Environmental Impact Assessment
Executive Summary

For

Shanxi Gas Utilization Project -
Yangcheng Gas Utilization Subproject

(Draft)

Coal Chemistry Institute of China Academy of Sciences

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1. INTRODUCTION

1.1 Project Background

The Province of Shanxi has been suffering from serious air pollution which is primarily caused by intensive use of coal in industrial and domestic sectors including space heating. In order to improve air quality, the Shanxi Provincial Government has proposed a series of initiatives for clean air in the province. The Shanxi Gasification Program (the “Program” hereinafter) is one of the action plans among the initiatives, which calls for promoting the use of gas to representing 7.5% of energy consumption in 2015 in the province.

The World Bank (hereinafter referred to as “WB”) Financed Shanxi Gas Utilization Project (hereinafter referred to as “SGUP”) is an important component of the “Program”. The SGUP is implemented by Shanxi Provincial Guoxin Energy Development Group Co., Ltd. (hereinafter referred to as “Guoxin Energy Group”) with the objectives to improve gas penetration and utilization rates, replace coal with gas, and thus reduce air pollutant emission in Shanxi Province.

The SGUP consists of two components, i.e. the CHP Component, which comprises two sub-projects, and the Gas pipeline network Component, which comprises four gas pipeline network sub-projects in four counties in Shanxi Province, which are Changzhi County Gas Utilization Sub-project, Xiangyuan County Gas Utilization Subproject, Tunliu County Gas Utilization Sub-project, Qingxu County Gas Utilization Sub-project.

The SGUP put into the implementation phase in 2014. Due to the economic and market environment changes in Shanxi, the 2nd phase project of 3 sub-projects of Changzhi, Xiangyuan and Tunliu in the 4 gas pipelines sub-projects are no longer in need for the gasification. For the rational allocation of bank funds, to avoid public waste of resources, in Nov. 2016, the Guoxin Energy Group requested to halt the 2nd phase of these three sub-project and to implement the Yangcheng County Gas Utilization Sub-project.

This subproject is an integral part of the Shanxi Gas Utilization Project which has been classified into Category A, hence the environmental impact assessment of this subproject will be carried out in accordance with the requirement of Category A.

1.2 Environmental Policies, Laws and Regulations

1.2.1 Laws and Regulations

The basis of the EIA Reports includes national and local environmental laws, regulations, policies, and the World Bank’s environmental and social safeguard policies. The main applicable laws and regulations include:

- Environmental Protection law of the People’s Republic of China, 1989;
- The Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution, 2000;
- The Law of the People's Republic of China on Prevention and Control of Water Pollution, 2008;
- The Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise, 1996;
- Technical Specifications for Environmental Impact Assessment; and various applicable standards for air, water, and noise.

1.2.2 Safeguard Policies and EHS Guideline

- OP 4.01 Environment Assessment;
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- OP 4.11 Physical Cultural Resources;
- OP 4.12 Involuntary Resettlement;
- EHS: General EHS Guideline; and
- EHS: Electric Power Transmission and Distribution;

1.2.3 Applicable Standards

The ambient air function belongs to the category II, in the implementation, the level 2 of "ambient air quality standards" (GB3095-2012) should be enforced.

Construction noise in the implementation should comply with the "construction site environmental noise emission standards" (GB12523-2011).

The project is urban pipeline network project, and there is no wastewater, waste gas and solid waste discharge in operation period.

Other applicable standards are included in Table 1-1.

### Table 1-1 Applicable Standards

<table>
<thead>
<tr>
<th>Category</th>
<th>Ref.</th>
<th>Name of standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment quality</td>
<td>1</td>
<td>Surface Water Quality Standard (GB3838-2002)</td>
</tr>
<tr>
<td>Pollutant discharge</td>
<td>2</td>
<td>Acoustic Environment Quality Standard (GB3096-2008)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Ambient Air Quality Standard (GB 3095-2012)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Noise Limits on Boundaries of Construction Sites (GB12523-2011)</td>
</tr>
</tbody>
</table>

2. PROJECT DESCRIPTION

2.1 Project Composition

The proposed project development objective (PDO) is to increase the gas share on energy consumption and reduce the discharge of air pollutants and GHG through the displacement of coal in Shanxi Province, and at the same time to upgrade the existing gas facilities to eliminate the existing security risks in Yangcheng County.

The main construction content of this project consists of construction of two urban gas pipeline networks (Anyang gas distribution station - Dongye town urban gas pipeline, and Lanhua151# valve wells - Yanli county urban gas pipeline) and associated supporting facilities, and the upgrading of the residents gas meter and the pipeline behind the meter in the existing gas pipeline networks.

The composition of the project are summarized in Table 2-1 below.
## Table 2-1  Project Description

<table>
<thead>
<tr>
<th>Item Project</th>
<th>Location</th>
<th>Capacity</th>
<th>Composition</th>
<th>Gas source</th>
<th>Service area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yangcheng pipeline network</td>
<td>Anyang gas distribution station-Dongye town urban gas pipeline</td>
<td>New construction of gas transmission and distribution system, with annual gas supply of $5627.98\times 10^4\text{Nm}^3$</td>
<td>1) New construction of 20.2 km pipeline at 0.8 MPa; 2) 8 surge tanks; 3) 7 Single valve well (DN150); 4) 1 Double valve well (DN200, DN300); 5) Auto-monitoring system for gas network</td>
<td>Tingdian booster station, construction has been completed</td>
<td>Along the pipeline network, county residents, commercial business in Yangcheng County, and township residents, commercial business, new rural residents and the surrounding industrial gas users etc. within the county</td>
</tr>
<tr>
<td></td>
<td>Lanhua151# valve wells - Yanli county urban gas pipeline</td>
<td>New construction of gas transmission and distribution system, with annual gas supply of $262\times 10^4\text{Nm}^3$</td>
<td>1) New construction of 7.59 km pipeline at 0.8 MPa; 2) 1 surge tanks; 3) 1 Single valve well (DN200); 4) Auto-monitoring system for gas network</td>
<td>Lanhua151# gas well in Xihe township, Yangcheng County, construction has been completed</td>
<td>Second gas source for residents, commercial business, and public construction in Yanli township</td>
</tr>
<tr>
<td>Upgrading of existing gas facilities in Yangcheng</td>
<td>Replacement of gas meter and pipeline behind the meter in the resident household</td>
<td>To upgrade the membrane meters and 26800 m pipeline behind the meter for the 13411 residents user of existing gas project in Yangcheng County.</td>
<td>——</td>
<td>Residents of the existing gas pipeline network of Yangcheng with the membrane meters and pipeline behind it to be upgraded.</td>
<td></td>
</tr>
</tbody>
</table>
2.2 Gas Consumption

The projected consumption of gas is given in Table 2-2 below:

