China E1886 v. 4
Shanxi Coalbed Methane Development and Utilization Project

Environmental Impact Assessment

(Part III: Pipeline Project from Central Gas Treatment Station to LNG Plant)

April 10, 2008

Public Disclosure Authorized

Shanxi Energy CBM Investment Holding Co., Ltd.

Environmental Impact Statement

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Executive Summary

The proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectof Shanxi Energy CMB Investment Controlling Co., Ltd. (Part III: Pipeline Project from Central Gas Treatment Station to LNG Plant), located in Duanshi Town, Qinshui County, Jincheng Municipality, covers a pipeline length of 1434m.

The pipeline is laid out along the mountain ridge, and the elevation difference is about 90m. It is considered to lay the gas pipeline along the waste land and farmland. At general locations, ditch will be excavated to lay and bury the pipes directly, and the depth of covering earth up the pipe is 1.0-1.2m. The pipeline passes through 1 highway, and the passing length is 10m. It also crosses 1 river, and the crossing length is 120m. Ditch will be excavated to lay and bury the pipes directly in the river, and the ditch depth is not less than 1.0m from the outer covering layer of the pipe to the eroding line, and it should be guaranteed that the minimum covering earth of the pipeline shall not be less than 2m; if there is no eroding data about the crossed river, it should be guaranteed that the pipeline should be buried not less than 2m below the riverbed earth. The banks on both sides of the river or canal should be protected with the method of rubble slope protection.

The pipeline is located in Jinfeng Village, Duanshi Town, Qinshui County, Jincheng Municipality. The work area is surrounded by mountains, and its landform is characterized with low mountains and hills. The project area belongs to monsoon climate of medium latitudes, Yellow River Region and Qin River System, and the major river in this area is Guxian River, a tributary of Qin River. The ambient air, surface water, ground water and ambient sound in this area is of good quality. The pipeline layout conforms to *Jincheng Municipality Town System Planning*, the land use policies stipulated in such laws and regulations as *Basic Farmland Protection Regulations* and the requirements of environmental function division. Based on analysis of the environmental status quo and the environmental impact, the project site selection will not cause fundamental change to the environmental quality of this area, and the environment can basically maintain its quality status quo. In terms of environmental protection, the pipeline route is feasible.

The construction of pipeline from Central Gas Treatment Station of the Proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectto

LNG Plant will inevitably cause certain adverse impact upon the ecological environment, the surface water environment, the ground water environment, the ambient air and the ambient sound, but the project construction will play a positive role in promoting local socioeconomic development, improving the quality of local people's lives. As long as simultaneous design, construction and use is earnestly carried out in the process of project implementation and production and the ecological restoration and pollution prevention and control measures proposed in the EIA are taken, cleaner production and compliant discharge will be realized, the gross control target met, the adverse impact of the project minimized and the economic benefits, social benefits and environmental benefits organically combined to realize sustainable social and environmental development.

From the perspective of environmental protection, the construction of pipeline from Central Gas Treatment Station to the LNG Plant under the Proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectof Shanxi Energy CBM Investment Controlling Co., Ltd. is feasible.

1. Policy, Legal and Administration Framework

The pipeline from the Central Gas Treatment Station to LNG Plant is located in the same area as the LNG Plant, and its policy, legal and management framework is the same as the Section on $4\times25\times10^4Nm^3/d$ CBM Liquification Project in Part II.

2 Project Analysis

2.1 Project Overview

Name of Project: CBM Development and Utilization Demonstration Project with Proposed WB Financing, of Shanxi Energy CBM Investment Controlling Co., Ltd. (Part III: Pipeline Project from Central Gas Treatment Station to LNG Plant).

Nature of construction: greenfield

Scale: pipeline DN200, with a length of 1434m.

Project owner: Shanxi Energy CBM Investment Holding Co., Ltd.

Construction Site: Duanshi Town, Qinshui County, Jincheng Municipality

Investment: This part of investment is listed in $4\times25\times10^4Nm^3/d$ CBM Liquification Project.

2.2 Pipeline Route

The pipeline from the Central Gas Treatment Station to the LNG Plant is laid out along the mountain ridge, and the elevation difference is about 90m. It is considered to lay the gas pipeline along the waste land and farmland and minimize crossing with rivers and roads. The total length of this pipeline is about 1434m.

See graphic 2-2-1 for the overall route of the gas pipeline.

2.3. Pipeline Layout

2.3.1 Principle of Pipeline Network Layout

(1) The route of pipeline should conform to the requirements of city master planning and should be considered in a unified manner and by combining far and near factors.

(2) Selecting favorable landform and trying to avoid the locations difficult for construction and with bad engineering geology (such as soft soil and waterlogging, area with shallow water, subsidence area, etc.). Avoiding or reducing the urban area with dense population or buildings in order to reduce the work of removal. Minimizing crossing with other pipelines and man-made obstacles.

(3) Trying to avoid the town planning area, development area, industrial and mining area as well as cash crops area such as fruit trees area, vegetables area, plastic tents area, etc. and important farm capital construction facilities of the cities and counties along the pipeline.

