COAL MINE METHANE IN UKRAINE:

Business Plan for a Development Project at Skochinsky Mine

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BUSINESS PLAN
FOR A DEVELOPMENT PROJECT
AT SKOCHINSKY MINE

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DISCLAIMER

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ABBREVIATIONS AND TERMS

CBM	Coalbed Methane
CIS	Commonwealth of Independent States
CMM	Coal Mine Methane
CO_2	Carbon Dioxide
DAF	Dry Ash Free
°C	Degrees Centigrade
DCF-ROI	Discounted Cash Flow-Return On Investment
G&A	General and Administrative (Expense)
GCAL	Giga-calories
KCM	Thousand Cubic Meters
KM	Kilometer
M	Meter
MOB/DE-MOB	Mobilization/De-Mobilization
PV	Present Worth
VAT	Value Added Tax

1.0 EXECUTIVE SUMMARY

The objective of this business plan is to demonstrate the financial feasibility of a coal mine methane development project at the Skochinsky Mine located in the Donetsk Region of Ukraine (See Exhibit 1). The business plan incorporates the utilization of Western technology and equipment and is patterned after similar projects that have been successfully implemented in other parts of the World. The project will entail three phases; pilot project, evaluation, and the full-scale development program.

The pilot project phase will consist of the drilling and completion of five standard wells and one gob well. An evaluation phase will follow the pilot project to assess the results of the drilling and completion conducted during the pilot project phase and to allow time for making the decision to continue into the development program. The business plan assumes a full year to complete the pilot project and the evaluation period at a cost of approximately $6.2 million.

The full-scale development program consists of the drilling and completion of four holes per month over a three-year period resulting in a total of 144 wells. The drilling program will include 124 standard wells and 20 gob wells. Selected coal seams and sandstones in the standard wells will be hydraulically stimulated (fractured) to provide an avenue for the gas and water to flow from the formation to the well bore. The gob wells will not be hydraulically stimulated. The gob wells will produce gas from the relaxed fractured coal seams and sandstones resulting from the longwall mining operations in the Skochinsky Mine.

The project Cash Flow and Economics (See Table 1) yields a discounted cash flow rate of return of 39.70% over the project evaluation period of thirteen years. Excluding working capital requirements, the maximum capital required for implementing the project is approximately $20.0 million. This projection includes income tax benefits associated with the project receiving Free Economic Zone designation. The pilot project costs are reflected in Year 0, or the year before the development program begins. The pilot project's first year of methane production is to be vented while the wells are being evaluated. The pilot project's well production for the second through the tenth year is reflected in the first through the ninth year of the development phase. All wells are assumed to have a ten-year life including the year it was drilled which results in a project life of thirteen years. A ten-year well life is very conservative as coal mine methane wells in the United States are expected to have a fifteen to twenty year life.

The project has additional prospects to increase the financial returns. There is the potential that gob wells and standard wells drilled in the near vicinity of an existing mine may qualify for greenhouse gas credits. Also, there is a good possibility that gas recovery rates may exceed those shown in the forecast.

An analysis of all factors indicates that the project has the potential to be financially viable. The resource density is very large and terrain demographics are suitable for a large-scale development project and a high-sustained rate of methane flow during and after mining indicates that adequate permeability will exist.

2.0 IMPORTANCE OF COAL-BED METHANE IN UKRAINE

Commercial development and utilization of methane in Ukraine will have many positive benefits to the economy, the environment, and to the coal industry. A fully implemented methane development project will result in the following:

- creating an alternative energy source that would mitigate Ukraine's dependency on imported fuel; primarily natural gas from Russia and other CIS countries,
- reducing the amount of methane, a potent greenhouse gas, that Ukrainian coal mines release to the atmosphere, and
- improving coal mine safety, coal mine employee health, and productivity.

In 1999, the Cabinet of Ministers of Ukraine considered a national energy program for 2000 to 2010. This program includes a set of goals for the energy sector to achieve a more balanced supply/demand situation through a combination of alternative energy sources and energy efficiency programs. One of the goals is to have eight billion cubic meters of methane produced per year by the year 2010.

For the purpose of this business plan, the following definitions apply:

- coalbed methane (CBM) – methane contained in coal seams and the rock strata surrounding the coal seams and
- coal mine methane (CMM) – methane contained in coal seams and the rock strata surrounding the coal seams in reserve areas that have been assigned to specific mines.

2.1 COALBED METHANE AS AN ALTERNATIVE FUEL SOURCE

The large-scale capture and utilization of CBM could contribute greatly towards Ukraine's energy requirements. Ukraine currently consumes approximately 75 billion cubic meters of natural gas on an annual basis while only producing approximately 18 billion cubic meters from domestic sources. This shortfall, of approximately 57 billion cubic meters per year, is being imported creating a serious increase in foreign debt. Ukraine receives 30 billion cubic meters of natural gas from Russia each year as compensation to transport Russian natural gas to Europe through pipelines located in Ukraine. The remaining 27 billion cubic meters of natural gas is sold to Ukraine at $80 per thousand cubic meters thus creating a negative balance of trade in excess of $2 billion per year.

Increasing domestic standard natural gas and oil production is not an economically feasible option for Ukraine. Under the Soviet Union, the larger and shallower natural gas and oil reserves were depleted; leaving small, deep, and more expensive reserves that will require vast capital resources to develop that Ukraine does not possess.

It is clear that the gas produced from a commercial CBM development project would have a ready market that would enhance the economic conditions in Ukraine.

2.2 ENVIRONMENTAL BENEFITS OF USING COAL MINE METHANE

Methane is one of a number of gases that scientists believe contribute to the greenhouse effect, the trapping of heat in the Earth's atmosphere. The extent to which any given greenhouse gas traps heat is measured relative to the heating effect of carbon dioxide. Methane is estimated to be 21 times as potent as carbon dioxide in trapping atmospheric heat over a hundred year period. Methane and other greenhouse gases are released to the atmosphere through various natural processes and through many human activities, such as the mining of coal.

Capturing and utilizing CMM in Ukraine can significantly reduce the amount of greenhouse gas that coal mines presently emit into the atmosphere. During 1999, Ukrainian coal mines generated approximately 2,060 million cubic meters of methane. Through degasification systems, the mines captured approximately 257 million cubic meters of methane (13% of the total generated) and used only 79 million cubic meters of the captured methane; thus emitting approximately 1,981 million cubic meters of methane into the atmosphere. Not only this is a waste of a vitally needed energy source but CMM emissions contribute to the greenhouse gas effect.

The development of CMM projects in Ukraine can reduce the amount of gas coal mines emit into the atmosphere. In addition, with the advent of the trading of carbon credits, Ukrainian coal mines could be considered as candidates to generate these credits. As of July, 2000 over $30 million of carbon credit transactions have taken place on a worldwide basis. Total potential market for carbon trading could reach in excess of $10 billion by the year 2010. Thus far, the carbon credit transaction values have only been a fraction of the costs that would be incurred to reduce greenhouse gas emissions. However, there is not a consensus among economists in determining the total mitigation costs that should be included in reducing greenhouse gas emissions. Mitigation costs of CMM development projects in Ukraine may be considerably less than those expected in the United States.

2.3 COAL MINE METHANE AS A HEALTH AND SAFETY ISSUE

The development of CMM projects at coal mines in Ukraine can greatly reduce the number of accidents and fatalities that Ukrainian mines are presently experiencing. In 1999, Ukraine coal mines experienced 296 fatalities, or 3.7 deaths per one million raw tonnes of coal produced. This grave statistic is one of the worse in the world. Many of the fatalities are the result of outbursts caused by high gas content and from explosions caused by the ignition of explosive concentrations of methane. Pre-mining degasification of the coal reserves, with the drilling of vertical wells and utilizing enhanced underground degasification system, would greatly reduce the accident and fatality rates in Ukrainian coal mines. In addition, removal of the methane from the mines will increase productivity by reducing the number of mine slowdowns or shutdowns due to high methane levels.

CMM development projects can reduce coal mine accidents and fatalities, while at the same time lower their mining costs by increasing productivity.

3.0 SKOCHINSKY MINE PROJECT

3.1 INTRODUCTION

This business plan for a commercial CMM development project at the Skochinsky Mine demonstrates the financial viability of such a project utilizing Western equipment and technology. The business plan was developed in cooperation with Western CBM development experts, Western energy experts, and data and information provided from Ukrainian CBM and energy professionals.

The project includes a Pilot Project Phase, an Evaluation Phase, and a Development Phase. Each Phase will be implemented in a manner to maximize the project cash flow and is patterned after development projects that have been successfully implemented in other countries. Prior to the start of the Pilot Project, additional time and expenses will be required to confirm the status of current Ukrainian laws and current tax regulations, creating a business structure to implement the project, contracting with Western drilling and completion organizations, and other necessary steps that are required to start a project in a developing country. These related expenses have not been included in this business plan and have been assumed that they will be absorbed by the project developer.

It is recognized that in Ukraine, as in most developing countries, many legal, economic, and administrative barriers will have to be overcome for the successful implementation of such a project as set out in this business plan. Many of the assumptions that have been made in assembling this business plan must be verified and/or revised based on current conditions prior to implementing the project.

3.2 BACKGROUND

Skochinsky Mine, located within the boundaries of the city of Donetsk, is one of the 241 underground coal mines in Ukraine. This mine was selected for evaluation based on its methane reserves, specific methane content of its coal seams, its annual coal production, and projected economic life. The Skochinsky Mine includes a reserve area of 80 square kilometers that contains methane of approximately 45 billion cubic meters. The mine reserve area contains thirty coal seams that have an aggregate thickness of 9.25 meters and the methane content of the coal seams range from 16 to 22 meters/tonne daf. During 1999, the mine produced approximately 785,000 raw tonnes from one seam that ranged in thickness from 1.10 to 1.95 meters.