Table 2-2 Gas Consumption

<table>
<thead>
<tr>
<th>NO.</th>
<th>User type</th>
<th>Daily Gas Consumption (10^3 m³/d)</th>
<th>Annual Gas Consumption (10^4 m³/a)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yangcheng gas Utilization</td>
<td>0.88</td>
<td>322.85</td>
<td>5.74</td>
</tr>
<tr>
<td>1</td>
<td>Residential users</td>
<td>0.19</td>
<td>70.22</td>
<td>12.48</td>
</tr>
<tr>
<td>2</td>
<td>Commercial users</td>
<td>13.75</td>
<td>4950.00</td>
<td>87.95</td>
</tr>
<tr>
<td>3</td>
<td>Industrial users</td>
<td>0.78</td>
<td>284.91</td>
<td>5.06</td>
</tr>
<tr>
<td>4</td>
<td>Unforeseen consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Total</td>
<td>16.42</td>
<td>5627.98</td>
<td>100</td>
</tr>
</tbody>
</table>

3. ENVIRONMENTAL BASELINE

3.1 General Setting

Shanxi Province is in northern China within the range of N 34°34’, N 40°44’, E 114°32’ and E 110°15’, adjacent to the Hebei Province, Henan Province, Shanxi province and the Inner Mongolia Autonomous Region. The province of Shanxi covers an area of 156,700 km² representing 1.6% of the total area of China, and the total population of the province is 36.108 million in the 11 municipalities and 119 counties.

The geographical location of the WB Financed Shanxi Gas Utilization Project-the Yangcheng subproject is given in Table 3-1 below.

Table 3-1 Geographical Location of the WB Financed Yangcheng Gas Utilization Project and Counties/Cities under the Project

<table>
<thead>
<tr>
<th>Project Name</th>
<th>County/City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yangcheng Gas pipeline network</td>
<td>Yangcheng County is located in the southeastern of Shanxi Province and the west of the Jincheng City, in between the three mountains of Taihang, Taiyue and Zhongtiao, bordering Qinshui County to the north, Jincheng City to the east, Qinshui County and Yuanqu County to the west, and Jiyuan County Henan province to the south</td>
</tr>
</tbody>
</table>

The pipeline network would go through Fengcheng Township, Baisang Township, Manghe Township, Dongye Township and Yanli Township.

3.2 Topography and Hydrogeology

Shanxi Province is located on the Loess Plateau with a rolling terrain, which has a complex landform formed with a variety of mountains, low hills, plateaus, basins and terraces. Shanxi Province extends along a narrow area, which slopes down from northeast to southwest, in between the Yellow River and Taihang Mountains, the mountain area accounts for over 70% of the total area of Shanxi Province. The outline of the boundary is a parallelogram from the northeast to the south west.

The Natural Environment including the Topography and Land Form, Engineering Geology, Hydrogeology and Earthquake of the WB Financed Shanxi Gas Utilization Project-the Yangcheng subproject are given in table 3-2.
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Table 3-2 General Introduction of Natural Environment in Project Areas

<table>
<thead>
<tr>
<th>Item Type</th>
<th>Topography and Land Form</th>
<th>Engineering Geology</th>
<th>Hydrogeology</th>
<th>Earthquake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yangcheng gas utilization subproject</td>
<td>The general trend of Yangcheng County terrain is higher in the South, West and northeast, lower in the East, showing a semi open basin shaped terrain, with mountains, hills and basins.</td>
<td>From the tectonic system, Yangcheng County is located in the middle of the Xicheng mountain tilt belt and the south of Zhanshang Wuxiang Yangcheng NNE fold belt. From the perspective of regional structure, most of the county are platform sedimentary cover, area of Chengguan, Qinchi, Yan Li mainly are north-south structure. The southern margin of Zhanshang Wuxiang Yangcheng NNE fold belt extends into the county from the Zhengzhuang, Duanshi, Changdian, and continue extend to Jialing, Baisang, which consists of a series of anticline syncline fold belt.</td>
<td>Groundwater distribution of Yangcheng County is not balanced, more in the north than the south, more in the east than the west, more in the periphery than the center. Groundwater types include quaternary riverbed impact sand and gravel. Groundwater types include the sand gravel pore water of the river bed impact, fissure water of the upper Permian sandstone, fissure water of the coal bearing strata of Lower Permian, Karst fissure phreatic water of Upper Carboniferous strata, Karst fissure phreatic water, and the fissure water of the Sinian sandstone and quartz andesite</td>
<td>The basic earthquake intensity is VI.</td>
</tr>
</tbody>
</table>

3.3 Mineral Resources

Shanxi Province is rich in mineral resources, especially in coal, bauxite, iron, etc. The abundant coal resources scatter more than 90 counties (cities, districts) across the whole province. See Table 3-3 for main mineral resources in the project areas.

Table 3-3 Main Mineral Resources in the Project Areas

<table>
<thead>
<tr>
<th>Project</th>
<th>City/County</th>
<th>Mineral Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yangcheng gas utilization subproject</td>
<td>Yangcheng</td>
<td>Xiangyuan County is rich in mineral resources, metal ores like iron, copper, aluminum etc. and non-metallic minerals ores like coal, sulfur, gypsum, quartz etc., especially rich reserves in coal, iron, sulfur, has proven coal reserves of 5.922 billion tons, iron ore reserves of 0.3 billion tons, 0.2 billion tons of sulfur ore, laid a good foundation for the Yangcheng County Economic Development</td>
</tr>
</tbody>
</table>

3.4 Climate

Located at the mid-latitudes, Shanxi Province is not far from the sea but less affected by the summer monsoon due to the mountain barrier, with a temperate continental monsoon climate. The annual temperature averages 3℃-14℃ and the annual precipitation averages 400 - 650 mm with 60% being distributed within the period from June to August. The precipitation is greatly affected by the terrain, with more in mountains, and less in basins.

3.5 Ecology

As one of the provinces with short land resources, Shanxi Province has the characteristics of complex and diverse landforms, serious soil erosion and multiple land types. The proposed project is located in the area already developed or disturbed by human activities, thus the artificial ecological characteristics dominate the project area. In addition, the proposed sub-project will cross the Jian River and Huoshi River, which are very small rivers with seasonal flow, and it is confirmed by local government agencies that there are no rare or endangered species in the rivers. The proposed sub-project will also extend through some
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plots of woods land, which are artificially planted for wind breaking by farmers. There are no rare animals, plants or large wind animals in the assessed area.

3.6 Socio-economy

There are 11 municipalities under the jurisdiction of Shanxi Province, the hometown of 36 million people.

The total production value throughout Shanxi Province reached RMB 1280.26 billion yuan in 2015. The value added of primary industry was RMB 78.81 billion yuan; The second industry generated RMB 522.43 billion yuan; The service sector contributed RMB 679.02 billion yuan; Per capita GDP is 35018 yuan.