(4) Trying to base on and utilize the existing roads to facilitate pipe transportation, construction and production & maintenance management.

2.3.2 Safety Spacing of Pipes

The routes should be selected on the basis of area grade division pursuant to *Town Gas Design Code*. The routing of pipelines in this project mainly covers Grade I and Grade II areas as well as a small Grade III area. The horizontal clear distance between pipeline and buildings or structures or between neighboring pipelines should strictly comply with the requirements pursuant to GB50028 *Town Gas Design Code*.

2.3.3 Pipeline Laying

In view of the landform, geomorphology, engineering geology, hydrogeology, climatic conditions, etc., the method of ditch excavation and direct laying will be adopted in this project for general locations. The depth of covering earth up the pipe is 1.0-1.2m.

The pipeline crosses 1 highway, and the crossing length is 10m. It also crosses 1 river, and the crossing length is 120m. Ditch will be excavated to lay and bury the pipes directly in the river, and the ditch depth is not less than 1.0m from the outer covering layer of the pipe to the eroding line, and it should be guaranteed that the minimum covering earth of the pipeline shall not be less than 2m; if there is no eroding data about the crossed river, it should be guaranteed that the pipeline should be buried not less than 2m below the riverbed earth. The banks on both sides of the river or canal should be protected with the method of rubble slope protection.

2.3.4 Pipeline Crossing Works

2.3.4.1 Crossing River

This project crosses Guxian River. The river is basically an ephemeral stream, with a small flow in normal times except the flood season. The pipeline crosses the river once, and the crossing length is 120m.

The form of river diversion by cofferdam and ditch excavation for burying and laying pipes will be adopted at river crossing site. The pipeline will be buried under the stable earth layer of the river bed and bank slope, the depth of pipe covering earth under the stable earth layer is preliminarily defined as not less than 2m. Concrete balancing weight is used to stabilize the pipes in excavation of river-crossing ditch. The balancing weight will be evenly distributed along the whole crossing pipeline.

2.3.4.2 Crossing Highway

This project crosses Grade II highway once, and pipe jacking crossing method will be used. The crossing method of ditch excavation and direct burial will be used in crossing township highway.

2.3.4.3 Crossing Other Underground Pipeline and Cable

When the pipeline crosses other various types of pipelines, it should cross them from underneath in principle, and the clear distance between them should not be less than 0.3m. When the pipeline crosses various types of cables, it must cross them from underneath, and the clear distance between them should not be less than 0.5m. Protective measures should be taken during construction.

2.3.5 Main Pipes

See Table 2-3-1 for the main pipes.

Table 2-3-1 List of Pipes

Outer diameter	Wall thickness (mm)	Material	Length (km)
ϕ406.4	7.9	L245	1.434

3. Environment Status Quo

The environmental status quo is the same as that of $4\times25\times10^4 Nm^3/d$ Coalbed Methane (CBM) liquification project; both projects are located in the same area, so they have the same environmental status quo.

4. Environmental Impact Assessment and Mitigation Measures

4.1. Environmental Impact Assessment and Mitigation Measures during Construction Period

During the project construction period, the component with great impact upon the environment is mainly the laying of gas pipeline; the transportation and stacking of construction materials in the course of construction may also exert certain impact upon the ambient air, the ambient sound and ecological environment. When the construction is completed, its impact will no longer occur, and its impact upon local ecological environment will also be removed gradually.

4.1.1 Analysis of Impact upon Ecological Environmental

4.1.1.1 Analysis of Impact upon Natural Ecology

(1) Analysis of Impact upon Ecological Components and Bio-diversity

It is learned from survey on the status quo of the eco-environment along the proposed gas pipeline, the bio-communities within the area along the pipeline mainly consist of common species and dispersed species (Bothriochloa ischaemum, green foxtail, salsola, Artemisia lavandulaefolia, Artemisia stolonifera, Artemisia annua, etc.).

Of the different periods of gas pipeline construction, the construction period has the greatest impact the eco-environment, but the adverse impact is temporary. This is mainly represented by the obvious damage to the surface vegetation and water system on the construction site during earth surface excavation and dumped waste material along the river, and the temporary sites such as earth taking and dumping sites along the pipeline and the construction site also have the problem of disrupting the eco-environment.

(2) Analysis of Impact upon Ecological Pattern

Analyzed from the utilization state of the land along the proposed gas pipeline, the assessment area mainly consists of farmland and wasteland. Farmland is the background matrix constituting the structure of the landscape along the pipeline and at the same time determines the basic function and dynamic trend of the landscape.

The construction design requires construction of new roads or utilization of the existing roads as access roads for construction; in the road section under construction,

farmland water conservancy facilities will also be tied up and agricultural traffic will be affected. Therefore, the construction period has a large impact upon the agro-production pattern, and such impact will be very obvious especially in the directly affected area. In view of this, taking such measures as restoration of vegetation and farmland rehabilitation for temporary land occupation, taking necessary temporary emergency measures for irrigation and agricultural traffic and implementing such measures in the whole process of construction are the essential way of mitigating or avoiding the adverse impact upon the ecological pattern along the pipeline.