Skochinsky is a State owned enterprise that is a part of the Donugol State Holding Company (an Association). Skochinsky Mine management and personnel have actively participated in gathering information and data for this business plan and have been supportive of the project.

3.3 PROJECT DESCRIPTION

This business plan for a CMM development project at the Skochinsky Mine was initiated after gathering and evaluating data and information regarding the mine and reserve area. The geology, hydrogeology, and structure of the area are well known from the extensive mining and coring in the area. An overview of the geology of the area is presented in Section 3.5 of this business plan.

The well drilling envisions the use of Western drilling and completion equipment and the utilization of proven technologies that have been successfully implemented in similar projects in other parts of the World. All of the assumptions that have been utilized in developing this business plan are based on similar projects and then modified to adjust to conditions that are expected to be encountered in Ukraine. All of the operating and equipment costs are those in effect as of January 1, 2000 and all of the financial projections are based on a constant dollar basis.

The business plan is based on drilling and capturing gas from vertical wells only. The business plan does not include additional gas that is available from the mine ventilation shafts and from their underground degasification system. The business plan assumes a stand-alone business structure so as not to burden the project with the financial constraints often found with the coal mines in Ukraine.

3.3.1 Pilot Project Phase

A Pilot Project Phase has been included in the business plan as a method to determine the viability of a commercial CMM project in Ukraine before a full development project would be initiated. The Pilot Project will be used to assess the potential production characteristics, confirmation of in-place gas volume, determination of fracturing characteristics, and to assess the water regime in the area. The Pilot Project Phase assumes the drilling and testing of five standard wells and one gob well. Selected coal seams and standstones within the five standard wells will be hydraulically stimulated to create a passageway, or avenue, for gas and water to flow from the formation to the wellbore. During the Pilot Project, the most suitable drilling and completion techniques and the target seam combination that will maximize the production potential from the development project will be defined. The gob well will not be hydraulically stimulated. The gob well will produce gas from the relaxed fractured coal seams and standstones located above the longwall mining operations.

Suitable drilling and completion equipment and related required services are not available in Ukraine to implement the Pilot Project. In addition, due to the limited size and scope of the Pilot Project, it would be cost prohibitive to purchase and use the appropriate suite of equipment and services exclusively for such a small project. Therefore, the costs for the Pilot Project are based on using a drilling contractor from Central or Western Europe, a hydraulic fracturing contractor from Western Europe, and the technical services and support being provided by experienced United States CBM operators.

The Pilot Project costs for drilling and completing the six wells are estimated to be approximately $6.2 million (See Table 2) and have been included in Year 0 of the project cash flow analysis (See Table 1). The estimated costs do not include provisions for extensive coring and desorbtion tests as the gas content in the coal seams is known with a high degree of confidence and the gas content for the sandstones is considered to be a minimum of 0.8 cubic meters per cubic meter of sandstone. The gas produced from the six wells during Year 0 has assumed to be vented until after the Evaluation Phase has been completed. However, gas produced from the six wells are included in the project cash flow analysis for the five standard wells (See Table 3) and for the one gob well (See Table 4) starting with Year 1 of the project economic analysis.

3.3.2 Project Evaluation Phase

It is recognized that after the completion of the Pilot Project Phase a period of time for evaluation must be considered before the start of the full development program. Drilling and completing wells for CMM is new for Ukraine and no historical data and information are available for a comparative analysis. The exact amount of time required for this evaluation is unknown and will vary in length based on the results obtained from the Pilot Project and the experience and knowledge of the developer. Sufficient time has been included in the project cash flow analysis by assuming that a full year (Year 0) will be required for the Pilot Project and Evaluation Phases. The costs associated for the evaluation period have not been included in the project cash flow and that they will be absorbed by the project developer.

3.3.3 Project Development Phase

The Project Development Phase assumes the successful completion of the Pilot Project and that a decision to proceed with the project was reached during the Evaluation Phase. Similar to the Pilot Project, the same equipment and services have been assumed to be available for implementing the full development program. It has been further assumed that the drilling and stimulation contractors have secured sufficient business in Ukraine to establish a base of operations. All of the associated costs for these services are based on this assumption and are critical to the financial viability of the project.

3.3.3.1 Drilling Program

The drilling program will be completed over a three-year period and that four wells per month will be drilled. During this period, 144 wells will be drilled that includes a combination of standard wells and gob wells (See Table 5). The standard wells, drilled to a depth of 1,400 meters, will have a density of three wells per square kilometer while the gob wells, drilled to a depth of 1,200 meters, will have an effective density of six wells per square kilometer.

The location of the 144 wells to be drilled during the Drilling Program was determined after reviewing the geology of the mine area, a mine map containing areas that had been previously mined, and projections of areas for future mine development. In the selected area for drilling, the wells will encounter 30 coal seams and 4 layers of sandstone. The drilling area has an average gas content of approximately 20 cubic meters per tonne in the coal seams and a minimum of 0.8 cubic meters of gas per cubic meter of sandstone.

The density of the selected area is assumed to be as shown in the table below.

The development costs for each standard well are estimated to be $331,000 and for each gob well to be $231,000 (See Table 6). The following is a general overview of the sequence of events associated with the drilling and completion of a standard well that will be followed during both the Pilot Project and the Project Development Phases. Standard wells drilled during the Pilot Project will be prepared for the hydraulic stimulation process before any well will be stimulated. During the Project Development Phase, the timing of the hydraulic stimulation will be scheduled to achieve the most cost-effective results. The sequence of events for the drilling and completion of a standard will are as follows:

- Prepare well site,
- Move in drilling rig and equipment,
- Set conductor casing,
- Drill surface hole,
- Run and set surface casing,
- Drill production hole,
- Run open hole electric log,

Density of gas resources

Interval	Coal seams			Sandstones			Total Density, Million m^3/km^2
	Number	Total Thickness, m	Density, Million m^3/km^2	Number	Total Thickness, m	Density, Million m^3/km^2	
$h_3Sh^1_6$-$i^2_3Si^2_3$ (standard wells)	30	9.25	236.30	3	77.00	386.90	623.20
h^0_8Si2-$i^2_3Si^2_3$ (gob wells)	25	6.31	163.87	2	27.00	108.65	272.52

- Move drill rig off and clean-up site,
- Run and set production casing with either drill rig or workover rig,
- Run cement bond log,
- Move in hydraulic stimulation and perforating equipment,
- Perforate bottom zone,
- Hydraulically stimulate the bottom zone,
- Run and set a bridge plug above the perforations just stimulated and below the next zone to be stimulated,
- Perforate the next zone to be stimulated,
- Hydraulically stimulate the zone just perforated,
- Run and set bridge plug and continue the sequence until all zones have been stimulated,
- Flow the well back to a pit or a tank,
- During the flow back period, move in and set up surface equipment,
- Use workover rig to circulate water or nitrogen through the tubing to clean sand and coal fines out of the well,
- Use workover rig to run pump, tubing, and rods.
- Hook up surface equipment, which will include drive head and electric motor for the pump, meter, separator, and a tank for produced water, and
- Begin pumping water and production gas.

It should be noted that during the flow back operation the water and nitrogen used in the stimulation process should be allowed to flow back slowly. This will allow the sand to stay in the formation rather than flowing back with the water and nitrogen. This process may take from two to six days depending upon the type of bridge plugs that are utilized. The characteristics of different bridge plugs are the following:

- Flow through bridge plugs: flow back process will take two to three days and a workover rig will not be necessary,
- Non-flow through bridge plugs: flow back process will take four to six days and a workover rig will be necessary,
- Retrievable bridge plugs: a wireline truck will be used to remove the plugs, and
- Drillable bridge plugs: a workover rig will be required.

The following is a general overview of the sequence of activities associated with the drilling and completion of a gob well that will be followed for gob wells that are drilled during both the Pilot Project and the Project Development Phases:

- Prepare well site,
- Move in drilling rig and equipment,
- Set conductor casing,
- Drill surface hole,
- Run and set surface casing,
- Drill production hole,
- Run open hole electric log,
- Move drill rig off and clean-up site,
- Run and set slotted production casing insert with either the drill rig or a workover rig,
- Hook up surface equipment which will include drive head and electric motor for the pump, meter, separator, and a tank for produced water, and
- Begin pumping water and production gas.

In the project area there is a layer of silty type clay above the coal seam that is being mined. This layer of clay will tend to bend and not break thus blocking direct communication between the mine and the gob well. Without direct communication, well bore water that enters the well will impede gas production and must be pumped out. In addition, without direct communication, well pressure can be maintained without the use of a compressor.

In addition to the sequence of activities enumerated for the drilling and completion of the standard and gob wells, the basic infrastructure must be constructed. The infrastructure will include the gas and water gathering systems, the monitoring system, compression equipment to gather and transport the gas, and a water disposal system. Additional infrastructure will be constructed as additional wells are developed and connected for ultimate utilization of the produced gas.

3.3.3.2 Gas Production And Economics

Based on a review of the geological information, the assumption of the availability of Western equipment and technology, and the experience from similar projects in other parts of the World, production profiles were developed for both the standard and gob wells (See Tables 7 and 8; Exhibits 2 through 5). The well production profiles have been forecasted for a ten-year period only. The total project gas production on an annual basis is shown on Table 9.

Each standard well has been placed at a density of three wells per square kilometer and will be drilled to a depth of 1,400 meters. With these parameters, the gas reserves per standard well have been calculated to be 78,000 thousand cubic meters (kcm) in the coal seams and 128,000 kcm in the standstones. Thus, each standard well will have a gas reserve base of 206,000 kcm. Utilizing Western fracturing equipment and technology, it has been projected that each standard well will recover a total of 32,600 kcm over a ten-year production cycle. Gas from the coal seams is estimated to be approximately 25% of the gas-in-place and gas from the sandstones is estimated to be approximately 10% of the gas-in-place.