Yangcheng County reached RMB 16.94616 billion yuan. The value added of primary industry was RMB 0.992 billion yuan; The second industry generated RMB 9.77061 billion yuan; The service sector contributed RMB 6.18355 billion yuan; Per capita GDP 43329 is yuan.

3.7 Physical Cultural Resources

The proposed sub-project will pass by a village temple in between the Nanyao Village and Beiyao Village at a distance of 20 meters. The temple was rebuilt in 1980’s by the villagers and is not listed in the inventory of local government for official protection.

3.8 Ambient Air Quality

According to the air quality monitoring report of Local environmental monitoring stations in the industrial site monitoring points at Huiyang coal mine from August 26, 2014 to September 1st, 2014. The monitoring results indicate that the SO$_2$ concentration failed to meet the required standard, while the TSP, PM$_{10}$, NO$_2$ in the region did not exceed the standard of ambient air quality standard (GB3095-2012) in level two.

3.9 Surface Water Quality

Surface Water Quality data from the surface water quality weekly report of Qinheshangli spring automatic monitoring station, December 19-25, 2016, show that the water quality in Qinheshangli spring meets the Class II of Surface Water Quality Standard (GB3838-2002).

3.10 Acoustic Environmental Quality

The monitoring results show that the day time noise level at the representative sensitive points along the gas pipeline network meet the required standard of Class I in Acoustic Environment Quality Standard (GB3096-2008). While the night time noise levels at Zhongzhuang village and Jianping Village exceed the standard 0.4 and 1.5 dB respectively.

3.11 Air Pollution Source

One of the primary causes for severe air pollution in Shanxi is the intensive consumption of coal. Coal is the fundamental energy source for Shanxi Province, offering 98% of total energy consumed in the province. The industrial sector consumed 96% of the coal used in the province, thus becoming the overriding source for air pollution.

The main features of ambient air pollution in Shanxi province are: 1) typical coal smoke pollution mainly represented by SO$_2$, NO$_x$, and particulate matters; 2) poor ambient air quality and high degree of pollution; 3) major pollutants concentration affected by seasonal changes; SO$_2$, NO$_x$, and PM$_{10}$ are the worst pollutions in winter.

After the implementation of Yangcheng County gas utilization project, The Yangcheng gas pipeline network are intended to supply 80% of the total gas volume to the industries, hence will effectively reduce the emissions of local industrial pollution sources, improve the atmospheric environment and speed up the energy re-structuring in the project counties.
4. ENVIRONMENTAL IMPACT ASSESSMENT

4.1 Impact Assessment in Construction Phase

4.1.1 Impact on Air

The air pollution will be caused mainly by air-borne dust and exhaust gas of equipment and welding of pipes. However the construction on each section is planned to be short, and the impact on air quality will immediately disappear once after the construction is completed.

4.1.2 Impact on Surface Water

The workers will rent the nearby residential houses in villages, and generate small amount of domestic wastewater. The pit toilet would be adopted. The feces would be collected by the nearby villagers for fertilization. When the construction is over, the pit toilet would be backfilled with earth after treated by the lime. The pressure testing of the pipeline will use small amount of water, the dry excavation will be used to cross Huoze River and Jian river. The pipeline will cross the Rivers in dry season, avoiding the disturbance of the river water. With good management and scheduling of the construction, such impacts on surface water quality will be mitigated to an acceptable level.

4.1.3 Impact on Groundwater

The excavation depth of the construction pipeline does not involve the aquifer, so it will not affect the groundwater. The wastewater from the construction containing SS and oil will not reach the groundwater aquifer through absorption by soil layer.

4.1.4 Impact of Solid Waste

The construction solid waste and spoil will be generated from the excavation. The domestic solid waste from the workers’ camps requires disposal. Steel pipe welding will produce the discard electrode head. Improper disposal of these wastes will have negative impacts on the environment.

4.1.5 Impact of Noise

A few operation equipment is required and the intensity of noise source is much weak. The period of the noise generation in each construction section is limited to 2 days. Construction noise mainly refers to some transient noises like sporadic knock, loading and unloading the vehicle crash, cries, crash. The noise impact is minor due to limited period.

4.1.6 Impact on Ecology

The project will cause soil erosion by disturbing soil and eliminating vegetation. However as the construction period of each section is very short, the impact on soil erosion is minor.

4.1.7 Social Impact

Pipeline project construction does not involve land acquisition and resettlement. The major social impact of the project includes the traffic blocking, impact on the commercial activities on both sides of the road and traffic safety, etc. The impacts will be addressed through careful scheduling of construction and cooperation with local departments on traffic control and infrastructure service. Also the project will hire a number of local people in construction, increasing the job opportunity.

4.1.8 Impact on Physical Cultural Resources

Xingshan temple is located between the Nanyao village and the Beiyao village, Manghe Township. It was built by the local villagers with raising funds. Xingshan Temple has total of three courtyards with the Jade Emperor Temple in the middle courtyard, the three Officials hall in the east courtyard and the Guangong Hall in the west courtyard.

Xingshan Temple is jointly managed by the Nanyao and Beiyao Village Committees with the
main function of the worship, prayer and other folk activities, and it will open at the local folk activities.

The temple is the local folk custom building but not in the list of cultural relics protection in Yangcheng County.

The pipeline construction will use the way of laying, construction dust, vibration and artificial destruction have some negative impacts on the temple. The construction period is short, there is no large mining machinery in the construction process, and the landforms will be restored after the construction immediately. The impact of the pipeline construction on Xingshan temple can be mitigate at acceptable level.

The mitigation measures in operation phase should be taken as follows:

Construction workers should be trained to have an awareness of protection of relics. Construction shall be strictly limited within the red line and the area beyond the red line can’t be excavated. When the pipeline construction is near Xingshan Temple, the small equipment or labor rather than large mechanical equipment shall be used as much as possible to mitigate the impact of noises and strong vibrations caused by large scale excavation machinery.

Construction fence should be set between construction site and Xingshan Temple. Constructors shall not stack earthworks in the enclosed area; moreover, neither be allowed to enter.

The whole construction process shall be monitored by a qualified supervision unit which is responsible for the supervision of construction activities, photographs and issue the supervision report; Moreover, picture of the construction site shall be taken and kept as the evidence of founded or not founded relics.

The specific requirement refers to the Physical Cultural Resources Management Plan.

Figure 4-1 shows the position relationship of the project pipeline with Xingshan Temple.

**Figure 4-1 Position relationship of the project pipeline with Xingshan Temple**

In construction period, construction noise and traffic congestion may have an impact on religious activities as well. Reasonable arrangements for the construction duration to avoid religious activities, and provision of temporary detour route can avoid or mitigate these impacts. Due to the small construction scale and short construction period, the impact is temporary and acceptable.
4.2 Impact Assessment in Operation Phase

4.2.1 Impact on Air

As the project is gas pipeline network, which will not emit any waste gas, thus will not cause adverse impact on the ambient air quality. But it's required to strengthen engineering quality control, pipeline network inspection and publicity of natural gas safety knowledge, and cooperate with competent gas authority to strengthen law enforcement and emergency drills to prevent gas leakage.