(3) Analysis of Impact upon Ecosystem Functions

The basic function of eco-system is conversion of substance and fixation of energy, specifically represented by production function, regulation function, protection function, etc. of eco-system.

The most important production function of the ecosystem in the area along the pipeline is agro-production function. On the condition of taking necessary temporary measures and strengthening management during the construction period, no obvious impact will be exerted on the agricultural pattern and components, i.e., no adverse impact will be exerted on the agro-ecological structure. As the ecological functions are subject to the structure of ecosystem, no obvious adverse impact will be exerted on the agro-production function of the area along the pipeline.

The proposed pipeline project will occupy a land area of 0.57hm^2 on a temporary basis, of which, the area of farmland is 0.2hm^2, and the area of low coverage grassland is 0.37hm^2. This project will have impact on the wasteland (mainly low coverage grassland) and farmland.

The vegetation biomass loss caused by project land occupation is calculated according to the following equation. See Table 4-1-2 for the results of calculation.

$$Closs=\sum Qi \cdot Si$$

In the equation, C_{loss} – value of total biomass loss, kg;

Qi – yielding capacity of the ith species of vegetation organism, kg / mu;

Si – land area of the ith species of vegetation occupied, mu.

Table 4-1-2: Table of Estimated Vegetation Biomass Loss Caused by Land

Occupation of Proposed Project

Type of vegetation	Covered land area (hm^2)	Unit area biomass（$g/m^2 \cdot a$）	Amount of loss（t）
Farmland	0.2	650	1.30
Low coverage grassland	0.37	500	1.85
Total	0.57	—	3.15

It can be seen from the above table that the vegetation biomass loss caused by the land occupation of the proposed project is about 3.15t/a, of which, the biomass loss caused by occupation of farmland and wasteland is 1.30t and 1.85t respectively.

The regulation and protection function of the ecosystem in this area is determined by the natural vegetation conditions in this area, and the impact exerted during the construction period is evidently greater than that during the operation period.

(4) Analysis of Impact upon Eco-environment along the Pipeline

The pipeline of this project has a total length of 1434m. The impact of pipeline construction on the eco-environment is mainly represented by damage to original vegetation, soil perturbation, impact on the habitat of wild animals and soil organisms, etc., caused by temporary land occupation of the project.

In the course of construction, efforts should be made to minimize damage to the vegetation surrounding the pipeline, reduce rolling compaction of mechanical transportation and perturbation of a certain degree on the construction site and its surrounding vegetation caused by trampling of construction workers.

Proactive and effective measures should be taken to minimize the impact of the project upon the local ecological environment and protect and utilize the original trees and shrubs. The principle of “proper trees at proper places” should be insisted on to conduct vegetation planting and greening project scientifically, select plant species suitable for planting based on the planting conditions and pay attention to collocation of grass, shrub, arbor species and combination of short-, medium- and long-term benefits. Bio-measures and engineering measures should be combined based on local conditions, to make the forestation and greening applicable, cost-cost-effective and attractive and make them play the role of protecting and beautifying the environment.

The implementation of the above measures during the different periods of construction along the pipeline can not only eliminate or minimize the adverse impact

of project construction upon the eco-environment but also improve the eco-environment of the project area and its surrounding area.

(5) Analysis of Impact of Construction Access Road upon Eco-environment

The construction access roads of this project, roughly along the existing roads, have a short mileage and their land occupation is little and temporary. After the completion of the project, all the land can be reclaimed, and therefore, the land occupation of construction access roads has a relatively small impact upon agro-production.

4.1.2.1 Analysis of Impact upon Agricultural Ecology

[1] Statistics of Land Requisition of the Proposed Project

The total land and vegetation area occupied by the pipeline project is 0.57hm^2, of which, the farmland area is 0.2hm^2, so project construction has a considerable impact upon the farmland eco-system.

[2] Analysis of Impact of Project Land Occupation upon Agricultural Eco-environment

The impact of temporary land occupation of this project upon the local agricultural eco-environment is temporary. In view of the actual conditions of agro-production in the area along the pipeline, attention should be paid to the following issues in the process of project construction:

(1) The land occupation of the proposed pipeline does not exert much impact upon the agro-production along the pipeline in terms of gross impact upon the affected area, but a good job should still be done in compensation for land requisition and the compensation funds should be made available according to relevant standards.

(2) Attention should be paid to rehabilitation of the temporarily occupied production land and efforts should be made to restore such land into farmland, woodland and garden plot based on the characteristics of the surrounding environment to reduce the loss caused by land occupation of the project.

(3) The farmland loss is assumed by the individual townships and residents along the pipeline, but such impact upon individual residents or small collectives is temporary. However, this project construction should minimize farmland occupation and reduce impact upon the local agricultural eco-environment.