Each gob well will be placed at an effective density of six wells per square kilometer and will be drilled to a depth of 1,200 meters. With these parameters, the gas reserves per gob well have been calculated to be 27,000 kcm in the coal seams and 18,000 kcm in the sandstones. Thus, each gob well will have a gas reserve base of 45,000 kcm. It has been projected that over a ten-year production cycle, each gob well will produce 20,237 kcm. Gas recovery from the coal seams and sandstones will be approximately 45% of the gas-in-place.

With the production profiles and various financial assumptions, economic evaluations were calculated for a typical standard well (See Table 10) and for a typical gob well (See Table 11). Over a ten-year production cycle a standard well is projected to have a positive cash flow of approximately $817,510 and a discounted cash flow rate of return (DCF-ROI) of 53.27% assuming special tax benefits. With similar assumptions, the typical gob well has a positive cash flow of approximately $484,784 and a DCF-ROI of 45.64%. The financial assumptions are listed on the respective Tables.

The special tax benefits that are assumed on Tables 10 and 11 are in regards to the recently passed law on Free Economic Zones. The Skochinsky Mine is included within one of the established Free Economic Zones and it is assumed that the tax benefits will be available for a commercial CMM development project. The particular tax benefits of a Free Economic Zone include a zero income tax rate for the first three years of an approved project and an income tax rate of 50% of the prevailing income tax rate for the next three years of the project. To reflect the benefits of this special tax treatment, economic evaluations were calculated without the tax benefits for a typical standard well (See Table 12) and for a typical gob well (See Table 13). Without the tax benefits the standard well DCF-ROI is reduced to 38.94% and the gob well in reduced to 33.51%.

3.3.3.3 Gas Markets, Pricing, and Payment

Key elements that are required for the successful implementation of this project include the following:

- A ready market to accept the gas that is produced,
- Consumers that are willing to pay a competitive price for the gas, and
- Consumers that have the ability to pay with cash for the gas.

As noted in Section 2, there is a ready market for gas that would be produced from a commercial CMM development project in Ukraine. For simplicity, the business plan has assumed that the produced gas would be sold into the existing natural gas system. For developers that wish to convert the produced gas into electricity, there are sufficient details in the business plan to form the basis of a new economic analysis.

The current official State price for natural gas in Ukraine is $80 per kcm plus a transportation fee of $3 per kcm. It has been assumed for the economic analysis of the business plan that the project would net $60 per kcm at the project site. The $20 reduction in the price is for rents, royalties, VAT, and other payments to the State but does not include income tax on the project profits.

It has been assumed for the economic analysis that the project would be paid in cash for all of the gas produced and sold. Historically in Ukraine, this would have been a gross assumption as most payments were made with the barter system. However, during the year 2000 there has been a significant increase in cash payments for services such as gas, electricity, and water. The State has established this as a high priority issue and is now allowing service providers the right to shut off consumers that have not paid. During the first six months of 2000 the cash payments have reached over 45% and the State has established a goal of reaching 50% by the end of the year. In addition, there are many large gas consumers that have the financials resources to pay in cash for their obligations that the project can seek out and secure.

3.4 THE ROLE OF SKOCHINSKY MINE

The successful implementation of this project will require the establishment and maintenance of a strong relationship with the Mine. The project developer must be kept aware of all current coal production, future coal development plans, and any deviations from these plans that are being considered. In addition, the Mine may be considered as a consumer of a portion of the gas that is produced.

The Skochinsky Mine can utilize the captured methane at the mine as boiler fuel. The mine has five boilers that primarily consume coal and during 1999 the mine consumed 15,136 Gcal of heat in their boilers. In addition, if electricity is generated with the captured methane, the mine could utilize a portion of the output. During 1999, the mine used electricity at the capacity of approximately 3 MW at an average cost of $0.035 per kilowatt hour.

Not included in this business plan is the potential additional source of funds through the trading of carbon credits. The Skochinsky Mine is a contributor of methane emissions into the atmosphere. During 1999, the mine liberated approximately 38.6 million cubic meters of methane; 34.6 million cubic meters via the ventilation shafts and 4.0 million through their degasification system. The mine did not captured and consumed any of this gas and it was all emitted into the atmosphere.

The Skochinsky Mine will encourage a coalbed development project to reduce their accidents and fatalities while at the same time reducing their costs by increasing productivity. Including the mine construction period and twenty-five years of coal production, the mine has recorded over 6,000 coal outbursts caused by excessive levels of methane. During the same time period, the mine has experienced over 260 fatalities. Due to the high level of methane in the mining areas during production, the mine is limited to taking only two passes per shift with the longwall shear and are then required to wait for the areas to stabilize before resuming production. With a properly implemented pre-mine degasification program the mine could realize a fifty-percent increase in production by being allowed to take three cuts per shift.

3.5 GEOLOGY OVERVIEW

3.5.1 General Information

The Skochinsky located in the western area of Donetsk-Makeevsky geologic/industrial zone and is within the city of Donetsk. The mine reserve area covers 80 square kilometers and lies between two rivers, the Volchia and the Kalmius. Topographically, it is a plain (steppe) crossed by small rivers and ravines with a maximum elevation of 250 meters above sea level in the northeastern part of the area and minimum of 148 meters near the Osikova Ravine. The climate in the mine area is considered to be moderately continental with maximum and minimum temperatures of +38°C and -30°C respectively, and an average yearly temperature of +8°C. The soil tends to freeze to depth of 1.2 and 1.5 meters. Yearly precipitation averages 0.5 meters. There are no preserves or any other conservation areas within the mine area. Electric power for the mine is provided by Donbassenergo and water is supplied from the canal Seversky Donets-Donbass through water mains.

3.5.2 Stratigraphy and Lithology

Geologically, the mine area is located in the southwestern flank of the Kalmius-Toretskaya depression with the C_3^1 coal-bearing strata (Upper Carboniferous period) and C_2^7, C_2^6, C_2^5, C_2^4, and C_2^3 (Middle Carboniferous period) strata overlapped with younger beds. Quaternary deposits developed within the mine area are typically 15 to 18 meters thick. These deposits are represented by soil, yellow-red and brown-red loam, and clay with limestone inclusions and some sand lens. Neogene deposits are developed non-uniformly. In the central and southern parts of the mine area their thickness ranges between 4 and 34 meters, gradually thinning out in a north by northwest direction. Neogene deposits are represented by speckled clay containing medium and fine sands. These deposits are 5 to 6 meters thick and often contain quicksand at the bottom. Under these deposits are layers of quartzite and gravelstony sandstones. Cretaceous deposits, that are typical only for the extreme western and northwestern parts of the mine area, are represented by chalky marl (23 meters in thickness), glauconitic sand (7 meters), and spongolite (up to 25 meters) (See Exhibit 6).

The coal seams contained in the strata C_3^1, C_2^7, C_2^6, and C_2^5 are developed by other mines in the area. The strata C_2^4, with a thickness of 220 meters, includes alternating bands of clay shale (22 to 27%), sandy shale (40 to 45%), sandstone (28 to 35%), and with tributary layers of limestone and coal seams. Sandstones, $i_3Si_3^2$ and $I_2Si_1^4$, with thickness of 10 to 27 meters are considered most uniform in structure.

The strata C_2^3 is formed with uniformly distributed layers of clay shale (35 to 40%), sandy shale (30 to 32%), sandstone with a different grain size (25 to 30%), and up to 2% of limestone and coal. The thickness of this strata increases eastward from 375 meters to 485 meters. Markers of this strata are as follows: h_{10}^B coal seam with underlayer h_{10}^H and overlying clay shale enclosing h_{11} coal seam and I_1 limestone; limestones H_6^1 and H_6 with underlying coal seams h_8^{H+B} and h_8^H; crystalline limestone H_5^0 with underlying coal seam h_6^1 and understratum of quartzitic sandstone; and, coal seam h_3 and limestone H_2 with underlying coal seam h_1.

3.5.3 Tectonics

The western and central parts of the mine area are noted for conformable monoclinal bedding that stretches southwest on the strike and northwest to a dip of 8 to 16 degrees. In addition, this formation has some disjunctions with amplitude of between 2 and 10 meters. The structure of the eastern and northeastern parts of the mine area is more complex which is attributed to the influence of the Frantsuzsky, Koksovy and Mushketovsky thrusts and the Vetkovskaya flexure whose apophyses have a series of tributary disjunctions. The Franstuzsky and Koksovy thrusts form a natural northeastern boundary of the mine area. The amplitude of the Frantsuzsky thrust ranges between 130 and 650 meters. The adjacent Koksovy thrust has a displacement amplitude of up to 180 meters that decreases to 15 meters in the northwest. The Mushketovsky thrust is the main disturbance within the mine area with an almost latitudinal strike. The pitch angle of the displacement plane decreases in a westward direction from 50 to 65 meters down to 5 to 10 meters. In the area of the Vetkovskaya flexure, the strike of the strata (originally southwestern) changes to latitudinal and the strata dips north by northwest at angles ranging from 8 to16 degrees up to 35 to 40 degrees.

3.5.4 Coal Strata

The coal strata C_2^4 in the mine area include 13 coal seams and layers of which six (i_3^2, i_3, i_2, i_1^4, i_1, and, i_0) are at least 0.45 meters thick although they are categorized as irregular. Geological and qualitative characteristics of the coal seams of C_2^4 and C_2^3 strata are shown in below.

The coal strata C_2^3 contains 18 coal seams and layers although only six of them,

h_{11}, h_{10}^B, h_8, h_6^1, h_5 and h_3, are minable; either through the whole area or in certain locations. The mine currently develops one coal seam, the h_6^1.

Petrographically, coals of the C_2^4 strata are durain-clarainous and clarain-durainous, while those of the C_2^3 strata are clarain and similar to them.