4.2.2 Impact on Surface Water

The gas pipeline network will not generate wastewater during operation stage, thus will not cause any impact on surface waters.

4.2.3 Impact on Groundwater

The project will not cause any impact on Groundwater in operation period.

4.2.4 Impact of Solid Waste

The project will not generate any solid waste in operation period.

4.2.5 Impact of Noise

The project basically has no impacts on the surrounding environment during the operation period. The surge tank is the only noise source of the project, which will generate lower sound pressure levels. It is estimated that the noise level at 3 m from the tanks will meet the Class 1 standard. As the surge tanks are carefully located to keep the distance at least 45 m from the residential area, there will not be any impacts on the acoustic quality in the sensitive receptors.

4.2.6 Impact on Ecology

The project will not cause any impact on ecology in operation period.

4.2.7 Social Impact

The positive social impacts to be presented by the operation of the project include: 1) ensuring the safety of the lives and property of residents; 2) improved living environment and quality for residents; 3) reduced burden of housework for women; 4) reduced morbidity and improved health condition for residents; 5) promotion of pollution reduction, expenditure reduction and increase the products quality for industries; 6) increased employment opportunities; 7) increased awareness and capability of women in public affairs; and 8) promote equalization of public services, shorten the gap between urban and rural areas.

The negative social impacts include 1) land acquisition and occupation; 2) affordability for poor families; and 3) re-employment risk for women; and 4) inconvenience.

4.2.8 Impact on Physical Cultural Resources

Xingshan temple is located between the Nanyao village and the Beiyao village, Manghe Township. The temple is not included in the list of cultural relics protection in Yangcheng County, and is the local folk custom building. The pipeline construction using the way of laying, and the project has no impact on Xingshan Temple in operation phase. The project has no impact on physical cultural resources.

5. Cumulative Impact

5.1 Analysis of Cumulative Impacts on Ambient Air

In response to the 12th Five Year Plan for Environmental Protection, a series of action plans
have been initiated including the Shanxi Gasification Program. This proposed project is an integral part of the Shanxi Gasification Program. The implementation of the Project can further promote the course of Shanxi Gasification Program and improve the gasification rate of Shanxi Province.

During the 12th Five years Shanxi Province reached the air pollution load reduction of NOX, SO\textsubscript{2} and Flue Gas by 310,250 t/a, 317,942 t/a and 184,575 t/a respectively. Shanxi Province has developed the new target for air pollution load reduction through its 13th Five Year Plan for Environmental Protection which calls for reduction of NOX, SO\textsubscript{2} and Flue Gas by 186,240 t/a, 224,120 t/a and 144,890 t/a respectively during the 5 years.

See Table 5-1 for the details of Air Pollutant Emission Reduction of Shanxi Province.

<table>
<thead>
<tr>
<th>Area</th>
<th>SO\textsubscript{2} Emission Reduction during the “12th Five-year Plan”</th>
<th>Air Pollutant Emission Reduction Target during the 13th Five-year Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOX</td>
<td>SO\textsubscript{2}</td>
</tr>
<tr>
<td>Proportion of Emission Reduction</td>
<td>25.0%</td>
<td>22.11%</td>
</tr>
<tr>
<td>Emission Reduction (10’000 t/a)</td>
<td>31.0250</td>
<td>31.7942</td>
</tr>
</tbody>
</table>

5.2 Analysis of Social Cumulative Impacts

This project will cause social cumulative impacts, including the affordability issue and the gas supply balance within the whole province. However these impacts can be mitigated by subsidies for poor families and careful planning and design of the gas pipeline network.

5.3 Analysis of Cumulative Impacts of Risks

Another cumulative impact of concern is the safety and security of the whole gas network in the province with which the project will be connected. In 2012, Beijing Gas and Heating Engineering Design Institute was contracted to conduct the safety and security assessment of the provincial gas network using TGNET model with the gas pressure and velocity being the limiting factors to model the safety situation when the whole provincial gas network is built. The main findings are that there will not be any explosion and leakage risk due to over-pressure; on the contrary, there will be some lower pressure areas on the gas network.

6. Land Acquisition and Resettlement

6.1 Land acquisition

According to the data collected by resettlement survey, the impacts area will cover 34 villages in 5 towns. The land to be permanently acquired by this project is 1.62mu in total for surge tanks. In addition, construction stage will require the temporary occupation of land totally of 500.22 mu, including 357.48mu dry farmland, 45 mu woods land 90 mu woods land, 70.92 mu rural roads, and 26.82 mu un-cultivated land.

Totally the land acquisition will affect 858 people in 373 households, all by temporary land occupation. All of the land, trees and other attachments will be compensated at the replacement cost.

The project will neither involve land occupation in the natural reserves or forest parks, nor demolition of structures, there hence is no impacted population, enterprise or other kind of units, either there is any impacted special facilities like bridges, water conservancy, electricity, telecommunications, cultural relics etc.
6.2 Livelihood Recovery

All families affected by temporary occupation of land will receive sufficient compensation. The owner of the Project shall be responsible for restoring the land affected to the previous conditions after the project is completed. During the construction period, many temporary employment opportunities will be created, when labor force from households affected will be employed preferentially, especially the vulnerable households shall be taken care of to the largest extent, so that they may receive some economic income.

6.4 Disadvantaged Group

According to the survey, there are no ethnic minorities to be affected by the Project. The statistical survey indicates that the disadvantaged people is only 4.8% of the people surveyed. The villages will allocate part of the compensation funds to support these disadvantaged families and the Project owner will provide job opportunities to the families in construction phase. In this project, the specific households affected are hard to be defined now, the PMO will compare and analyze the ages, physical conditions, employment, household income and other aspects of household members affected with the materials grasped by local civil affairs department, so as to further define the vulnerable groups affected by the Project.

7. Due Diligence Review

A due diligence review has been conducted for the critical issues that would affect the performance of the Project and the findings are as follows:

7.1 Due Diligence of pipe network associated project

Anyang gas distribution station is the start point of “Anyang gas distribution station-Dongye town urban gas pipeline”, it’s natural gas daily capacity can meet the needs of the Project. The EIA approval process has been completed, and it is expected to formally put into operation in March 2017, and can be completed with the progress of the Project.

The gas source of “Lanhua151# valve wells -Yanli county urban gas pipeline” comes from Lanhua151#gas wells, The project is under the approval of the domestic EIA procedures, is expected to put into operation in May 2017, and can be completed with the progress of the Project.

