environmental standards (SAES).

However, the management of JEC was transferred to the Royal Commission for Jubail and Yanbu (RCJY) in 2015 and renamed it Jazan City for Primary and Downstream Industries ("Jazan Complex"). As a consequence of this transfer, the IGCC is required to comply with RCJY Environmental Regulations and Standards (RCER-2015).

An Environmental Impact Assessment (EIA) has been conducted for the IGCC Project in 2016 and based on that study the facility received a 5-year Environmental Operating Permit (EPO) from the RCJY in April 2019 with certain conditions to be met by the operator including compliance with RCJY Environmental Regulations and Standards (RCER-2015).

The 2016 EIA was benchmarked with respect to Saudi's General Environmental Regulation (GER) 2001 and PME 2012 Regulations (currently GAMEP) and not against lender requirements (in line with Equator Principles III, IFC Performance Standards and IFC EHS Guidelines), or with Royal Commission regulations and standards.

Therefore, the ESIA is an update of the approved EIA (2016) to ensure that the study remains current and is aligned with prospective lending bank requirements.

It is important to note that the IGCC's construction is almost complete, and as such, the scope of the ESIA report relates specifically to the commissioning and operational phases of the Project.

2 PROJECT DESCRIPTION

The project is located on the Red Sea coastline of Saudi Arabia within JCPDI which is approximately 80 km north of Jazan City.

Figure 2-1 Regional Location of IGCC Project Site

The IGCC plant will have a maximum power production capacity of 3,800 MW from which 1,000 MW will be used internally, including 300 MW that will be sent to the Saudi Aramco Refinery within the JCPDI, with the remainder (2,500 MW) to be exported to Saudi Electricity Company (SEC) for the National Grid

The Project will include air separation units (ASUs) gasifier units (GFU), acid gas removal units (AGR), soot ash removal units (SARU), sulphur recovery units (SRU) and finally the power blocks. Ancillary to the primary components are utilities e.g., water treatment, wastewater treatment, tankage, etc. The IGCC complex also includes a Reverse Osmosis (RO) Plant that has been designed to produce approximately 1,700 m_3/h of desalinated water for industrial and on-site uses including potable water supply.

The IGCC Facility operates on the principles of industrial ecology as it is tightly integrated in terms of process flows with the Jazan Refinery. The primary feedstock for the IGCC gasifiers is from the refinery process with high sulphur fuel oil as a secondary feedstock. The IGCC will

produce certain products for Saudi Aramco's refinery (oxygen, nitrogen, sulphur, nickel, vanadium, hydrogen, steam, water and power) and export power for the national network.