(4) The construction site of the proposed pipeline should be greened in time to compensate for the impact of this project on the local forestry eco-environment.

[3] Economic Loss Estimates of Impact upon Agriculture

The impact of construction of the pipeline and the liquification plant upon agro-production can be divided into indirect impact and direct impact. The indirect impact of pipeline construction may play a positive role of promoting economic development, but it is difficult to estimate the degree of its impact; its direct impact may be measured by estimating loss in agro- and forestry production through calculation of reduction in production area. Direct economic loss may be estimated according to the following formula:

Economic loss = reduced production area × unit area yield × unit market price

= unit market price × reduced production area × total yield / total production area

= production area loss rate × total yield × unit market price

= production area loss rate × total yield value

Agricultural loss caused by land occupation of the pipeline project is temporary and it is proposed to estimate the loss on the basis of 3 years (two-year rehabilitation period and 1-year construction period). The agricultural and forestry economic losses caused by project land occupation is estimated by application of the above direction economic loss estimation formula and on the basis of the land utilization status quo of the assessment area in 2006, statistics of project land occupation and the unit area output value of various types of land in the assessment area. See Table 4-1-3 for the results of estimates.

Table 4-1-3: Estimates if Impact upon Rural Economy of the Area along the Pipeline

Item	Occupied area (hm^2)	Unit area Yearly output value (yuan /mu)	Yearly economic loss (in RMB10,000)
Temporary land occupation	0.2	16380	0.33

It can be seen from the estimation results that the economic loss caused by temporary land occupation of the project to the assessment area along the pipeline is about RMB3,300; the economic loss caused by temporary land occupation is about

RMB10,000 for three years (1 year for construction and 2 years for reclamation and rehabilitation).

4.1.2 Analysis of Impact upon Ambient Air and Mitigation Measures

The impact upon ambient air during the construction period is mainly represented by: impact of construction dust emission and secondary dust emission on the environment; damage by pipe laying to the surface vegetation and farmland along the pipeline and exposure of surface soil, which will cause dust emissions upon wind blowing; secondary dust emissions caused by dust-producing construction materials such as sand, cement and lime if they are piled up at random and without any shield. The construction will increase TSP concentration in the ambient air in partial area.

Mitigation measures: such measures as covering and sprinkling and dust damping should be adopted during windy season to reduce dust emissions.

4.1.3 Analysis of Impact upon Water Environment and Mitigation Measures

(1) Analysis of Impact of Construction Form on the Water Environment

The form of river diversion by cofferdam and ditch excavation for burying and laying pipes will be adopted in the project for crossing river, and the construction work should generally be done in low water season. The pipeline will be buried under the stable earth layer of the river bed and bank slope, the depth of pipe covering earth under the stable earth layer is preliminarily defined as not less than 2m. Concrete balancing weight is used to stabilize the pipes in excavation of river-crossing ditch. The balancing weight will be evenly distributed along the whole crossing pipeline.

The river-crossing operation of the pipeline would exert short-term impact upon the water quality of the river and the sediment charge in water would increase; improper disposal of surplus earth and stone work after ditch backfilling may cause silting-up of river channel and soil erosion; the operation of river diversion by cofferdam may exert certain impact upon aquatic organism and may even exert certain impact upon the surrounding environment and cause soil erosion or block the river channel if handled improperly. It is suggested in the EIA that the surplus earth and stone work

be handled or piled up properly on suitable sites nearby. As long as management is strengthened and effective water and soil conservancy measures are adopted, the construction will not exert much impact upon the river.

In short, proper operation schemes should be adopted in such construction activities as ditch excavation and crossing in the river channel so as to minimize the possible impact upon the surface water environment. The above construction activities may exert certain impact upon SS, PH, and petroleum in the water, but the impact is short-lived and will disappear automatically with the completion of the construction. In addition, the relevant stipulations in *Shanxi Provincial River Channel Management Regulations* should be implemented strictly. Efforts should be made to avoid damaging the existing hydrotechnical safety facilities such as dyke and violating other requirements.

(2) Impact of Construction Materials Transportation and Piling upon the Water Body Environment

The dust emissions caused by transportation of construction materials and the fine dust caused by construction will exert certain impact upon the surface water body. In addition, some construction materials such asphalt, oil, chemicals, if they are not kept properly at their piling places and are brought into water body by rain wash, will cause pollution to the water environment.

In the construction, therefore, protection and management measures should be strengthened according to the characteristics of different construction materials to minimize their impact upon the water environment.

(3) Impact of Domestic Sewage from Camp Buildings upon Water Environment

The water pollution sources during the construction period of this project is mainly domestic sewage of construction workers, and the major pollutants in the sewage include BOD, SS and COD. The domestic sewage of construction workers is used for road sprinkling and dust damping; as it has small discharge volume and is not discharged into surface water body, it has very little impact upon the surface water body.

4.1.4 Analysis of Noise Impact and Mitigation Measures

The main sources of noise during the construction period include noise of various types of mechanical equipment on the construction site and traffic noise caused by transportation of materials.