“Anyang gas distribution station-Dongye town urban gas pipeline” will reserved industrial gas for Manghe Town Industrial Park.

7.2 Due Diligence of Existing gas facilities upgrading project

With the promotion of the Shanxi Gasification Program throughout Shanxi, Yangcheng County now has approximately 60 thousand users existing gas user residents, and public service users more than 200 households, the upgrade is mainly This project mainly aims to eliminate hidden dangers, and upgrade the membrane meters and 26800 m pipeline behind the meter for the13411 residents user of existing gas project in Yangcheng County.

8. Comparison of Alternatives

During project development, various alternatives have been screened and compared with technical, economic and environmental criteria. In terms of the environmental assessment of alternatives, the primary objective was to identify and adopt options with the least adverse environmental impacts.

8.1 With and Without Project Scenario

The scenarios of “With” and “Without” Project have been considered and compared. Although the With Project scenario will cause environmental impacts on noise, water, solid
waste, and ecology in the project area, these impacts can be mitigated to an acceptable level through carefully designed mitigation measures. The positive impact to be brought by the scenario of With Project obviously overweight the negative impacts and will bring the replacement of gas for coal, eliminate security risks in existing gas facilities, promote the local economy and living standard of the people, as well as reduce the air pollution and GHG emission. The alternative of ‘with project’ is highly recommended.

8.2 Alternatives of Alignments for gas pipeline network

Two alternative alignments for gas pipeline network were developed for further comparison: Option 1; and Option 2. The route of option 1 is longer, but with less temporary land occupation, less impact on the local ecological environment, close to the Hongshang and Laoquan villages; The route of option 2 is shorter, with more temporary land occupation and far from the above two villages. Option 1 is considered to be the preferred option after comprehensive comparison.

At the section where the Xingshan Temple is located, two alternative alignments have been established and compared. The option 1 to avoid the Xingshan Temple by at least 40 meters is not financially and socially feasible, as it will cause large occupation of farmland and disturbance of ecology. The option 2 that just pass by the temple by 20 meters will only cause minor impact on the temple, and the overall cost is much lower than the option 2. Thus the option 2 is preferred.

8.3 Alternatives of pipeline pressure and material

Two alternatives of pipeline pressure and material were compared for the Anyang distribution station to Dongye town gas pipeline, and option 1 is recommended, which uses 0.8MPa sub-high pressure main pipeline, and the medium pressure branch pipeline behind the surge tanks with PE.

9. Risk Analysis

The environmental risks in construction period mainly refer to accidents in the operation period caused by the application of unqualified pipes and mis-operation in the construction process. Therefore, operation in the construction period shall be performed in strict accordance with construction specifications and construction management shall be strengthened to prevent future accidents.

The environmental risks in operation period mainly refer to fire explosion risks. In the operation period, it is critical to prevent the leakage of gas, eliminate fire sources, establish strict safety management regulations and strengthen management to minimize hazards.

Meanwhile, an emergency preparedness plan have been developed to cope with these potential risks which include the institutional arrangement, mitigation measures and management system, emergency response plan, training plan, public awareness and education plan and monitoring plan.

10. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

10.1 Public Consultation

In accordance with the requirements of the China’s EA Law and the World Bank, two rounds of public consultation were conducted by the EIA team. The first round focused on environmental screening to define public concerns, to assist identification of key environmental issues and to draw public response and comments on the initially developed mitigation measures for the potential adverse impacts identified before EA TOR finalization. The second round was designed to ensure public awareness of the EA effort and final project definition and mitigation by presenting a draft EA report to the public through information
disclosure procedures.

The EIA team conducted two rounds of public consultation on the Xingshan Temple Physical Cultural Resources. During the project preparation period, the representatives from Nayao and Beiyao villages were interviewed on Dec. 22, 2016. The background of the Anyang gas distribution station - Dongye town urban gas pipeline component, potential impacts and mitigation measures taken and the information about Xingshan Temple was communicated. After the EIA report was drafted, Yangcheng County Culture Bureau and the representatives from Nayao and Beiyao villages were interviewed on Feb. 12, 2017. More information about Xingshan Temple was communicated, and Public consultation questionnaire on the Physical Cultural Resources were filled up by the representatives.

Details of the two rounds of public consultation undertaken are presented in Table 10-1.

<table>
<thead>
<tr>
<th>Round</th>
<th>Timing</th>
<th>Participants</th>
<th>Form</th>
<th>Organizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dec 2016</td>
<td>People from sensitive receptors and representatives of relevant departments</td>
<td>Questionnaires, interview and public meeting</td>
<td>Macro research institute, Shanxi provincial DRC Institute of sociology, Shanxi Academy of Social Sciences, Coal Chemistry Institute of China Academy of Sciences</td>
</tr>
<tr>
<td>2</td>
<td>Feb. 2017</td>
<td>People from sensitive receptors and representatives of relevant departments</td>
<td>Questionnaires, interview and public meeting</td>
<td></td>
</tr>
</tbody>
</table>

Through the consultation, it is understood that the public strongly support the Project as they think it would be a good approach to improve the air quality and the Project will benefit the local people. It is also understood that the main concern of the public is the impact of traffic blocking and safety issues, and they hope the project be put into operation as soon as possible, residents can use natural gas as soon as possible. As for the Xingshan Temple Physical Cultural Resources, the local villagers and the management unit agreed to support the construction of gas pipeline, with a good protection of the Xingshan Temple.

In response to the public consultation, the public concerns have been carefully considered in the impact assessment and development of mitigation measures. Construction units agree to improve the procedures as soon as possible for the early completion. As for the Xingshan Temple Physical Cultural Resources, the EIA team explained that the laying construction will take short time of construction and no large scale machinery will be used, the land form will be restore as soon as the construction is over. The impact on Xingshan Temple will be minimum. As a result, the public who raised the concerns are satisfied with the conclusion and mitigation measure.

10.2 Information Disclosure

Information on the Project has been disclosed to the public throughout the public consultation. An advertisement has been placed on Yangcheng Newspaper on Feb.13, 2017 to invite the public to express their concerns about the Project, and to inform the public the place to assess to the draft EIA report. In addition, the draft EIA report and other project related information, including project environmental information, have been placed in the villages to be affected by the project.

In addition to the advertisement on newspaper, the information of the project as well as the draft EIA report is available at the internet address: http://www.sxgxny.com/newslist/163.html
11. ENVIRONMENTAL MANAGEMENT PLAN

11.1 Institutional arrangement

The institutional arrangement and responsibilities of relevant agencies and organizations for environmental management in implementation and operation stages are as follows:

- Guoxin Energy Group will take the ultimate responsibility for environmental protection and management in the project implementation. This organization is the project owner, with the responsibility for supervising the engaging environmental supervisors and monitoring agencies by each County PMO, reporting the EMP implementation to the Bank and conducting the training plan;

- Environmental Supervisors, to be engaged by each County PMO, will be responsible for supervising the day to day environmental management during the construction phase against the contracts and the checklists. Their responsibilities will include response to environmental monitoring reports and developing appropriate mitigation actions. They will also handle any environmental events which may occur during construction;

- Shangxi Provincial PMO is responsible for project coordination and management, including environmental management and environmental supervision of the components, supervision and examination of EMP implementation, and guarantee of incorporation of environmental protection measures in bidding documents and civil works contract.