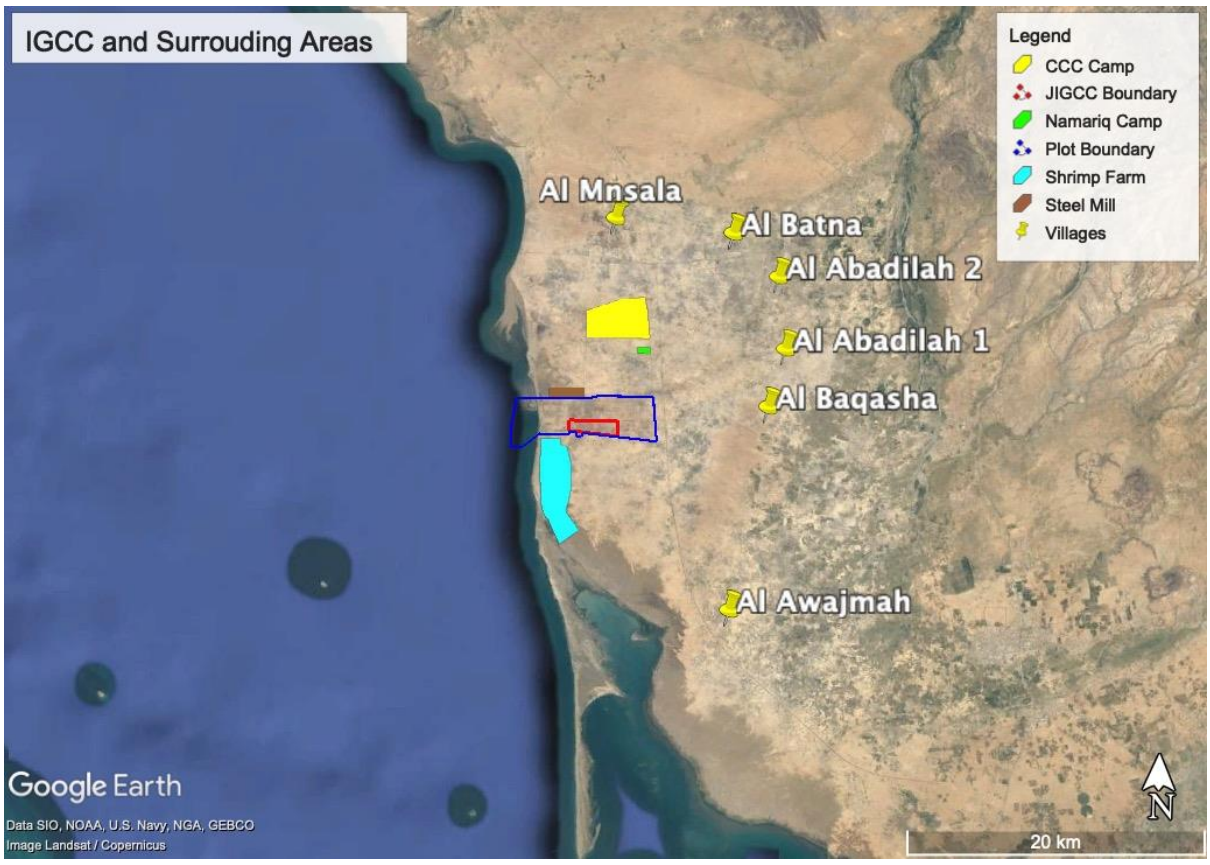
3 EXISTING BASELINE CONDITIONS

The baseline environmental conditions in the project area were established through a combination of reviews of existing data sources (i.e. previous 2016 EIA) and recent site inspections and field surveys (April to July 2019).

The IGCC plant is bordered by Saudi Aramco Refinery from the north and east and by a Marine Terminal from the west. A large abandoned shrimp farm is located 900 m south west of the Project. A steel mill is located approximately 1.5 km north east of the IGCC Project site.

There are no permanent residential areas (or transient/informal settlers) within the proposed IGCC/Refinery plot areas, nor immediately adjacent to the Project. However, Namariq and CCC Worker Camps are located approximately 4.8 and 5.6 km to the north east of the Project. Outside of the 10km radius, there are several villages 10 to 15 km away to the east and north east of the IGCC.

Figure 3-1 IGCC Project Site and Surrounding Areas



The existing ambient air quality conditions in the study area are good with the exception of PM_{10} which appears to be influenced by both desert sand storms and the effects of construction vehicles to/from the IGCC and Refinery site.

The 2019 baseline updates included a noise survey which was conducted at the Project site's fence line at six (6) locations. Noise levels at all monitoring locations were below the Royal Commission noise limit of 75 dB(A) and IFC/WHO noise limit 70 dB(A) for industrial areas. Even though the noise results were below the noise limits, they do not reflect the expected background noise levels in the study area during the day-time, due to the pre-commissioning and construction activities ongoing at the IGCC Project site and Refinery Complex. The monitoring results for the night time monitoring present a better reflection of the expected background noise levels around the Project site, due to the general lack of these major noise sources observed during the day time monitoring.

The IGCC Project site has already been levelled, cleared and graded during site preparation and construction works undertaken over the past 3 years. The Project site is located within the Refinery Complex and therefore the surrounding areas from the north, east and west are also under construction. Therefore, most of the Project site and immediate surroundings are built up and contain no natural habitat or flora. The immediate surrounding of the site from the south is coastal sand plain with minimal vegetation cover and includes sparse growth of shrubs. This area has already been modified due to the development of the area and adjacent roads

The nearest nationally protected areas to the Project site are Asir National Park to the north and north east (95 km), Wadi Jazan to the south east (65 km) and Farasan Island to the south west (59 km) which is also a UNESCO Word Heritage Site. The project is too far from these areas to have any effect on them.