The construction period of this part of the project is earthwork operation period, and the large scale equipment used mainly includes excavator, crane, etc. As the construction period generally involves outdoor work, the noise produced by these construction machines will exert certain impact upon the ambient sound environment. The noise level of various types of construction equipment during the construction process is between 85-100dB(A). The sound levels of noise source at different distances on the construction site are provided based on comparison with the actual situation of other construction sites. See Table 4-1-4.

Table 4-1-4: Noise Level of Main Noise Sources at Different Distances during the Construction Period (unit: dB(A))

Construction period	Main noise source	Sound level at sound source	Noise level at different distance					
			40m	60m	80m	100m	200m	400m
Earth and stone work	Bulldozer, excavator and transportation vehicles	92～102	60～72	56～66	54～64	52～62	46～56	40～50
foundation	Pile driver	112～122	80～90	76～86	74～84	72～82	66～76	60～70
Structure	Concrete mixer	92～102	60～70	56～66	54～64	52～62	46～56	40～50
	Concrete vibratory machine	87～97	55～65	51～61	59～69	47～57	41～51	35～45
Installation	Welder, electric drill, electric hammer and multipurpose carpenter's plane	77～87	45～51	41～51	39～49	37～47	31～41	25～35

In accordance with the stipulations of *Limits on Noise at Boundary of Construction Sites*, the noise limit at boundary of the construction site is 70-75dB(A) during daytime and 55dB(A) at night. At the foundation stage, night operation of pile driver is prohibited. It can be seen from the above table that the impact distance is within about 60m during daytime and the impact distance except for pile driver is about 210m at night. Therefore, the boundary of construction site of this project can meet the requirements of noise limit standards at boundary of construction sites. Construction near Jinfeng Section at night would affect the normal rest of residents.

Mitigation measures: Construction near Jinfeng Section is prohibited at night.

4.1.5 Analysis of Impact of Solid Wastes upon the Environment and Mitigation Measures

The pipeline of this project has a total length of 1434m, and the dumped earthwork of the pipeline project is about 0.2m^3/m. The waste earthwork produced by the pipeline project is used to fill in the low-lying area around the pipeline and then grass seeds will be planted to restore the vegetation and prevent soil erosion.

Domestic garbage will be collected, centralized and transported to Duanshi Town Domestic Garbage Disposal Plant for disposal.

4.2 Analysis of Impact on Environment and Mitigation Measures during Operation Period

4.2.1 Analysis of Impact on Ecological Environment and Mitigation Measures

At normal operation state, the area where pipelines are laid is under normal conditions, surface vegetation and farm crops growing are normal, animal corridor cut by the project during construction period is restored as well. According to the data, the first gas transmission pipeline in Northern China has been running for more than 20 years, no unhealthy tendency is discovered about the surface natural ecological environment and agricultural eco-environment in the area with CBM pipelines laid underground, surface vegetation and farm crops growing in the area with pipelines laid underground make no obvious difference from the area without that, which is a proof that pipeline transmission is a clean transmission mode with slightest impact on

ecological environment and smallest scope of impact. Therefore, it can be considered that pipeline produces no unfavorable influence on ecological environment during the regular gas transmission process.

4.2.2 Analysis of Impact on Water Environment and Mitigation Measures

No pollutants such as effluent will be discharged during pipeline operation period. It is a clean transmission mode and produces no impact on water environment.

4.2.3 Analysis of Impact on Ambient Sound and Mitigation Measures

No noise will be produced during pipeline operation period and no impact will be exerted upon ambient sound.

4.2.4 Analysis of Impact on Ambient Air and Mitigation Measures

No gas emissions will be produced during pipeline operation period and no impact will be exerted on ambient air.

4.2.5 Analysis of Impact of Solid Wastes on Environment and Mitigation Measures

No solid wastes will be produced during pipeline operation period and no impact will be exerted on environment.

4.3 Analysis and Assessment of Environmental Impact during Servicing / Maintenance Period

The main environmental impact during servicing / maintenance period lies in sludge produced during pigging operation (with ferric oxide as principle component). Ferric oxide is a general industrial solid waste, and the volume of sludge produced in the project is about 2kg, which is to be transported by Environment and Sanitation

Sections to specified industrial solid waste disposal sites for disposal. Pipe-line gas transmission is a clean mode, and moreover, the principle component of CBM is methane and the principle waste produced during the servicing / maintenance period is pigging sludge; therefore, there is no environmental impact during this period.

5. Alternative Analysis

5.1 Pipeline Layout Scheme Comparison & Selection

5.1.1 Pipeline Layout Schemes

Scheme 1: Pipeline passes between Shuiquanze and Yanggelang and has a length of 1.434km.

Scheme 2: Pipeline is to be laid from the western Jinfeng Village and has a length of 5km.

5.1.2 Comparison of Different Schemes and Selection

See Table 5-1-1 for comparisons on different schemes from land occupation, crossing project, length of pipeline, etc. See graphic 5-1-1 for the pipeline layout in different schemes.