- Yangcheng county PMO is the project executing unit and responsible for supervising the implementation of the EMP, ensuring the ECOPs and mitigation measures be included in the bidding documents and contracts for contractors, and reporting and filing management during the construction and operation period;

- Shanxi Provincial EPB will be responsible for enforcement of environmental regulations and standards and review of environmental monitoring reports;

- Monitoring Stations, to be engaged by each county PMO, will undertake environmental monitoring of air quality, noise, water quality, and soil erosion, and other impacts on the environment in the project construction and operation; and

- Contractors will be responsible for implementing the mitigation measures in implementation phase.

Detailed institutional arrangement for the construction phase is attached in Annex 1.

A training program will be undertaken during project implementation for management and technical staff from the above organizations. Training course contents will include: environmental regulations, environmental monitoring, mitigation measures, and handling and responses to environmental incidents.

11.2 Mitigation Measures

Mitigation measures for the potential impacts in the design, construction, and operation phases are summarized in Annex 2.
ANNEX 1 INSTITUTIONAL ARRANGEMENT

Shanxi Province EPB
↓
City and County EPBs
↓
Shanxi Provinicial Guoxin Energy Development Group Co., Ltd
↓
PMO of World Bank Financed Shanxi Gas Utilization Project
↓
Yangcheng PMO

External Environmental Management

Supervise execution of EMP

Report execution status of environmental management

Institutional Arrangement for Construction Phase
Institutional Arrangement for Construction Phase

- Shanxi Province EPB
- City and County EPBs
- World Bank
- Shanxi Provincial Guoxin Energy Development Group Co., Ltd
- PMO of World Bank Financed Shanxi Gas Utilization Project
- Yangcheng PMO

External Environmental Management

Internal Environmental Management

Supervise execution of EMP  Report execution status of environmental management
## ANNEX 2 MITIGATION MEASURES

Mitigation measures in the design, construction, and operation phases

<table>
<thead>
<tr>
<th>Issue</th>
<th>Mitigation Measures</th>
<th>Implementing Agency</th>
<th>Supervision Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design phase</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe Network Route Selection</td>
<td><strong>Consider route layout of pipe network comprehensively from relocation quantity, investment, construction difficulty, and cost of land acquisition.</strong></td>
<td>Design institute</td>
<td>World Bank, PIUs</td>
</tr>
</tbody>
</table>
| Acoustic Environment                                  | **1) In design of pipe network routes, consider noise impacts on residents, hospitals and schools during construction, and whenever possible, avoid them reasonably.**  
**2) Arrange surge tanks 200m away from residential quarters.**                                                                                                                                                                                                                                                                                                   | Design institute, EA unit | World Bank, PIUs   |
| Solid waste                                           | **Consider earthwork backfill and balance of spoil earth works in the pipeline network route design.**                                                                                                                                                                                                                                                                                                                      | Design institute    | World Bank, PIUs   |
| Ecological Environment                                | **Whenever possible, lay pipes along roads to reduce destruction of farmland, forest land and grassland.**                                                                                                                                                                                                                                                                                                              | Design institute    | World Bank, PIUs   |
| Cultural Resources                                    | **Investigate whether there are cultural relics and historic sites along pipe network routes in design.**                                                                                                                                                                                                                                                                                                              | Design institute, Cultural relics departments | World Bank, Local cultural relics departments |
| Land Acquisition and Relocation                       | **Whenever possible, reduce land acquisition and relocation in route selection to reduce impacts on the livelihoods of residents.**                                                                                                                                                                                                                                                                                   | Design institute, Social impact assessment agency | World Bank, PIUs   |
| Life of Residents, Traffic and business               | **1) Adopt pipe jacking and directional drilling when crossing roads to reduce impacts on residents’ life and traffic.**  
**2) Make full preparation and conduct detailed investigation of roads and underground utilities along the routes.**  
**3) Communication with residents in advance, to reasonable arrange the construction time for the replacement of gas membrane meter to avoid the impact on local residents caused by the meter replacement, interruption of gas, construction noises.**                                                                                             | Design institute    | World Bank, PIUs   |
<p>| <strong>Construction Phase</strong>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     |                     |</p>
<table>
<thead>
<tr>
<th>Issue</th>
<th>Mitigation Measures</th>
<th>Implementing Agency</th>
<th>Supervision Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acoustic Environment</td>
<td>1) In order to reduce noise of construction equipment, provide regular repair and maintenance to machinery, keep them in sound state, and reduce noise pollution caused by poor operating status of equipment; strengthen regular overhaul and maintenance of power machinery and equipment; 2) Reasonably arrange the construction site to prevent too high noise level at some parts and try to keep high-noise construction equipment far from sensitive areas to minimize noise during the construction period; 3) When the pipeline construction is near residents, cultural relics, schools, hospitals and other sensitive targets, the artificial excavation shall as far be used to mitigate the impact caused by noises and strong vibrations to the minimum level. 4) Set speed limit for roads near noise sensitive areas and reduce or prohibit horn blaring; 5) Whenever possible, avoid simultaneous operations of high-noise equipment; restrict operation hours and prohibit operations during nighttime (22:00-6:00 the next day) to ensure a good environment for local residents to rest well at night. In particular, when passing sensitive points along urban pipeline, implement civilized construction, strictly control working hours of high-noise machinery and try to reduce the impacts of construction noise.</td>
<td>Construction units</td>
<td>PIUs, Local EPBs</td>
</tr>
<tr>
<td>Atmospheric Environment</td>
<td>1) Section construction, spoil at single side of the ditch excavated, if the spoil stays on site for over 1 week, the dust net should be covered. 2) Set special canopy for building materials prone to cause air-borne dust and cover raw materials using dust cloth during construction; 3) Suppress dust by sprinkling during earthworks which are dry and likely to cause dust and try to shorten the time of dusting operations; during windy weather of force 4 or above, stop earth work and cover dust screen; 4) Materials and garbage shall be shipped in closed containers, do not spread them into the air or handle them roughly, and guarantee materials will not be spilled or leaked so as to reduce shedding along the road and re-entrainment from transportation, and transport vehicles shall drive at low speeds in sensitive areas to reduce impacts on the surroundings. 5) Construction workers will rent houses nearby. They shall use bottled gas to cook and may not use coal</td>
<td>Construction units</td>
<td>PIUs, Local EPBs</td>
</tr>
<tr>
<td>Water Environment</td>
<td>1) The pipeline pressure testing water is clean water, after the pipeline pressure test which contains a small amount of suspended matter, there is no other pollution, after settling tank sedimentation treatment, can be used for dust suppression; equipment flushing water can be reused as road sprinkler. 2) When workers rent nearby houses, the hand wash water should be spilled to suppress the dust, other</td>
<td>Construction units</td>
<td>PIUs, Local EPBs</td>
</tr>
</tbody>
</table>
### EXECUTIVE SUMMARY