Most recent investigations (2018) at the Refinery area have indicated groundwater is encountered at a depth of 11 to 12 m. The groundwater samples analysed for Volatile Organic Compounds (VOCs) and Total Petroleum Hydrocarbons (TPHs) were not detected with the exception of toluene and gasoline range (C6-C9).

Soil samples taken from the IGCC Project site showed the soils are not potentially contaminated. Concentration of oils & grease, TPH, VOC, sodium, potassium and a suite of heavy metals were either below the detection limit or when detected were within the established Dutch Standards.

An archaeological survey conducted in 2013 for the IGCC Project on behalf of Saudi Aramco, identified seven (7) archaeological sites within and surrounding the IGCC Project area. One of the sites (i.e. Site 4) is within the IGCC boundary located in the north-east of the site. It was classified as a site of moderate importance as it contained shards of pottery and although suspected to be a burial site, this was not confirmed. No above ground features of the archaeological site were observed during the ESIA team's site visit (April 2019).

To the east and north east of the site are three further archaeological sites which are described as "very important" sites. Of these sites, (ref 2 and 7) are graveyards whilst site 6 is fenced area known as *Umm Kahfa* which appears to be an early site for the manufacture of pots dating back approximately 2,000 years. Sites 1, 3 and 5 located south eastern and north of the Project site were classified as of low significance.

Figure 3-2 Archaeological Sites within and Surrounding IGCC Project Site

Detailed marine surveys in the Project area were undertaken in 2014 as part of a previous study conducted for the Refinery and IGCC Cooling Water Discharge and in 2016 as part of the fourth quarterly construction phase environmental monitoring for the IGCC Project.

The recorded in-situ physico-chemical properties within the Project area throughout the three monitoring campaigns conducted in 2016 appear to be consistent, with Temperature, dissolved oxygen, and salinity falling within close range of values. pH levels were above the Royal Commission monthly and maximum range for one month only. As for turbidity, exceedance was observed at two (2) locations during two (2) months out of the three (3) months monitoring campaigns. Heavy metals recorded levels below Royal Commission standards. Some exceedance of water metal concentration standards occurred, with Nickel, Iron and Zinc occurring in concentrations above the Royal Commission monthly average limits, however, were within the maximum ambient limits. Other parameters such as phosphate, nitrite, nitrate and silicon were all within the relevant water quality standards.

The 2014 ecological survey revealed that less than 17% of areas surveyed contained seaweeds and 2% contained coral. Three genera of corals were identified, *Porites*, *Platygyra* and *Favites*

but their contribution to biotic cover was less than 5%. During the October 2016 monitoring survey, growth of brown bushy thalli of *Sargassum* was prominent in the coastal area of Jazan Economic City.

4 ENVIRONMENTAL AND SOCIAL IMPACTS

The project will have a number of environmental, social and economic impacts during the operational phase, some of which are potentially significant and will require appropriate mitigation. Details of all the identified impacts are provided in Volume 2 and are summarised below.

4.1 Air Quality

As the Project is located within the Jazan Economic City (JEC), an industrial zone with several key anthropogenic sources of emissions the existing airshed already contains increased levels of airborne pollutants which would not otherwise be present. Long term continuous ambient air quality monitoring has been conducted at the Project site from 2013 to 2018 which was used in this ESIA assessment to determine the operational based cumulative impacts that the Project may have on other JCDPR site users and nearby sensitive receptors to provide an indication of longer-term pollutant concentration in the Project area.

Air monitoring results indicate that ambient concentrations of all pollutants are in compliance with the applicable standards with the exception of PM_{10} and $PM_{2.5}$. The high concentrations of particulate pollutants are likely attributable to wind-blown dust and possibly some of the early site preparation (earth moving) work on the Project, therefore the airshed is considered degraded for PM_{10} and $PM_{2.5}$.

In general, the concentrations of pollutants such as NO_2 and SO_2 have increased over the monitoring period which appears to be associated with construction at the Project, Saudi Aramco refinery, and marine terminal and increased activity at the construction worker camps. Construction involves the use of heavy machinery which can have very high NOx and SO_2 emissions, and mobile source activity at the worker camps can also contribute to high ambient concentrations.