Table 5-1-1: Comparison on Pipeline Schemes

Item	Scheme 1	Scheme 2
Length	1.434km	5km
Temporary land occupation	0.57hm^2	2.0hm^2
Highway crossing	Crossing highway at 1 site, with a crossing length of 10m	
River crossing	Crossing river at 1 site, with a crossing length of 120m	
Scheme recommended	Scheme 1	

In terms of pipeline length, Scheme 2 involves much longer length than that Scheme 1 and much greater investment than Scheme 1; the land area occupied by Scheme 2 is 3.5 times that by Scheme 1; both schemes have the same river and highway crossing length and frequency. From the perspective of environmental protection, Scheme 1 is recommended.

6. Environmental Management Plan

The environmental management organization, assessment of the environmental management capability of management organizations and environmental management training plan are the same as those of the Liquification Plant and are therefore omitted here.

6.1. Environmental Management Plan

6.1.1 Environmental Monitoring Plan

6.1.1.1 Environmental Monitoring Plan during the Planning/Design Period

Environmental management during the planning / design period covers survey and planning of environment functional delineation in the area, survey of the scenic spots, natural reserves and historical and cultural relics in the area. See Table 6-4-1 for the Environmental Management Plan during the Planning / Design Period.

The environmental management expense needed during the planning / design period is about RMB10,000.

6.1.1.2 Environmental Monitoring Plan during the Construction Period

Environmental management during the construction period mainly covers recording of degree of environmental impact during the construction period, settlement of appeals to higher authorities for help against the environmental problems during the construction period and modification and supplementation of deficiencies of environmental impact assessment based on actually produced environmental impact.

See Table 6-4-2 for the Environmental Monitoring Plan during the Construction Period.

6.1.1.3 Environmental Monitoring Plan during the Operation Period

See Table 6-1-3 for the Environmental Monitoring Plan during the Operation Period.

6.1.1.4 Environmental Monitoring Plan during the Maintenance Period

See Table 6-4-4 for the Environmental Monitoring Plan during the Maintenance Period.

Table 6-4-1 Planning/Design

N.A

Table 6-4-2 Construction

Item	Environmental Concerns/Issues/Impacts	Management/Mitigation Measures	Monitoring			Costs ('0000RMB
			Monitoring Indicators	Timing/Frequency/Duration	Institutional Responsibility	
Pipeline between CTU and the LNG Plant(1434m)	1.1 Impact on soil	1.1 to strictly control construction boundary 1.2 To excavate soils by layers and pile them in distinct zones and backfill soils as per their original layers. 1.3 To restore vegetation after construction.	1.1.1 to check construction boundary; 1.1.2 To check if excavation, piling, and backfill of soil is in compliance with requirements. 1.13 To check if the re-vegetation is completed.	During construction process; Before the commissioning of the pipeline.	Contractors Supervising consultant	Included in contractors and consultant fee.
	2. Dust at the construction sites	2.1. Water spray at construction sites and cover of construction material to prevent dust.	2.1.1 To inspect if there is dust occurred at construction sites.	During dry and windy days		
	3. Noise	3.1 Construction must be prohibited at night once the construction site is within 210 m from villages.	3.1.1 To inspect if there is construction at night.	During construction process		
	4. Impact on vegetation	4.1 to strictly control construction boundary; 4.2 to timely restore vegetation after construction is completed.	4.1.1To inspect construction boundary; 4.1.2 To check if the vegetation is restored to designated level	During construction process; 1-3 years after construction	Contractors Supervising consultant SECBMIH	

Table 6-4-3 Operation

N.A.

Table 6-4-4 Maintenance

Item	Environmental Concerns/Issues/Impacts	Management/Mitigation Measures	Monitoring			Costs ('0000RMB
			Monitoring Indicators	Timing/Frequency/Duration	Institutional Responsibility	
Pipeline between CTU and the LNG Plant(1434m)	1. methane leakage	2..1 to implement measures listed in the Safety Management Plan	1.2.1 To monitor methane concentration in the atmosphere.	Continuous monitoring during the maintenance period	SECBMIH	TBD
	2. solid waste removed from the pigging process	2.1. Solid waste to be collected and sent to Jincheng Solid Waste Disposal Station for landfill.	2.1.1 to check if the solid waste has been sent to the Jincheng Solid Waste Disposal Station	Before the maintenance is completed	SECBMIH	TBD

6.1.2 Environmental Monitoring Procedure

The construction unit shall, according to the engineering characteristics of the construction project and by combining the operation and management experience of similar projects with the requirements of environmental management system (ISO14001), draw out the environmental monitoring procedure during the construction period and the operation period. The environmental monitoring procedure shall cover the following components:

(1) Setting up dedicated environmental management body and making fund and staff available.

(2) Formulating environmental management system, environmental monitoring scheme, training plan and pollution control measures for the proposed construction project, according to the construction plan and the specific contents of this report.

(3) Organizing training according to the training plan to ensure that all the staff members meet the requirements on environmental awareness and operation capability, including training on skills of carrying out the above pollution prevention and control measures.