**Shanxi Gas Utilization Project – Yangcheng Gas Utilization Subproject**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solid waste</strong></td>
<td>small amount of living water be collected into the bucket, after precipitation, use the upper clean water to spray the dust and the bottom dregs be dumped into the trash bin.</td>
</tr>
<tr>
<td></td>
<td>3) The dry excavation would be adopted when the pipe laying goes through the Huoze and Jian River The construction shall be carried out in a dry season. The contraction area shall be strictly controlled, especially for the river crossing section. It is not allowed to refuel the construction machinery or store oil storage tanks in the river way, or clean the construction machinery in the mainstream area or floodplain area of the river. In case of any oil leakage of the mechanical equipment, the scattered oil shall be collected together promptly, and cleared and shipped uniformly after the end of construction. After the construction is completed, the river bed of the construction section shall be restored to the greatest extend; the excess earth after the backfill of pipe ditches can be piled up and compacted on the landside slope of the river crossing section; the relevant provisions on local river management shall be strictly followed.</td>
</tr>
<tr>
<td></td>
<td>4) When building temporary toilets, timely bury the feces; when construction is finished, the feces can be sent to villagers nearby as fertilizer, and the toilets shall be buried after lime treatment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementing Agency</th>
<th>Supervision Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction units</td>
<td>PIUs, Local EPBs</td>
</tr>
</tbody>
</table>
### EXECUTIVE SUMMARY

**Shanxi Gas Utilization Project – Yangcheng Gas Utilization Subproject**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>6)</td>
<td>Timely bury the feces in temporary toilets; when construction is finished, the feces can be sent to villagers nearby as fertilizer, and the toilets shall be buried after lime treatment.</td>
</tr>
</tbody>
</table>

| 1)    | Take full advantage of the natural topography in the project area to minimize the temporary excavation area and the affected vegetation area; reduce the cut-and-fill amount to ensure the self cut-and-fill balance to the greatest extent; adopt the measure of excavation and backfilling in layers to protect the surface mellow soil. The original soil must be backfilled from 500mm above the pipe top elevation, to ensure the ecological restoration as soon as possible after construction. |

| 2)    | Strictly follow the design requirements to carry out the construction in crossing of roads, rivers and other ecologically sensitive areas, enclose the areas easily suffered by water or soil loss to minimize the scope of impact. |

| 3)    | Formulate strict operational standards, establish the ecological environment supervision system for construction period and prohibit the construction vehicles to randomly open construction access roads. |

| 4)    | Adopt section construction as the first construction technology and clear the construction site promptly once the construction of it is completed in order to minimize the temporarily occupied area due to excavation; enclose, cover or spray the earth mass subject to excavation to control soil erosion or rising; enclose the temporarily piled or stored materials with straw bags filled with earth for temporary protection, and cover them with grass curtain in windy or rainy weather to prevent water and soil erosion; the temporary enclosure of the soil mass subject to excavation is focused in the prevention area for construction area; take water and soil conservation measures, such as slope protection, retaining wall, discharge ditches, etc.; adopt different forms of soil preparation based on the slope of lines (the soil preparation includes the leveling of horizontal ditches, fish-scale pits, and cavernous land, etc. The affected area shall be re-ploughed or planted with proper plants based on their adaptability. Temporary prevention measures such as slope protection and temporary discharge ditches are mainly adopted in the temporary protection zones. After the construction is completed, the land reclamation shall be carried out to recover the original topography and vegetation. |

| 5)    | Water and soil conservation measures for river crossing sections: The pipe ditches after backfilling have belonged to affected area and the soil would be easily washed away. Therefore, the water and soil conservation measures such as retaining wall, |

<table>
<thead>
<tr>
<th>Implementing Agency</th>
<th>Supervision Agency</th>
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</thead>
<tbody>
<tr>
<td>Construction units</td>
<td>PIUs, Local EPBs, Water conservancy bureaus</td>
</tr>
</tbody>
</table>
### EXECUTIVE SUMMARY

**Shanxi Gas Utilization Project – Yangcheng Gas Utilization Subproject**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>revetment and slope protection, shall be taken after the pipe laying across rivers, to prevent the water and soil erosion, bank slope collapse and avoid the pipeline bareness and destruction hereof.</td>
</tr>
<tr>
<td></td>
<td>The way of directional drilling shall be adopted when crossing the ditch. Construction shall avoid agricultural irrigation season when crossing the ditch with function of agricultural irrigation, and construction wastes can’t be stacked in the ditch during the construction. Timely restoration shall be made after the construction and use function of the ditch can’t be affected.</td>
</tr>
<tr>
<td></td>
<td>Road crossing section: not to affect the local traffic, the pipe jacking is recommend in construction; the pipeline should be embedded with protective casing, when casing cross the road, the casing should be out of road land 2m. The protective casing use reinforced concrete casing, which meets the requirements of Concrete and reinforced concrete drain pipe (GB/T11836-2009).</td>
</tr>
<tr>
<td></td>
<td>1) Observe local cultural customs, strictly manage construction personnel, and prevent acts conflicting with local cultural customs during construction.</td>
</tr>
<tr>
<td></td>
<td>2) Pay attention to the protection of buildings that reflect local culture along pipeline.</td>
</tr>
<tr>
<td></td>
<td>3) Strictly follow the Management Plan for Material and Cultural Resources during pipeline network construction near Xingshan temple.</td>
</tr>
<tr>
<td></td>
<td>4) The construction shall stop and reporting be made to the cultural relic authority in strict accordance with the Law of the Peoples Republic of China on Protection of Cultural Relics, if cultural relics are found during construction of pipeline. The construction shall not restart until after the cultural relics are fully excavated and the construction permit is obtained.</td>
</tr>
<tr>
<td></td>
<td>5) Pay attention to the protection of buildings that reflect local culture along pipeline.</td>
</tr>
<tr>
<td></td>
<td>6) Construction workers should be trained to have an awareness of protection of relics.</td>
</tr>
<tr>
<td></td>
<td>7) Construction shall be strictly limited within the red line and the area beyond the red line can’t be excavated.</td>
</tr>
<tr>
<td></td>
<td>8) When the pipeline construction is near Xingshan Temple, the small equipment or labor rather than large mechanical equipment shall be used as much as possible to mitigate the impact of noises and strong vibrations caused by large scale excavation machinery.</td>
</tr>
<tr>
<td></td>
<td>9) Construction fence should be set between construction site and Xingshan Temple. Constructors shall not stack earthworks in the enclosed area; moreover, neither be allowed to enter.</td>
</tr>
<tr>
<td></td>
<td>10) The whole construction process shall be monitored by a qualified supervision unit which is responsible for the supervision of construction activities, photographs and issue the supervision report;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultural Resources</th>
<th>Implementing Agency</th>
<th>Supervision Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PIUs, Local cultural relics departments, Nanyao and Beiyao village committee</td>
<td></td>
</tr>
</tbody>
</table>
## EXECUTIVE SUMMARY