Emissions modelling addressed the cumulative impacts of emissions from the IGCC in addition to the emissions from the Saudi Aramco Jazan Refinery and the steel mill, which are adjacent to the IGCC facility. Although the operation of the plant will include combustion related activities with direct emissions to the local air-shed, the cumulative effect of the project is not expected to result in exceedances to applicable RCER, PME or IFC/WHO regulations for air quality at nearby sensitive receptors or users within the JCPDI.

4.2 Noise & Vibration

Operational vibration is not anticipated to be a significant factor related to the power plant activities since any rotating parts are usually designed to avoid vibration. All rotating equipment is fixed in the upper levels of the turbine housing and will not involve interaction with the ground or other surfaces that could result in significant vibrations within or away from the project site. Therefore, any impacts from vibration during the operation of the plant is considered unlikely and of low significance.

There are no receptors of high sensitivity to noise around the IGCC plant. The closest receptors within 2 km radius (area of influence) are the steel mill (which also considered a noise source) and the abandoned shrimp farm. Both are considered of low sensitivity. Other receptors outside the area of influence (more than 2 km), such as the CCC and Namariq camps, located more than 4.5 km away, are extremely unlikely to be impacted by the operation of the IGCC Plant. Therefore, the operation of the IGCC plant will not contribute to the background noise at these receptors. Noise levels at all sensitive receptor locations, will comply with World Bank/IFC noise standards.

Noise modelling conducted in 2017 for the operation of the IGCC plant showed the predicted noise levels are well within the Royal Commission noise limit at the Project boundary. Another noise study conducted in 2018 for the Sulphur Recovery Unit (SRU) also showed the predicted noise levels along the Project fence line are well within the RC and IFC/WHO noise limits for industrial areas.

4.3 Solid Waste & Wastewater Management

A variety of waste streams will be produced during the operation of the project. These will include domestic waste, hazardous and non-hazardous wastes. Hazardous wastes include waste oils, oily rags, chemical containers and office/domestic sources include fluorescent light bulbs, batteries, etc. Non-hazardous domestic waste from the operation of the administration offices/facilities will be generated from activities of the employees, which are not directly associated with the production processes such as paper, tin cans, plastics, cartons, rubber, glass and food residues.

The impacts associated with the generation of waste from domestic and industrial sources could be wide ranging and include those associated with collection, storage, transport and disposal.

Hazardous waste generated from IGCC will be transported and managed at various locations in the Kingdom since there are no hazardous waste management facilities within the Refinery and the JCPDI at this time. One of the facilities that will be considered for the disposal of the hazardous waste is a landfill located in Rabigh, approximately 700 km north of IGCC which will increase the transportation distances of waste. In addition, disposal to landfills does have

several potential environmental impacts including the production of methane, which is a greenhouse gas. Therefore, reduction in the need to landfill waste will be a priority and achieved by adopting the waste management hierarchy and best practice for waste management. In addition, it will be particularly important to properly store the waste in designated and secured hazardous waste storage area at the site until it gets collected to final disposal.

Domestic, sanitary, oily and other chemical wastewater will be treated on-site in dedicated treatment plants. The ESIA outlines appropriate mitigation and management measures that will be implemented to ensure effective management of waste and wastewater during the operational phase. With proper control measures in place, the environmental impacts associated with the waste during operational phase can be suitably controlled and minimized.

4.4 Marine, Hydrodynamics, Water & Sediment Quality

To update the baseline marine environment data presented as part of the 2016 EIA, 5 Capitals undertook a revised project-specific marine survey during July 2019 offshore of the Project area incorporating seawater and sediment sampling & benthic habitat assessment. The data was used to confirm sensitive receptor locations, which have been determined using the existing baseline benthic habitat survey reports and to validate whether there have been any changes to the ambient water and sediment quality obtained since commencement of construction.

Of the 15 sites visited, 5 were to areas previously considered to contain sensitive receptors such as coral, mangroves and sargassum seaweed which support juvenile marine life. The majority of the sites visited had highly turbid water conditions where underwater assessment of the benthos observed fine mud like sediments. At the two sites where water clarity was improved (one of which was earlier reported to contain sargassum) the seafloor comprised of more consolidated sediments with presence of sargassum, algae, sponges and few instances of small coral heads. Overall the habitat conditions appear to have deteriorated since the earlier baseline surveys were carried out as indicated by the fine sediment texture and observed effects of sedimentation which was noted on sessile marine fauna.