Coal Characteristics:

Symbol	*Average thickness meters*	*% of mine field*	*Ash %*	*Moisture %*	*Sulfur %*	*Volatiles %*
i_3^2	0.47	3	8.3	1.5	3.2	29.5–44.9
i_3	0.48	33	7.1	1.9	2.9	35.4–44.9
i_2	0.53	26	12.6	1.7	0.9	28.0–41.0
i_1^4	0.65	38	8.4	2.3	1.0	34.7–46.4
i_1	0.47	14	11.9	1.4	2.8	39.4–45.4
i_0	0.54	10	12.4	1.5	3.4	40.6–48.0
h_{11}	0.48	29	11.7	2.2	0.7	27.5–38.5
h_{10}^B	0.61	95	11.8	2.0	3.5	18.5–45.4
h_8^{B+H}	0.69	29	12.6	1.7	3.3	29.8–49.5
h_8^H	0.60	56	10.4	1.6	0.9	17.9–39.1
h_6^1	1.30	95	9.6	2.2	1.1	14.6–35.0
h_5	0.59	40	17.1	1.6	3.0	18.0–41.2
h_3	0.60	90	13.9	2.2	0.6	15.9–36.7

3.5.5 Coal Methane Content

Data collected from geological surveys show that the CBM content of coal-bearing strata C_2^3 ranges between 16 and 22 m^3/t daf. According to data gathered by the mine, average gas content is approximately 20 m^3/t daf. Methane gas is mainly retained in the coal matter in a sorbed state. Gas pressure measured at the h_6^1 seam through exploratory wells ## 9123, 9131 and 9143 at the depths of 110 to 1,364 meters ranged between 10.8 and 13.6 MP. According to averaged results of an analysis of the chemical composition of gas recovered, the main component of the gas mixture is methane (94.2%) with some ethane (1.69%), propane (0.31%), carbon dioxide (0.52%), and nitrogen (2.98%). CBM resources within the active mine levels total 4.7 billion cubic meters. The density of the CBM resources in the 30 coal seams and layers not being undermined within the mine field are estimated at 236.3 million m^3/km^2; while those contained in the 12 seams and layers effected by active mining in h_6^1 total 70.4 million m^3/km^2. The gas saturation of the sandstone averages 0.8 m^3/m^3 because of their porosity. In the sandstones of C_2^4 strata it ranges from 4 to 11% while in the C_2^3 strata it ranges from 2 to 4%. The density of the CBM resources in sandstones is estimated to be 337 million m^3/km^2.

3.5.6 Hydrogeology

The water-bearing horizons of the quaternary deposits are not expanded but are pressure-free because of their being fed through atmospheric precipitation. The water bearing horizons of the Neogene-Paleogenic beds with pressure-free pore water is fed through infiltration of atmospheric precipitation; such beds overlay carboniferous rock strata whose waters they naturally replenish. In carboniferous deposits, fractured sandstones are considered the most water-bearing. The layers of limestones do not impact water encroachment. In test holes drilled under the mine shafts, the piezometric water level was 8 to 32 meters deep. Data from geologic surveys indicate that down to a depth of 250 meters, average filtration coefficient of carboniferous rocks is 0.0128 meters per hour. At depths from 250 to 800 meters the average filtration is 0.0016 meters per hour and at greater depths than 800 meters it is 0.00021 meters per hour due to reduced porosity. Chemical composition of waters changes from sulfate sodium-calcium (down to 250 meters), to sulfate-chloride sodium-calcium (between depths of 250 and 800 meters), and then to chloride sodium (at depths deeper than 800 meters). Water mineralization correspondingly changes from 3 to 9 grams per liter.

3.6 PROJECT RISKS

The primary risks in a CBM project are the lack of resource and low gas production. In addition, regulations for disposal of produced water, restraints on the acquisition of surface rights, and poor market conditions for natural gas can adversely affect projects. Also, implementing a project in a developing country contains its own sets of risks involving legal and tax issues. Some of these factors are addressed below:

- Resource: The Skochinsky Mine coal seam depth and thickness are known from coring and mining. The gas content has been determined from a long history of mining and gas emission measurements. There is a high degree of confidence in the accuracy of the resource estimate but even with some degree of error the resource density is extremely high.

- Gas production rate: High sustained rate of gas flows during after termination of mining indicates potential for good permeability. However, the only definitive way to determine permeability and other production characteristics is to drill and evaluate wells. The best available technology has been assumed to be employed by experienced personnel to design and complete the project. The combination of high resource density and the potential for satisfactory permeability gives a high degree of confidence that commercial production can be achieved.
- Water Disposal: Problems with wastewater disposal can be an impediment to CBM/CMM development projects. Wastewater produced from the operations will be discharged into local streams. There is an adequate stream system in or near the project area to receive the wastewater produced from the project. There should be no regulatory problems since the water quality will be the same or similar to the wastewater discharged from the coal mine.
- Acquisition of drill sites and rights-of-way: Demographics and terrain in the project area are suitable for the planned scope of the project. The method to obtain the right to use the surface for drilling and production activities is unclear and warrants farther investigation.

Exhibit 1: General Location Map

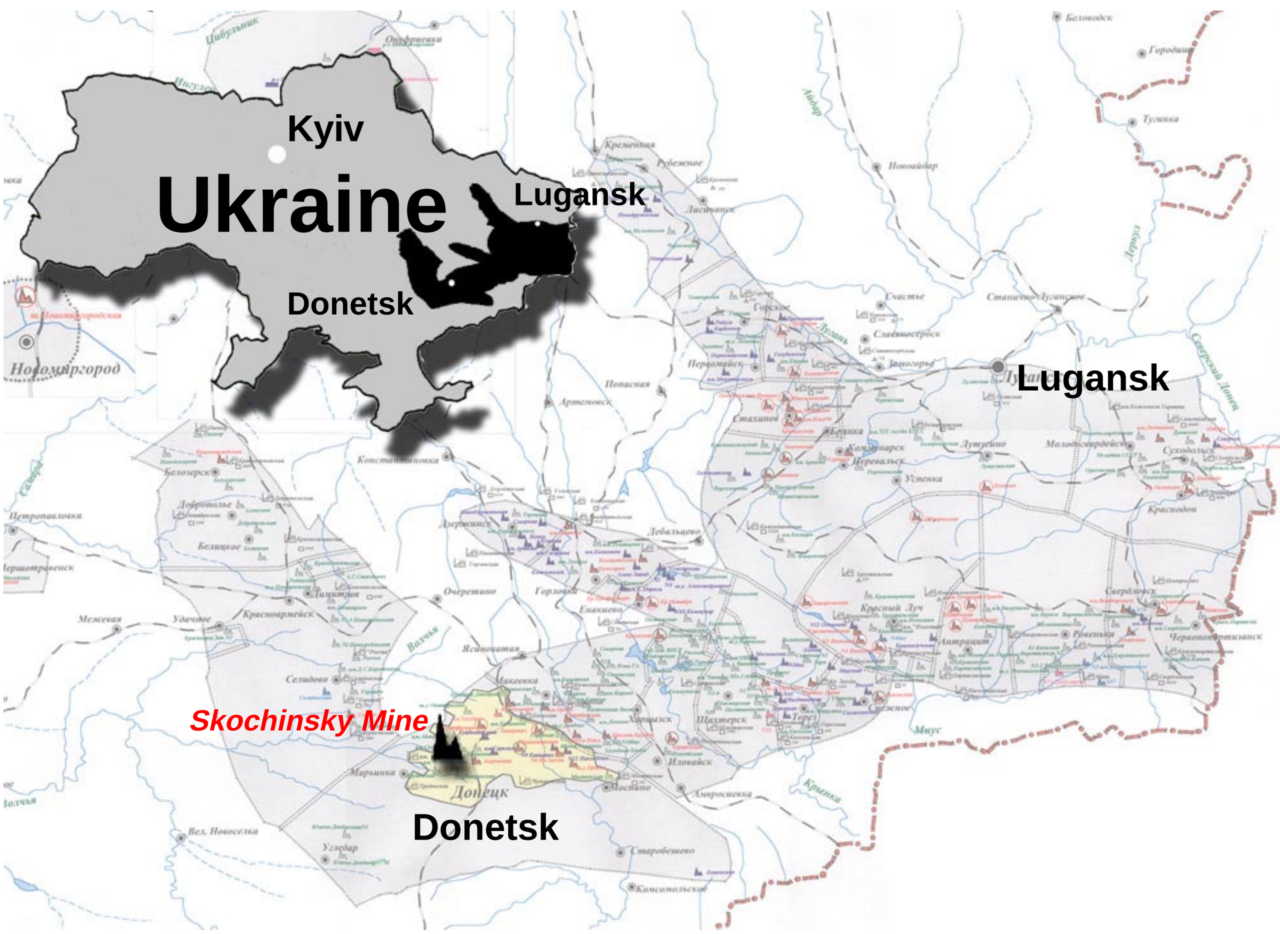


Table 1: Cash Flow and Economics

	Year 1	Year 2	Year 3	Year 4	Year 5
Gob Wells Started	4	8	8	0	0
Investment Per Well	$231 000	$231 000	$231 000	$231 000	$231 000
Pilot Wells in Production	1	1	1	1	1
Total Gob Wells in Production	5	13	21	21	21
Standard Wells Started	44	40	40	0	0
Investment Per Well	$331 000	$331 000	$331 000	$331 000	$331 000
Pilot Wells in Production	5	5	5	5	5
Total Standard Wells in Production	49	89	129	129	129