### Shanxi Gas Utilization Project – Yangcheng Gas Utilization Subproject

<table>
<thead>
<tr>
<th>Issue</th>
<th>Mitigation Measures</th>
<th>Implementing Agency</th>
<th>Supervision Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moreover, picture of the construction site shall be taken and kept as the evidence of founded or not founded relics. Specific requirement refers to the Physical Cultural Resources Management Plan.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Acquisition and Relocation</td>
<td>Land acquisition for pipe network is temporary. A feedback mechanism for the construction period is established to collect opinions of people affected.</td>
<td>PIUs</td>
<td>World Bank, Local governments</td>
</tr>
</tbody>
</table>
| Life of Residents             | 1) Notice boards shall be set up at construction sites to inform the public of the construction content and construction period, ask for public understanding of inconvenience caused by the construction, and indicate the contact person and complaint hotline.  
   2) Because of large power consumption during construction, the construction units shall contact relevant departments in advance to determine pipeline connection scheme, get ready for connection of temporary pipeline, and in sections where space is not enough, transform the utility lines first to prevent temporary water and electricity failure and impacts on normal power and water supply to residents, industrial & mining enterprises and government units along the lines.  
   3) The hanging height and direction of construction lamps shall not affect the rest of residents at night.  
   4) Pipe site selection shall be reasonably designed far from schools, if possible, and the pipes shall be neatly piled and taken care of by specially designated personnel.  
   5) Reasonable arrangement of construction time for the replacement of gas membrane meter to avoid the impact on local residents like the interruption of gas, construction noises. | Construction units | World Bank, Local EPBs |
| Traffic Safety                | 1) In order to minimize impacts of the project construction on the life of urban residents and urban traffic, make unified shunt planning for the routes of vehicles in urban road traffic to prevent traffic jam; when necessary, cooperate with public security and communications administration authorities to ensure smoothness and normal operation of urban traffic, and issue a notice to reassure the public in advance by radio, TV and newspaper  
   2) Stress safety rules to drivers;  
   3) Drivers shall improve their driving skills and must hold driving license;  
   4) Restrict driving time and work out a driver shift schedule to prevent the drivers from being too tired; Avoid dangerous roads and driving in dangerous periods of the day to reduce the possibility of accidents;  
   5) Regularly maintain vehicles and use parts authorized by manufacturers to avoid serious accidents due to equipment failure or premature failure of parts;  
   6) Pedestrians and vehicles should avoid using the road at the same time;  
   7) Cooperate with local communities and competent authorities to improve road signs, increase visibility. | Construction units | PIUs, Local traffic safety department, World Bank |
<table>
<thead>
<tr>
<th>Issue</th>
<th>Mitigation Measures</th>
<th>Implementing Agency</th>
<th>Supervision Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Safety</td>
<td>and enhance overall road safety, especially roads near schools and other areas with children. Carry out traffic education and pedestrian safety education jointly with local communities (such as publicity activities at schools); 8) Coordinate with emergency handling personnel to ensure proper first aid treatment when accidents happen; 9) Whenever possible, use materials which can be locally purchased to shorten transportation distance; build relevant facilities (such as workers’ dormitory) close to project sites and carry workers using buses so as not to increase traffic flow; 10) Take traffic safety control measures and use road signs and signalmen to warn people and vehicles of dangers.</td>
<td>Construction units</td>
<td>PIUs, Local traffic safety department</td>
</tr>
<tr>
<td>OHS</td>
<td>Use baffles in welding areas and offer welding goggles and/or masks to welding workers.</td>
<td>Construction units</td>
<td>PIUs, Local EPBs</td>
</tr>
<tr>
<td>Operation Phase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acoustic Environment</td>
<td>Arrange surge tanks 200m away from residential quarters.</td>
<td>PIUs</td>
<td>Local EPBs</td>
</tr>
<tr>
<td>Atmospheric Environment</td>
<td>Strengthen engineering quality control, pipeline inspection, pipe network inspection and publicity of natural gas safety knowledge, and cooperate with competent gas authority to strengthen law enforcement and emergency drills to prevent gas leakage.</td>
<td>PIUs</td>
<td>Local EPBs</td>
</tr>
<tr>
<td>Water Environment</td>
<td>Pipeline inspection personnel only, use existing office facilities, domestic waste water collected and disposed by the city pipe network system, no impact on surface water</td>
<td>PIUs</td>
<td>Local EPBs</td>
</tr>
<tr>
<td>Cumulative Risk Impact</td>
<td>1) Create gas supply safety assurance system, establish early warning and emergency preparedness mechanisms and use information technology to build management, dispatching and warning systems for pipeline network across the province to address potential gas related disasters and gas supply accidents and ensure gas supply safety. 2) The increase of gas load sets higher requirements for gas transmission and distribution systems. To ensure near-, mid- and long-term gas demand of pipeline network, it is suggested that the implementing unit further improve data and verify data accuracy to ensure that verification of the network’s engineering situation could better reflect weaknesses of the network and to guide network planning and construction. 3) Before laying of gas pipeline, the layout shall be optimized throughout the province to reach a balance in gas supply; gas emergency preparedness facilities shall also be taken into consideration. 4) Rapid increase of gas load has resulted in more problems with the existing emergency dispatching system. To ensure safe and steady operation of the network, it is necessary to complete upgrading of the system and improve emergency handling capacity at an earlier date and accelerate the planning and construction of an emergency handling and dispatching center.</td>
<td>PIUs</td>
<td>PIUs, Local EPBs</td>
</tr>
<tr>
<td>Issue</td>
<td>Mitigation Measures</td>
<td></td>
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<tr>
<td>5)</td>
<td>Disseminate knowledge about safe use of gas to residents along the pipeline, improve safety problems reporting and identification system and ensure rapid response to and addressing of problems such as pipeline leakage to prevent the expansion of accidents.</td>
<td>Implementing Agency</td>
<td>Supervision Agency</td>
</tr>
</tbody>
</table>
ANNEX 3  GEOGRAPHICAL LOCATION AND NOISE MONITORING POINTS OF YANGCHENG GAS UTILIZATION SUB-PROJECT

Geographical Location and Noise Monitoring Points of Yangcheng Gas Utilization Sub-project