(4) Making clear division of work, assigning responsibilities to individuals, conducting daily management (including on-site supervision and check) according to plan and monitoring the environmental impact of the proposed project.

(5) Establishing sound information transmission channels, especially an effective response channel for the possible complaints from residents.

(6) Organizing relevant monitoring units to conduct regular monitoring according to monitoring plan and report the monitoring results to relevant authorities in time.

(7) Correcting in time the problems of illegal environmental activity and harassment to people recurring during the construction period and the operation period, formulating preventive measures and modifying relevant management methods if necessary to meet the needs of specific conditions.

(8) Doing a good job in management of important records in the process of environmental management such as monitoring report, resident complaints, ticket of rectification and control within a specified period, etc.

(9) The environmental management organ shall review the implementation of the work regularly and prepare *Environmental Monitoring Report* of the proposed project for submission to relevant authorities. Making continuous improvement on relevant parts of the rectification, management and monitoring procedures according to the review opinions of the environment administrative authority on the Environmental Monitoring Report of the proposed project and based on the possible complaints on environmental problems, so as to better complete the environmental management work.

6.1.4 Environmental Monitoring Report

(1) Environmental Monitoring Plan during the Construction Period

In accordance with the environmental management laws and regulations on construction projects in China and the business policy requirements of the World Bank, the environmental monitoring organ shall prepare *Environmental Monitoring Report by Stage* so as to convince the environmental protection authorities that all the environmental protection measures have been carried out as required in the approved environmental monitoring plan and that special protection measures are being or will be taken so as to control the unexpected adverse environmental impact in the project plan.

The contents of *Environmental Monitoring Report by Stage* shall include, setup of environmental management organs, project progress, main construction contents and methods, environmental impact caused and measures to mitigate such impact, and implementation of such measures. It shall also include contents on resident complaints and settlement if necessary. In addition to the above monitoring report, the construction unit shall also prepare by itself the daily and monthly reports for submission to the higher competent authority and local environmental protection authority.

(2) Environmental Monitoring Plan during the Operation Period

After the proposed project is put into operation, the environmental monitoring organ shall prepare *Environmental Monitoring Report* regularly (generally twice a year). The main contents of the report shall include, setup and changes of the environmental

management organ, implementation of the review opinions of the environmental protection authority on preliminary report, monitoring system (including time, frequency, site, instruments and equipment used, standards applied, etc.), statistical analysis results of monitoring data, further pollution prevention and control measures proposed, etc.

The project unit shall collect the environmental monitoring reports and send them to the World Bank twice a year.

7. Public Consultation

As this project and CBM liquefaction component are located in the same region and the affected residential scope is the same as well, public investigation and CBM liquefaction component should be conducted simultaneously.

8. Safety Assessment

On the basis of Safety Assessment Statements on 4×250000Nm^3/d CBM Liquefaction component of the Proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectof Shanxi Energy CBM Investment Holding Co., Ltd. (Certificate of Qualification NO. APJ-guo-0018-2005) prepared by National Technology Center of Petrochemical Project Risk Assessment in Oct, 2007, CBM Central Gas Treatment Station Project is included in this assessment. Its safety assessment contents and conclusions are the same as those of CBM Liquefaction Component.

9. Conclusion of Assessment

9.1 Project Overview

The proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectof Shanxi Energy CBM Investment Holding Co., Ltd. (Part 3: Pipeline Project from the Central Gas Treatment Station to LNG Plant) is located in Duanshi Town, Qinshui County, with a total pipeline length of 1434m.

The pipeline is laid out along the mountain ridge, and the elevation difference is about 90m. The gas pipeline is considered to be laid along the waste land and farmland. At general locations, ditch will be excavated to lay and bury the pipes directly, and the depth of covering earth up the pipe is 1.0-1.2m. The pipeline crosses 1 highway, with a crossing length of 10m. It also crosses 1 river, with a crossing length of 120m. Ditch will be excavated to lay and bury the pipes directly in the river, with a ditch depth of not less than 1.0m from the outer covering layer of the pipe to the eroding line, and it should be guaranteed that the minimum covering earth of the pipeline shall not be less than 2m; if there is no eroding data about the crossed river, it should be guaranteed that the pipeline should be buried not less than 2m below the riverbed earth. The banks on both sides of the river or canal should be protected with the method of rubble slope protection.

9.2. Environment Status Quo

The project area belongs to monsoon climate zone of medium latitudes; the work area is surrounded with mountains, and its landform is characterized with low mountains and hills.The pipeline is laid to the western side of Guxian River

(1) Quality of Surface Water Environment

The surface water indicator of all the three monitoring sections exceeds petroleum standard, with the maximum excess rate doubling the standard, and the other indicators comply with Class III of *Quality Standard of Surface Water Environment* (GB3838-2002).

(2) Ground Water Quality

Of the two groups of monitored ground water data, the overall index of Escherichia coli single factor in Dongshan and Gudui exceeds 1, with an excess rate of 100%, and

the maximum excess rate is 75 times the standard, and the other monitoring results comply with Class III of *Quality Standard of Surface Water Environment* (GB/T14848-93).