Gob Well Cash Flow - (each)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Net Production Revenue	$ 124 054	$ 150 366	$ 108 887	$ 86 022	$ 71 047	$ 60 246	$ 52 050	$ 45 654	$ 40 483	$ 36 270	$ 775 077
Depreciation	($ 32 340)	($ 32 340)	($ 32 340)	($ 32 340)	($ 32 340)	($ 32 340)	($ 32 340)	($ 4 620)	$ —	$ —	($ 231 000)
Taxable Income	$ 91 714	$ 118 026	$ 76 547	$ 53 682	$ 38 707	$ 27 906	$ 19 710	$ 41 034	$ 40 483	$ 36 270	$ 544 077
Standard Well Cash Flow - (each)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Net Production Revenue	$ 199 849	$ 242 248	$ 175 414	$ 138 569	$ 114 440	$ 97 052	$ 83 839	$ 73 536	$ 65 225	$ 58 408	$1 248 580
Depreciation	($ 46 340)	($ 46 340)	($ 46 340)	($ 46 340)	($ 46 340)	($ 46 340)	($ 46 340)	($ 6 620)	$0	$0	($331 000)
Taxable Income	$ 153 509	$ 195 908	$ 129 074	$ 92 229	$ 68 100	$ 50 712	$ 37 499	$ 66 916	$ 65 225	$ 58 408	$ 917 580

Taxable Income	Year 0*	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Total
Gob Wells Started in Year 1		$366 855	$472 103	$306 188	$214 727	$154 826	$111 624	$78 839	$164 134	$161 932	$145 080			$2 176 308
Gob Wells Started in Year 2			$733 710	$944 206	$612 375	$429 454	$309 652	$223 247	$157 678	$328 269	$323 865	$290 161		$4 352 617
Gob Wells Started in Year 3				$733 710	$944 206	$612 375	$429 454	$309 652	$223 247	$157 678	$328 269	$323 865	$290 161	$4 352 617
Gob Well Pilot Project		$88 306	$46 827	$23 962	$8 987	($1 814)	($10 010)	($16 406)	$31 617	$36 270				$207 738
Standard Wells Started in Year 1		$6 754 414	$8 619 930	$5 679 256	$4 058 094	$2 996 418	$2 231 337	$1 649 943	$2 944 304	$2 869 896	$2 569 930			$40 373 520
Standard Wells Started in Year 2			$6 140 376	$7 836 300	$5 162 960	$3 689 176	$2 724 016	$2 028 488	$1 499 948	$2 676 640	$2 608 996	$2 336 300		$36 703 200
Standard Wells Started in Year 3				$6 140 376	$7 836 300	$5 162 960	$3 689 176	$2 724 016	$2 028 488	$1 499 948	$2 676 640	$2 608 996	$2 336 300	$36 703 200
Standard Wells Pilot Project		$151 009	($114 161)	($260 452)	($356 116)	($425 152)	($477 536)	($518 469)	$143 141	$231 800				($1 625 937)
Total Taxable Income		$7 360 583	$15 898 785	$21 403 545	$18 481 533	$12 618 243	$9 007 713	$6 479 310	$7 192 557	$7 962 432	$8 652 780	$5 559 322	$2 626 461	$123 243 264
Income Tax Rate		**0.00%**	**0.00%**	**0.00%**	**15.00%**	**15.00%**	**15.00%**	**30.00%**	**30.00%**	**30.00%**	**30.00%**	**30.00%**	**30.00%**	
Income Tax		$0	$0	$0	($2 772 230)	($1 892 737)	($1 351 157)	($1 943 793)	($2 157 767)	$(2 388 730)	$(2 595 834)	$(1 667 796)	$(787 938)	$(17 557 982)
Income After Taxes		$7 360 583	$15 898 785	$21 403 545	$15 709 303	$10 725 507	$7 656 556	$4 535 517	$5 034 790	$5 573 702	$6 056 946	$3 891 525	$1 838 523	$105 685 282
Add non cash items:														
Depreciation		$3 040 710	$5 153 030	$7 265 350	$7 265 350	$7 265 350	$7 265 350	$7 265 350	$4 659 027	$2 414 080	$301 760	$0	$0	$51 895 360
Net Cash Flow From Operations		$10 401 293	$21 051 815	$28 668 895	$22 974 654	$17 990 857	$14 921 906	$11 800 867	$9 693 817	$7 987 782	$6 358 706	$3 891 525	$1 838 523	$157 580 642
Investment in Gob Wells	($443 285)	($924 000)	($1 848 000)	($1 848 000)	$0	$0								($5 063 285)
Investment in Standard Wells	($5 788 075)	($14 564 000)	($13 240 000)	($13 240 000)	$0	$0								($46 832 075)
Cash Flow After Investment	($6 231 360)	($5 086 707)	$5 963 815	$13 580 895	$22 974 654	$17 990 857	$14 921 906	$11 800 867	$9 693 817	$7 987 782	$6 358 706	$3 891 525	$1 838 523	$105 685 282
Cumulative Cash Flow	($6 231 360)	($11 318 067)	($5 354 251)	$8 226 644	$31 201 298	$49 192 155	$64 114 061	$75 914 929	$85 608 746	$93 596 528	$99 955 234	$103 846 759	$105 685 282	
Discount Rate		**39.70%**						* Pilot Project Evaluation Year						
PV of Cash Flows In		$30 583 504	Assumes flows come in at end of period											
PV of Cash Flows Out		($30 583 504)	Assumes flows go out at beginning of period											
Net Present Value		0												
Internal Rate of Return		**39.70%**												

Table 2: Pilot Project Drilling and Completion Cost Estimate

		Standard	Gob
	Well Type	**Standard**	**Gob**
	Number of Wells	**5**	**1**
	Total Depth - feet	**4,600**	**3,900**
	- meters	**1,400**	**1,200**
Drilling			
	Survey	$1 000	$1 000
	Location & Road	$15 000	$15 000
	Water	$5 000	$5 000
	Fuel	$30 000	$23 000
	Mob / De-mob	$72 000	$72 000
	Rig Cost	$156 800	$147 000
	Cementing	$25 000	$25 000
	Cementing Overhead	$11 000	$11 000
	Transportation	$5 000	$5 000
	Welding	$1 000	$1 000
	Logging	$20 000	$0
	Conductor Casing - Cost	$1 500	$1 500
	Surface Casing - Cost	$10 350	$10 350
	Production Casing - Cost	$22 000	$15 000
	Mud	$7 500	$7 500
	Bits	$12 000	$12 000
	Drilling Cost per Well	$395 150	$351 350
	Contingency (10%)	$39 515	$35 135
	Total Drilling Cost Per Well	$434 665	$386 485
Completion			
	CEMENT PRODUCTION CASING		
	Cementing Overhead	$5 500	
	Equipment	$18 000	
	Materials	$3 700	
	Personnel	$6 600	
	Sub-Total	$33 800	$0
	CEMENT BOND LOGS		
	Mob / De-Mob - Prorated: 5 Wells	$900	
	Service	$5 850	
	Sub-Total	$6 750	$0
	FRACTURE STIMULATION		
	Mob / De-mob - Prorated: 5 Wells	$54 000	
	Equipment	$260 000	
	Materials	$208 000	
	Personnel	$48 000	
	Bridge Plugs	$15 000	
	Perforating	$2 000	
	Sub-Total	$587 000	$0
	WELL CLEANOUT		
	Rig Time	$29 400	
	Tools	$4 000	
	Sub-Total	$33 400	$0
	TANGIBLES		
	2-7/8" Production Tubing	$10 000	$7 800
	Rods & Pump	$12 000	$9 000
	Pumping Unit	$30 000	$30 000
	Surface Equipment	$10 000	$10 000
	Sub-Total	$62 000	$56 800
	Total Completion Cost (Per Well)	$722 950	$56 800
Summary			
	Total Cost Per Well	**$1 157 615**	**$443 285**
	Total Project Costs	**$5 788 075**	**$443 285**
	GRAND TOTAL	**$6 231 360**	

Table 3: Pilot Project Economic Evaluation for Five Standard Wells

Assumptions:

Capital Cost	$5 788 075
Gas Price ($/kcm)	$60.00
Gathering Costs ($/kcm)	$11.20
Pipeline Tariff ($/kcm)	$3.50
Misc. Op'g Costs ($/kcm)	$5.25
G & A ($/kcm)	$1.75
Depreciation	14%

Production Profile for Five Standard Wells

Reserves (kcm*) 515 000

Year of Operation	*Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Yr*
0	56.74	20 710	20 710	4.02%	
1	68.77	25 100	45 810	8.90%	21.20%
2	49.80	18 177	63 987	12.42%	-27.58%
3	39.34	14 357	78 344	15.21%	-21.01%
4	32.49	11 859	90 203	17.52%	-17.40%
5	27.55	10 057	100 260	19.47%	-15.20%
6	23.81	8 689	108 949	21.16%	-13.60%
7	20.88	7 620	116 570	22.63%	-12.30%
8	18.52	6 760	123 330	23.95%	-11.29%
9	16.58	6 052	129 382	25.12%	-10.47%

Results:(Year)	*0 ***	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Gas Production (kcm/yr)	20 710	25 100	18 177	14 357	11 859	10 057	8 689	7 620	6 760	6 052
Gross Revenue	$0	$1 506 014	$1 090 605	$861 428	$711 564	$603 413	$521 349	$457 225	$405 591	$363 132
Gathering Costs	$0	($281 123)	($203 580)	($160 800)	($132 825)	($112 637)	($97 319)	($85 349)	($75 710)	($67 785)
Pipeline Tariff	$0	($87 851)	($63 619)	($50 250)	($41 508)	($35 199)	($30 412)	($26 671)	($23 659)	($21 183)
Misc. Operating Costs	$0	($131 776)	($95 428)	($75 375)	($62 262)	($52 799)	($45 618)	($40 007)	($35 489)	($31 774)
G & A	$0	($43 925)	($31 809)	($25 125)	($20 754)	($17 600)	($15 206)	($13 336)	($11 830)	($10 591)
Net Production Revenue	$0	$961 339	$696 170	$549 878	$454 215	$385 179	$332 795	$291 862	$258 902	$231 800
Depreciation	$0	($810 331)	($810 331)	($810 331)	($810 331)	($810 331)	($810 331)	($810 331)	($115 761)	$0
Taxable Income	$0	$151 009	($114 161)	($260 452)	($356 116)	($425 152)	($477 536)	($518 469)	$143 141	$231 800