The marine discharge hydrodynamic assessment presented in the 2016 EIA assessed the dispersion of cooling water. This model has been updated by HR Wallingford with the "as-built" configuration (6 outfall pipes, 2km from the shoreline) in an excavated basin 20m deep and 400m x 400m in area. Two scenarios to discharge cooling water with 3 types of movement (northward, southward and no drift) were assessed in relation to PME (2012), RCER (2015) and IFC standards. The results of modelling temperature and residual chlorine has predicted compliance with PME standards <30m from the discharge and compliance with RCER standards at the 5 sensitive receptor locations. Results also showed compliance to the IFC +3 °C contour close to the outfall at the bed for the higher flowrate and lower temperature operating scenario and at 600 m at the surface for the lower flowrate and higher temperature

operating scenario. The increase in temperature at the sensitive coral and mangrove sites is on average less than 0.1degrees C. The results of the thermal dispersion modelling also predict no more than 0.5 to 1 degree C increase in water temperature at the water intake to the IGCC.

4.5 Soil, Geology and Groundwater

Potential risks of concern during the operational phase are expected to be limited to the management of hazardous materials/wastes/wastewater. In the event of leaks and spillages, the wastewater or wastes may enter and contaminate the soil and eventually infiltrate to the groundwater depending upon the safeguards that are employed. The significance of impacts from this source depends on what material/chemical is lost to the soil/groundwater, its toxicity, quantity and location. The adoption of spill prevention measures such as secondary containment, and proper on-site practices e.g, BMPs will help minimise the risk of soil and groundwater quality impacts arising from accidental spillages.

In addition, contaminated stormwater if allowed to drain on unpaved surfaces, may contaminate the underlying soil and groundwater. Contaminated and oily stormwater will be collected on site via process drainage systems and transferred to the IGCC WWTP for treatment.

4.6 Terrestrial Ecology

During the operation phase most fauna species will have been lost from the site due to the disturbance and loss of habitat during the construction phase. The habitat to the south of the IGCC has been largely disturbed due to the past shrimp farm development and no sensitive habitats are present in this largely cleared coastal sand plain. Therefore, no further direct impacts are anticipated on the ecological resources in general. The only activities that may potentially impact the ecology of the site would be through indirect measures, relating to poor management practices of any designated landscaped areas; or to the fauna species inhabiting/using these areas. However, the ecological receptors at this area is considered to be of low sensitivity since the immediate surrounding is also considered disturbed due to the development of the entire area and there are no sensitive, endangered flora or fauna within the immediate surrounding or within the site. The Project's Operational Environmental and Social Management Plan (OESMP) will include dust controls and control of noisy activities and restrictions on the transportation of equipment/ materials, including speed limits, pest management, and proper site management in line with International Good Practises.

4.7 Archaeology and Cultural Heritage

Based on the archaeological survey conducted during 2013, three (3) important archaeological sites were found surrounding the IGCC site (Site 2, 6 and 7). Archaeological site 2 is located within the boundaries of the Jazan Refinery Complex footprint, while site 6 and 7 are located outside the Jazan Refinery Complex boundaries. One archaeological site (site 4) is located within the IGCC boundary in the north-east of the site. Based on the site visit conducted in April 2019, there were no above ground evidence of the site within the IGCC Project area.

During the operational phase, the main concern is to ensure the archaeological sites are not damaged from any activities related to the commissioning and operation of the IGCC Project such as accidental damage or from illegal dumping or practises close or within site. This may require fencing and/or covering of parts of sites and/or providing access control. The conservation, management, presentation and promotion of all archaeological sites is conducted by SCTH and it will be important to liaise closely with the them.

4.8 Landscape and Amenity

With regards to visual receptors during the operational phase of the Project, other than the worker camps and existing industrial facilities such as steel mill and refinery, there are no visual receptors that may potentially be impacted as a result of the Project's operational activities.

Following the impacts of construction and establishment of project features, the operational phase of the Project is not anticipated to result in any changes to the landscape character or visual envelope of receptors overlooking the Project site. Although potential lighting impacts due to light installation across the Project site during operations may occur, this will not have any significant impact on the identified receptors as the Project area and surrounding industrial facilities already have lighting installations.