(3) Ambient Air Quality

TSP and PM_{10} exceed standard, with an excess rate of 40%; NO_2 and SO_2 comply with Class II Standard in *Ambient Air Quality Standard* (GB/T14848-93).

(4) Ambient Sound

The noise level of the proposed plant site is within the range of 35.3dB(A)□37.8dB(A) in daytime and of 32.6dB(A)□33.2dB(A) at night, both of which comply with the standard limit of Class I Area pursuant to *Ambient Noise Standard in Urban Area*. The noise level at places around the proposed plant such as Yanggelang, Shuiquanze, Dongshan, Dongshanling, etc., is within the range of 38.3dB(A)□39.5dB(A) in daytime and of 34.0dB(A)□37.2dB(A) at night, both of comply with the standard limit of Class I Area pursuant to *Ambient Noise Standard in Urban Area*. At the traffic noise monitoring site of Jinfeng Village, the noise level is 53.5dB(A) and 45.8dB(A) during daytime and at night respectively, both complying with the the standard limit of Class IV Area, while that at Shuiquan is 51.2dB(A) and 42.9dB(A) during daytime and at night respectively, both complying with the standard limit of Class I Area .

9.3 Environmental Impact and Mitigation Measures

9.3.1 Environmental Impact during Construction Period

The proposed pipeline project will occupy a land area of 0.57hm^2 on a temporary basis, of which, the area of farmland is 0.2hm^2, and the area of low coverage grassland is 0.37hm^2. The vegetation biomass loss caused by the land occupation is about 5.01t/a, of which, the biomass loss caused by occupation of farmland and wasteland is 3.9t and 1.11t respectively. The economic loss caused by temporary land occupation of the project to the assessment area along the pipeline is about RMB3,300 Yuan per annum; the economic loss caused by temporary land occupation is about RMB10,000 per annum and will last for three years (1 year for construction and 2 years for reclamation and rehabilitation).

9.3.2 Environmental Impact during Operation Period

No gas emission, effluent, waste residue and noise are generated during the pipeline operation period, so there is no impact upon the eco-environment.

9.3.3 Environmental Impact during Servicing / Maintenance Period

The main environmental impact during servicing / maintenance period lies in sludge produced during pigging operation (with ferric oxide as principle component). Ferric oxide is a general industrial solid waste, and the volume of sludge produced in the project is about 2kg, which is to be transported by Environment and Sanitation Sections to specified industrial solid waste disposal sites for disposal. Pipe-line gas transmission is a clean mode, and moreover, the principle component of CBM is methane and the principle waste produced during the servicing / maintenance period is pigging sludge; therefore, there is no environmental impact during this period.

9.4 Alternative Analysis

In terms of pipeline length, Scheme 2 involves much longer length than that Scheme 1 and much greater investment than Scheme 1; the land area occupied by Scheme 2 is 3.5 times that by Scheme 1; both schemes have the same river and highway crossing length and frequency. From the perspective of environmental protection, Scheme 1 is recommended.

9.5 Environmental Management Plan

Different environment management bodies will be set up for the construction period and the operation period. Each member of the body will be arranged to receive training before assuming their positions. A complete environment monitoring plan will be included in the environment management plan regulates self-contained. Each environment management body is able to meet the environmental management needs of this project and formulate and submit *Environment Monitoring Statement* to relevant authorities. According to the review opinions of competent environmental administration authority on *Environment Monitoring Statement* of the proposed project and the possible complaints relating environmental problems, continuous improvements will be made to the relevant parts of rectification monitoring procedures in order to accomplish environment management better.

9.6 Overall Conclusion

The construction of the proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectof Shanxi Energy CBM Investment Holding Co., Ltd. conforms to *The 11th Five-Year Planning on CBM Development and Utilization Plan* of China and conforms to local socioeconomic development plan, Xinshui County overall planning, environmental protection planning and water environment function delineation.

The construction of pipeline project from the Central Gas Treatment Station to LNG Plant under the proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectof Shanxi Energy CBM Investment Holding Co., Ltd. will inevitably exert adverse impact on ecological environment, surface water environment, ground water environment, ambient air and ambient sound. The construction of the project will play a positive role in promoting local socioeconomic development and improving the residents' life quality, etc.

As long as the principle of simultaneous design, construction and use is earnestly carried out in the process of project implementation and production and the ecological restoration and pollution prevention and control measures proposed in the EIA are taken, cleaner production and compliant discharge will be realized, the gross control target met, the adverse impact of the project minimized and the economic benefits, social benefits and environmental benefits organically combined to realize sustainable social and environmental development.

Therefore, in terms of environmental protection, the construction of pipeline project from the Central Gas Treatment Station to LNG Plant under the proposed World Bank-funded Shanxi Coalbed Methane Development and Utilization Projectof Shanxi Energy CBM Investment Holding Co., Ltd. is feasible.