*1,000 cubic meters

** Pilot Project Evaluation Year

Table 4: Pilot Project Economic Evaluation for One Gob Well

Assumptions:

Capital Cost	$443 285
Gas Price ($/kcm)	$60.00
Gathering Costs ($/kcm)	$11.20
Pipeline Tariff ($/kcm)	$3.50
Misc. Op'g Costs ($/kcm)	$5.25
G & A ($/kcm)	$1.75
Depreciation	14%

Production Profile for One Gob Well

Reserves (kcm*) 45 000

Year of Operation	*Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Year*
0	8.87	3 239	3 239	7.20%	
1	10.76	3 926	7 165	15.92%	21.21%
2	7.79	2 843	10 008	22.24%	-27.59%
3	6.15	2 246	12 254	27.23%	-21.00%
4	5.08	1 855	14 109	31.35%	-17.41%
5	4.31	1 573	15 682	34.85%	-15.20%
6	3.72	1 359	17 041	37.87%	-13.60%
7	3.27	1 192	18 233	40.52%	-12.29%
8	2.90	1 057	19 290	42.87%	-11.33%
9	2.60	947	20 237	44.97%	-10.41%

Results:(Year)	*0 ** *	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Gas Production (kcm/yr)	3 239	3 926	2 843	2 246	1 855	1 573	1 359	1 192	1 057	947
Gross Revenue	$0	$235 560	$170 580	$134 760	$111 300	$94 380	$81 540	$71 520	$63 420	$56 820
Gathering Costs	$0	($43 971)	($31 842)	($25 155)	($20 776)	($17 618)	($15 221)	($13 350)	($11 838)	($10 606)
Pipeline Tariff	$0	($13 741)	($9 951)	($7 861)	($6 493)	($5 506)	($4 757)	($4 172)	($3 700)	($3 315)
Misc. Operating Costs	$0	($20 612)	($14 926)	($11 792)	($9 739)	($8 258)	($7 135)	($6 258)	($5 549)	($4 972)
G & A	$0	($6 871)	($4 975)	($3 931)	($3 246)	($2 753)	($2 378)	($2 086)	($1 850)	($1 657)
Net Production Revenue	$0	$150 366	$108 887	$86 022	$71 047	$60 246	$52 050	$45 654	$40 483	$36 270
Depreciation	$0	($62 060)	($62 060)	($62 060)	($62 060)	($62 060)	($62 060)	($62 060)	($8 866)	$0
Taxable Income	$0	$88 306	$46 827	$23 962	$8 987	($1 814)	($10 010)	($16 406)	$31 617	$36 270

*1,000 cubic meters
** Pilot Project Evaluation Year

Table 5: Drilling Program Schedule

	YEAR 1		YEAR 2		YEAR 3	
	Standard Wells	*Gob Wells*	*Standard Wells*	*Gob Wells*	*Standard Wells*	*Gob Wells*
Month 1	3	1	2	2	3	1
Month 2	3	1	3	1	4	0
Month 3	3	1	3	1	3	1
Month 4	4	0	3	1	3	1
Month 5	4	0	3	1	4	0
Month 6	4	0	4	0	3	1
Month 7	4	0	3	1	3	1
Month 8	4	0	3	1	3	1
Month 9	3	1	4	0	3	1
Month 10	4	0	4	0	3	1
Month 11	4	0	4	0	4	0
Month 12	4	0	4	0	4	0
Category Total	**44**	**4**	**40**	**8**	**40**	**8**
Year Total	**48**		**48**		**48**	
Grand Total	**144**					

Table 6: Development Project Well Cost Estimates

Standard Well Specifications
Depth: 4,600ft (1,400m)
cased, cemented to surface, logged & perforated multiple zone hydraulic fracture stimulation progressive cavity pump with electric motor

Gob Well Specifications
Depth: 3,900ft (1,200m)
slotted production casing insert, progressive cavity pump with electric motor

Intangibles	*Standard Well*	*Gob Well*
Permits	$500	$500
Road & drill site construction	$5 000	$5 000
Survey	$500	$500
Drilling	$48 000	$45 000
Cementing	$12 000	$8 000
Logging	$5 000	$0
Perforating	$12 000	$0
Hydraulic frac	$75 000	$0
Workovers and cleanout	$10 000	$10 000
Miscellaneous services	$10 000	$10 000
Sub-Total	**$178 000**	**$79 000**
Tangibles		
Casing (conductor, surface & production)	$15 000	$14 000
Tubing	$5 000	$5 000
Wellhead	$10 000	$10 000
Pump & rods	$15 000	$15 000
Surface facilities & equipment	$13 000	$13 000
Flow line & meters	$20 000	$20 000
Separator	$5 000	$5 000
Sub-Total	**$83 000**	**$82 000**
Total Drilling & Completion Costs	**$261 000**	**$161 000**
Other Costs		
Pro rata portion of gas & water gathering system	$30 000	$30 000
Contingency	$20 000	$20 000
Overhead	$20 000	$20 000
Sub-Total	**$70 000**	**$70 000**
Total Well cost	**$331 000**	**$231 000**

Table 7: Production Profile for One Standard Well

Reserves (kcm*) 206 000

Year of Operation	*Average Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Year*
1	14.30	5 218	5 218	2.53%	
2	17.33	6 325	11 543	5.60%	21.22%
3	12.55	4 580	16 123	7.83%	-27.59%
4	9.91	3 618	19 741	9.58%	-21.00%
5	8.19	2 988	22 729	11.03%	-17.41%
6	6.94	2 534	25 263	12.26%	-15.19%
7	6.00	2 189	27 452	13.33%	-13.61%
8	5.26	1 920	29 372	14.26%	-12.29%
9	4.67	1 703	31 075	15.08%	-11.30%
10	4.18	1 525	32 600	15.83%	-10.45%

Exhibit 2: Standard Well Daily Production Forecast

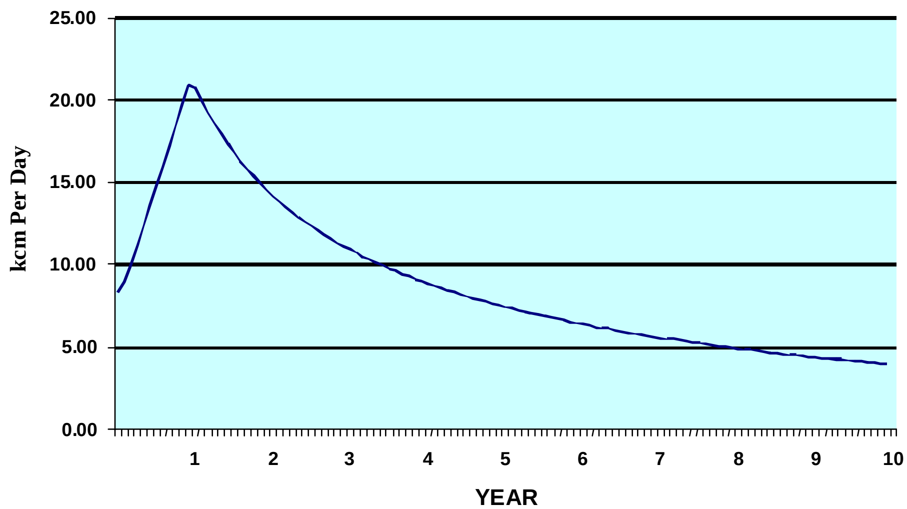
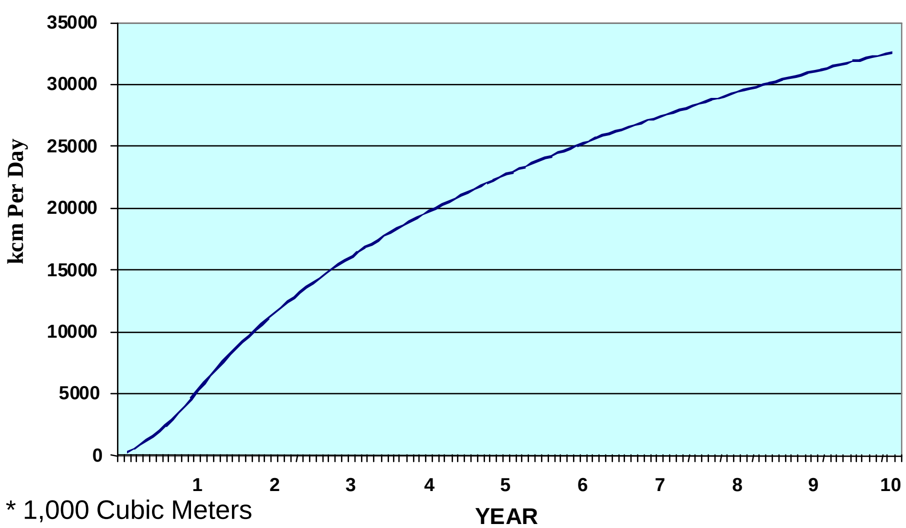


Exhibit 3: Standard Well Cumulative Production Forecast



* 1,000 Cubic Meters

Table 8: Production Profile for One Gob Well

Reserves (kcm*) 45 000

Year of Operation	*Average Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Year*
1	8.87	3 239	3 239	7.20%	
2	10.76	3 926	7 165	15.92%	21.21%
3	7.79	2 843	10 008	22.24%	-27.59%
4	6.15	2 246	12 254	27.23%	-21.00%
5	5.08	1 855	14 109	31.35%	-17.41%
6	4.31	1 573	15 682	34.85%	-15.20%
7	3.72	1 359	17 041	37.87%	-13.60%
8	3.27	1 192	18 233	40.52%	-12.29%
9	2.90	1 057	19 290	42.87%	-11.33%
10	2.60	947	20 237	44.97%	-10.41%