4.9 Community Health, Safety & Security

The project will carry various risks that could result in impacts to public safety where such impacts are transferred or received outside of the project site. Such impacts may relate to fire, H2S/VOC emissions during venting, explosions, spills of back up fuels, un-warranted releases of wastewater and security concerns of trespassers. The extent of such impacts may range outside of the projects boundaries and require the involvement of outside agencies to help manage and abate such impacts (e.g. Civil Defence, Police and Army).

Public risks during operation have the potential to result in incidents, which could have a significant impact upon neighbouring communities and populations. Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and via appropriate training of staff.

4.10 Socio- Economics

At a strategic level the operation of the IGCC facility offers potential to support the continued growth of the local and national economies through the ability to provide an important source of power to the Saudi Arabian national energy grid and contributing to the energy mix in the Kingdom. The Project will aim to employ Saudi nationals in accordance with the recent Saudi Nationalisation Scheme on Saudisation and the Saudi Vision 2030 thereby contributing to minimizing the number of unemployed Saudi Nationals in the Kingdom. A significant positive economic impact during operation will result from any local employment created by the project.

4.11 Labour & Working Conditions

The risks associated with the operational phase of the project are anticipated to be significantly less than during the construction phase due to reduced site activity and requirements for heavy plant and machinery. There will be occupational health and safety risks attributable to the operational phase associated with operation, maintenance and inspection requirements. Maintenance and inspection will also require the use of site vehicles and activities that pose risks to human health and safety. A structured Grievance Redressal Mechanism (GRM) shall be implemented at the plant level in multiple languages anonymously (online and hardcopy) so that workers have access to vent their concerns. The human resources department shall be responsible for implementing the GRM for the facility.

During the operational phase of the Project planning will be needed to enforce just & fair treatment of operation and maintenance staff (including any engaged contractors and their sub-contractors). Allowance will also need to be made for site staff welfare facilities including sanitation, rest, recreational and medical facilities.

4.12 Human Rights

The Project is located in an industrial area away from population clusters or communities. The closest villages identified to the Project were approximately 10 to 13km away, which is considered far from the Project site and will not be directly affected by the Project and therefore are not considered 'Affected Communities'. Also, there are no identified settlements or any evidence of land use within the project area likely to be attributable to indigenous peoples.

The main risk with regards to the operation of the plant is employment through third party contractors. Workers/staff not employed directly by the O&M Company but contracted or engaged by third party companies may not comply with the national and international human rights requirements. These risks will need to be managed under mitigation and management controls set out in the 'Labour and Working Conditions' and 'Human Rights'

Sections of the ESIA. It should be noted a grievance mechanism plan has been developed for the Project. Complaints and any concerns related to employment and working conditions should be raised in line with the grievance procedure.

4.13 Climate Affairs

Published data indicates that temperature and rainfall are predicted to increase in Jazan area for the period 2025 to 2084, however it is noted that the life time of the plant is 25 years.

In addition to the above, the climate related hazards of high significance for Jazan area include coastal flooding, extreme heat, water scarcity, wildfire and earthquakes. Other hazards such as urban floods, landslide, volcano, Tsunami and cyclone are ranked as low to very low. Coastal flooding and extreme heat are determined to be the most significant climate related hazards to the IGCC Project. A disaster management strategy should be developed for the operation phase as part of the Project's Emergency Response Plan. Additional measures to be considered as part of the disaster management plan are provided in the 'Climate Affairs' 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 commissioning and operational phase of the project. The framework has been developed to ensure that all Environmental & Social impacts identified for the operational phase are appropriately identified and controlled through the development of a robust operational phase ESMS and associated Management Plans.

The 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 Lenders.

The primary documents guiding the environmental and social management of the operational phase will be the Operational Environmental & Social Management Plan (OESMP) respectively.

6 Cumulative Impacts

The ESIA has assessed cumulative impacts of several environmental and social parameters. For instance, present-day air quality, noise levels and operational marine discharges have considered the measured baseline conditions in combination with the predicted process contributions.

However, although there are plans to develop the JCPDI detailed development plans or strategies for these future Projects are not immediately available. As such, future cumulative impact assessment has not been undertaken in the ESIA. Therefore, the assessment of cumulative impacts with reference to this Project has only gone as far as those cumulative impacts upon specific receptors as a result of the proposed project and existing impacts from other local industrial facilities currently in existence.