Exhibit 4: Gob Well Daily Production Forecast

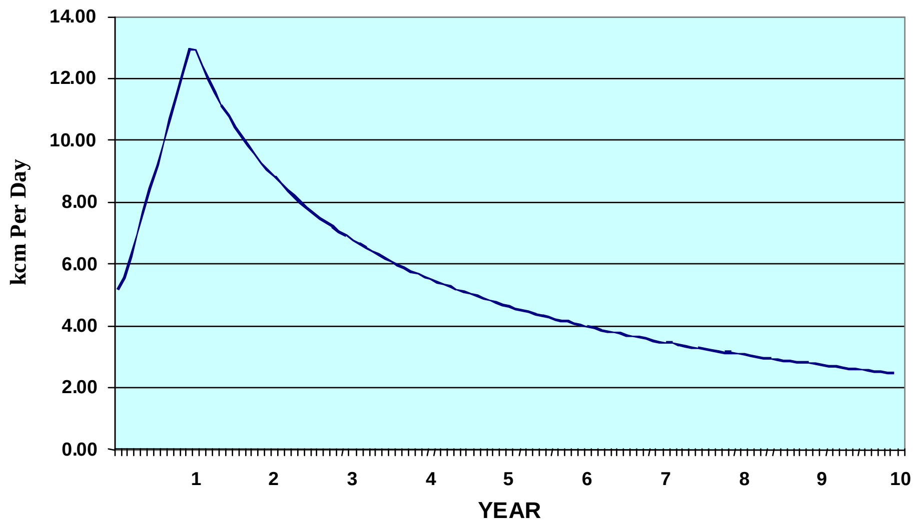
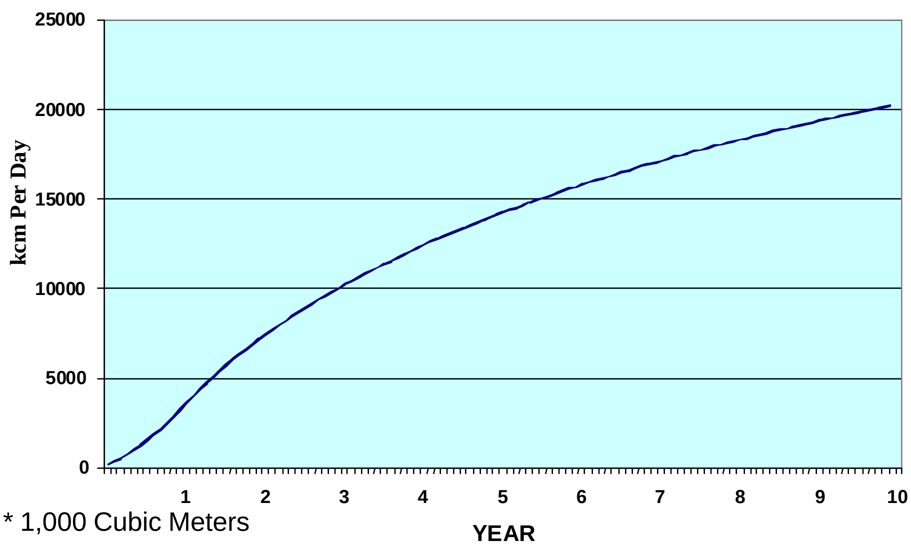


Exhibit 5: Gob Well Cumulative Production Forecast



* 1,000 Cubic Meters

Table 9: Project Gas Production

Wells Started:

Project Year:	**1**	**2**	**3**
Gob Wells Started	4	8	8
Pilot Gob Well	1	1	1
Standard Well Started	44	40	40
Pilot Standard Well	5	5	5

Well Production Year:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Gob Well Flow	3 239	3 926	2 843	2 246	1 855	1 573	1 359	1 192	1 057	947
Pilot Gob Well Flow	3 239	3 926	2 843	2 246	1 855	1 573	1 359	1 192	1 057	947
Standard Well Flow	5 218	6 325	4 580	3 618	2 988	2 534	2 189	1 920	1 703	1 525
Pilot 5 Standard Wells Flow	20 710	25 100	18 177	14 357	11 859	10 057	8 689	7 620	6 760	6 052

Project Year:	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gob Well Started Year 1		12 956	15 704	11 372	8 984	7 420	6 292	5 436	4 768	4 228	3 788	—	—
Gob Well Started Year 2			25 912	31 408	22 744	17 968	14 840	12 584	10 872	9 536	8 456	7 576	—
Gob Well Started Year 3				25 912	31 408	22 744	17 968	14 840	12 584	10 872	9 536	8 456	7 576
Pilot Gob Well		2 373	1 718	1 357	1 121	951	821	720	639	572	—	—	—
Standard Well Started Year 1		229 592	278 300	201 520	159 192	131 472	111 496	96 316	84 480	74 932	67 100	—	—
Standard Well Started Year 2			208 720	253 000	183 200	144 720	119 520	101 360	87 560	76 800	68 120	61 000	—
Standard Well Started Year 3				208 720	253 000	183 200	144 720	119 520	101 360	87 560	76 800	68 120	61 000
Pilot 5 Standard Wells		26 175	18 955	14 972	12 367	10 487	9 061	7 947	7 049	6 311	—	—	—
Annual Total:		271 096	549 309	748 261	672 016	518 962	424 718	358 723	309 312	270 811	233 800	145 152	68 576
Project Total:		4 570 736											

Note: all volumes in kcm

Table 10: Economic Evaluation for One Standard Well w/Tax Benefits

Assumptions:

Capital Cost per well	$331 000
Gas Price ($/kcm)	$60.00
Gathering Costs ($/kcm)	$11.20
Pipeline Tariff ($/kcm)	$3.50
Misc. Op'g Costs ($/kcm)	$5.25
G & A ($/kcm)	$1.75
Depreciation	14%
Income Tax:	
First Three Years	0.0%
Next Three Years	15.0%
Thereafter	30.0%

Production Profile for One Standard Well

Reserves (kcm*) 206 000

Year of Operation	*Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Year*
1	14.30	5 218	5 218	2.53%	
2	17.33	6 325	11 543	5.60%	21.22%
3	12.55	4 580	16 123	7.83%	-27.59%
4	9.91	3 618	19 741	9.58%	-21.00%
5	8.19	2 988	22 729	11.03%	-17.41%
6	6.94	2 534	25 263	12.26%	-15.19%
7	6.00	2 189	27 452	13.33%	-13.61%
8	5.26	1 920	29 372	14.26%	-12.29%
9	4.67	1 703	31 075	15.08%	-11.30%
10	4.18	1 525	32 600	15.83%	-10.45%

Results: (Year)	1	2	3	4	5	6	7	8	9	10
Gas Production (kcm/yr)	5 218	6 325	4 580	3 618	2 988	2 534	2 189	1 920	1 703	1 525
Gross Revenue	$313 080	$379 500	$274 800	$217 080	$179 280	$152 040	$131 340	$115 200	$102 180	$91 500
Gathering Costs	($58 442)	($70 840)	($51 296)	($40 522)	($33 466)	($28 381)	($24 517)	($21 504)	($19 074)	($17 080)
Pipeline Tariff	($18 263)	($22 138)	($16 030)	($12 663)	($10 458)	($8 869)	($7 662)	($6 720)	($5 961)	($5 338)
Misc. Operating Costs	($27 395)	($33 206)	($24 045)	($18 995)	($15 687)	($13 304)	($11 492)	($10 080)	($8 941)	($8 006)
G & A	($9 132)	($11 069)	($8 015)	($6 332)	($5 229)	($4 435)	($3 831)	($3 360)	($2 980)	($2 669)
Net Production Revenue	$199 849	$242 248	$175 414	$138 569	$114 440	$97 052	$83 839	$73 536	$65 225	$58 408
Depreciation	($46 340)	($46 340)	($46 340)	($46 340)	($46 340)	($46 340)	($46 340)	($6 620)	$0	$0
Taxable Income	$153 509	$195 908	$129 074	$92 229	$68 100	$50 712	$37 499	$66 916	$65 225	$58 408
Income Tax	$0	$0	$0	($13 834)	($10 215)	($7 607)	($11 250)	($20 075)	($19 567)	($17 522)
Income After Taxes	$153 509	$195 908	$129 074	$78 395	$57 885	$43 105	$26 249	$46 841	$45 657	$40 885
Net Cash Flow From Oper	$199 849	$242 248	$175 414	$124 735	$104 225	$89 445	$72 589	$53 461	$45 657	$40 885
Initial Investment	($331 000)									
Cumulative Net Cash Flow	($131 151)	$111 097	$286 511	$411 246	$515 471	$604 917	$677 506	$730 967	$776 624	$817 510

Economic Indicators:

<u>Discount Rate</u> 53.27%

<u>Discounted Net Cash Flow</u> $331 000 <u>Net Present Value</u> $0

<u>Internal Rate of Return</u> 53.27%

* kcm = 1,000 cubic meters

Table 11: Economic Evaluation for One Gob Well w/Tax Benefits

Assumptions:

Capital Cost per well	$231 000
Gas Price ($/kcm)	$60.00
Gathering Costs ($/kcm)	$11.20
Pipeline Tariff ($/kcm)	$3.50
Misc. Op'g Costs ($/kcm)	$5.25
G & A ($/kcm)	$1.75
Depreciation	14%
Income Tax:	
First Three Years	0.0%
Next Three Years	15.0%
Thereafter	30.0%

Production Profile for One Gob Well

Reserves (kcm*) 45 000

Year of Operation	*Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Year*
1	8.87	3 239	3 239	7.20%	
2	10.76	3 926	7 165	15.92%	21.21%
3	7.79	2 843	10 008	22.24%	-27.59%
4	6.15	2 246	12 254	27.23%	-21.00%
5	5.08	1 855	14 109	31.35%	-17.41%
6	4.31	1 573	15 682	34.85%	-15.20%
7	3.72	1 359	17 041	37.87%	-13.60%
8	3.27	1 192	18 233	40.52%	-12.29%
9	2.90	1 057	19 290	42.87%	-11.33%
10	2.60	947	20 237	44.97%	-10.41%

Results: (Year)	1	2	3	4	5	6	7	8	9	10
Gas Production (kcm/yr)	3 239	3 926	2 843	2 246	1 855	1 573	1 359	1 192	1 057	947
Gross Revenue	$194 340	$235 560	$170 580	$134 760	$111 300	$94 380	$81 540	$71 520	$63 420	$56 820
Gathering Costs	($36 277)	($43 971)	($31 842)	($25 155)	($20 776)	($17 618)	($15 221)	($13 350)	($11 838)	($10 606)
Pipeline Tariff	($11 337)	($13 741)	($9 951)	($7 861)	($6 493)	($5 506)	($4 757)	($4 172)	($3 700)	($3 315)
Misc. Operating Costs	($17 005)	($20 612)	($14 926)	($11 792)	($9 739)	($8 258)	($7 135)	($6 258)	($5 549)	($4 972)
G & A	($5 668)	($6 871)	($4 975)	($3 931)	($3 246)	($2 753)	($2 378)	($2 086)	($1 850)	($1 657)
Net Production Revenue	$124 054	$150 366	$108 887	$86 022	$71 047	$60 246	$52 050	$45 654	$40 483	$36 270
Depreciation	($32 340)	($32 340)	($32 340)	($32 340)	($32 340)	($32 340)	($32 340)	($4 620)	$0	$0
Taxable Income	$91 714	$118 026	$76 547	$53 682	$38 707	$27 906	$19 710	$41 034	$40 483	$36 270
Income Tax	$0	$0	$0	($8 052)	($5 806)	($4 186)	($5 913)	($12 310)	($12 145)	($10 881)
Income After Taxes	$91 714	$118 026	$76 547	$45 630	$32 901	$23 720	$13 797	$28 724	$28 338	$25 389
Net Cash Flow From Oper	$124 054	$150 366	$108 887	$77 970	$65 241	$56 060	$46 137	$33 344	$28 338	$25 389
Initial Investment	($231 000)									
Cumulative Net Cash Flow	($106 946)	$43 420	$152 306	$230 276	$295 516	$351 576	$397 713	$431 057	$459 395	$484 784

Economic Indicators:

Discount Rate	45.64%		
Discounted Net Cash Flow	$231 000	Net Present Value	$0
Internal Rate of Return	45.64%		

* kcm = 1,000 cubic meters

Table 12: Economic Evaluation for One Standard Well w/o Tax Benefits

Assumptions:

Capital Cost per well	$331 000
Gas Price ($/kcm)	$60.00
Gathering Costs ($/kcm)	$11.20
Pipeline Tariff ($/kcm)	$3.50
Misc. Op'g Costs ($/kcm)	$5.25
G & A ($/kcm)	$1.75
Depreciation	14%
Income Tax:	
First Three Years	30.0%
Next Three Years	30.0%
Thereafter	30.0%

Production Profile for One Standard Well

Reserves (kcm*) 206 000

Year of Operation	*Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Year*
1	14.30	5 218	5 218	2.53%	
2	17.33	6 325	11 543	5.60%	21.22%
3	12.55	4 580	16 123	7.83%	-27.59%
4	9.91	3 618	19 741	9.58%	-21.00%
5	8.19	2 988	22 729	11.03%	-17.41%
6	6.94	2 534	25 263	12.26%	-15.19%
7	6.00	2 189	27 452	13.33%	-13.61%
8	5.26	1 920	29 372	14.26%	-12.29%
9	4.67	1 703	31 075	15.08%	-11.30%
10	4.18	1 525	32 600	15.83%	-10.45%

Results: (Year)	1	2	3	4	5	6	7	8	9	10
Gas Production (kcm/yr)	5 218	6 325	4 580	3 618	2 988	2 534	2 189	1 920	1 703	1 525
Gross Revenue	$313 080	$379 500	$274 800	$217 080	$179 280	$152 040	$131 340	$115 200	$102 180	$91 500
Gathering Costs	($58 442)	($70 840)	($51 296)	($40 522)	($33 466)	($28 381)	($24 517)	($21 504)	($19 074)	($17 080)
Pipeline Tariff	($18 263)	($22 138)	($16 030)	($12 663)	($10 458)	($8 869)	($7 662)	($6 720)	($5 961)	($5 338)
Misc. Operating Costs	($27 395)	($33 206)	($24 045)	($18 995)	($15 687)	($13 304)	($11 492)	($10 080)	($8 941)	($8 006)
G & A	($9 132)	($11 069)	($8 015)	($6 332)	($5 229)	($4 435)	($3 831)	($3 360)	($2 980)	($2 669)
Net Production Revenue	$199 849	$242 248	$175 414	$138 569	$114 440	$97 052	$83 839	$73 536	$65 225	$58 408
Depreciation	($46 340)	($46 340)	($46 340)	($46 340)	($46 340)	($46 340)	($46 340)	($6 620)	$0	$0
Taxable Income	$153 509	$195 908	$129 074	$92 229	$68 100	$50 712	$37 499	$66 916	$65 225	$58 408
Income Tax	($46 053)	($58 772)	($38 722)	($27 669)	($20 430)	($15 214)	($11 250)	($20 075)	($19 567)	($17 522)
Income After Taxes	$107 457	$137 135	$90 352	$64 561	$47 670	$35 499	$26 249	$46 841	$45 657	$40 885
Net Cash Flow From Oper	$153 797	$183 475	$136 692	$110 901	$94 010	$81 839	$72 589	$53 461	$45 657	$40 885
Initial Investment	($331 000)									
Cumulative Net Cash Flow	($177 203)	$6 272	$142 964	$253 864	$347 874	$429 713	$502 302	$555 763	$601 421	$642 306

Economic Indicators:

Discount Rate	38.94%		
Discounted Net Cash Flow	$331 000	Net Present Value	$0
Internal Rate of Return	38.94%		

* kcm = 1,000 cubic meters

Table 13: Economic Evaluation for One Gob Well w/o Tax Benefits

Assumptions:

Capital Cost per well	$231 000
Gas Price ($/kcm)	$60.00
Gathering Costs ($/kcm)	$11.20
Pipeline Tariff ($/kcm)	$3.50
Misc. Op'g Costs ($/kcm)	$5.25
G & A ($/kcm)	$1.75
Depreciation	14%
Income Tax:	
First Three Years	30.0%
Next Three Years	30.0%
Thereafter	30.0%

Production Profile for One Gob Well

Reserves (kcm*) 45 000

Year of Operation	*Production, kcm per day*	*Production, kcm per year*	*Cumulative Production, kcm*	*Cumulative Production, % of Reserves*	*Decline Rate % of Prior Year*
1	8.87	3 239	3 239	7.20%	
2	10.76	3 926	7 165	15.92%	21.21%
3	7.79	2 843	10 008	22.24%	-27.59%
4	6.15	2 246	12 254	27.23%	-21.00%
5	5.08	1 855	14 109	31.35%	-17.41%
6	4.31	1 573	15 682	34.85%	-15.20%
7	3.72	1 359	17 041	37.87%	-13.60%
8	3.27	1 192	18 233	40.52%	-12.29%
9	2.90	1 057	19 290	42.87%	-11.33%
10	2.60	947	20 237	44.97%	-10.41%

Results: (Year)	1	2	3	4	5	6	7	8	9	10
Gas Production (kcm/yr)	3 239	3 926	2 843	2 246	1 855	1 573	1 359	1 192	1 057	947
Gross Revenue	$194 340	$235 560	$170 580	$134 760	$111 300	$94 380	$81 540	$71 520	$63 420	$56 820
Gathering Costs	($36 277)	($43 971)	($31 842)	($25 155)	($20 776)	($17 618)	($15 221)	($13 350)	($11 838)	($10 606)
Pipeline Tariff	($11 337)	($13 741)	($9 951)	($7 861)	($6 493)	($5 506)	($4 757)	($4 172)	($3 700)	($3 315)
Misc. Operating Costs	($17 005)	($20 612)	($14 926)	($11 792)	($9 739)	($8 258)	($7 135)	($6 258)	($5 549)	($4 972)
G & A	($5 668)	($6 871)	($4 975)	($3 931)	($3 246)	($2 753)	($2 378)	($2 086)	($1 850)	($1 657)
Net Production Revenue	$124 054	$150 366	$108 887	$86 022	$71 047	$60 246	$52 050	$45 654	$40 483	$36 270
Depreciation	($32 340)	($32 340)	($32 340)	($32 340)	($32 340)	($32 340)	($32 340)	($4 620)	$0	$0
Taxable Income	$91 714	$118 026	$76 547	$53 682	$38 707	$27 906	$19 710	$41 034	$40 483	$36 270
Income Tax	($27 514)	($35 408)	($22 964)	($16 105)	($11 612)	($8 372)	($5 913)	($12 310)	($12 145)	($10 881)
Income After Taxes	$64 200	$82 618	$53 583	$37 577	$27 095	$19 534	$13 797	$28 724	$28 338	$25 389
Net Cash Flow From Oper	$96 540	$114 958	$85 923	$69 917	$59 435	$51 874	$46 137	$33 344	$28 338	$25 389
Initial Investment	($231 000)									
Cumulative Net Cash Flow	($134 460)	($19 502)	$66 420	$136 338	$195 772	$247 646	$293 783	$327 127	$355 465	$380 854

Economic Indicators:

Discount Rate	33.51%
Discounted Net Cash Flow	$231 000
Internal Rate of Return	33.51%

Net Present Value $0

* kcm = 1,000 cubic meters

Exhibit 6: Stratigraphic Column