

INTRATECH inc

**DEFINITIONAL MISSION REPORT
OIL AND GAS SECTOR IN AFGHANISTAN**

FOR

U.S. TRADE AND DEVELOPMENT AGENCY

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Submitted by

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TABLE OF CONTENTS

	<i>Section</i>	Page
A.	Executive Summary	1
B.	Project Description	3
C.	Development Impact	13
D.	Project Sponsors Commitment	13
E.	Implementation Financing	13
F.	U.S. Export Potential	13
G.	Foreign Competition	15
H.	Impact on U.S. Labor	15
I.	Qualifications	15
J.	Justification	15
K.	Terms of Reference	16
L.	Recommendations	24
M.	Contacts	25

DM REPORT - Oil and Gas Sector in Afghanistan

A. EXECUTIVE SUMMARY

The Afghanistan Interim Administration (AIA) has placed a high priority on the development of the country's infrastructure including the transportation, water and energy sectors. They see the development of the oil and gas sector as a priority, since it will be an important source of revenue, and they recognize the critical role that the private sector must play. A World Bank assistance program (Emergency Infrastructure Reconstruction Program) consisting of a grant of US\$33 million has recently been approved and includes funds for the development of the oil and gas sector. The Bank has started policy-related technical assistance directed at the development of an institutional framework conducive to private sector participation.

The Ministry of Mines and Industry (MMI), which has the responsibility for the oil and gas sector, has placed priority on two projects a) the constructing of a natural gas pipeline between Sare-pul/Mazare-I-Sharif and Kabul, and b) updating and enhancing the geological information and definition of the future potential petroleum resources of the country.

The U.S. Trade and Development Agency (TDA) was part of a U.S. Government interagency delegation that visited Afghanistan in August 2002 to discuss a range of commercial and business development issues including the development of the oil and gas sector. INTRATECH was part of this Definitional Mission (DM) and was tasked by TDA to identify potential areas for TDA's participation in the downstream oil and gas sector. This report is based on discussions with the MMI and other interested parties in Kabul, and limited site visits and discussions in Sheberghan and Mazare-I-Sharif.

Based on these visit, the DM identified four potential activities to improve the downstream oil and gas sector in Afghanistan. These are as follows:

- 1) A Feasibility Study of a Natural **Gas Pipeline** between Sare-pul/Mazare-I-Sharif and Kabul including the distribution of gas and power generation in Kabul.
- 2) Technical Assistance to restart the **Gas Treatment plant** at Sheberghan, which currently limits gas production and utilization in the region.
- 3) Technical Assistance to improve the operations of the **Fertilizer Plant** at Qala Jangi which is operating at less than half of its potential capacity
- 4) A pre-feasibility study of a small (1-5,000 BPD) **refinery** to replace the current domestic oil processing facilities.

The DM also reviewed the past proposals to construct a trans-shipment pipeline from Turkmenistan through Afghanistan to Pakistan, since some sources were advocating

synergies and linkages between that pipeline and the Mazar to Kabul pipeline being currently proposed.

Observations and Recommendations.

- a) The DM believes that improving the operations of the Gas Treatment and Fertilizer plant could increase natural gas production by 40 percent, and increase fertilizer production from 40,000 tons per year to 100,000 tons per year in short order at relatively minor cost.
- b) The Sare-pul/Mazare-I-Sharif to Kabul natural gas pipeline appears to be in the national and regional interest in developing Afghanistan's domestic energy resources. It will also reduce imports of expensive liquid fuels as well as having beneficial social and environmental impacts.
- c) Limited observations of the current crude oil processing facility indicate that there are economics, safety and environmental reasons to replace these facilities with a centralized efficient refinery. A better definition of the optimum size and location of such a refinery is needed.

The DM recommends that TDA support these activities and has accordingly terms of reference and a Budget for these studies, which are presented in this report. The estimated budget for these activities is US\$1.11 million.

B. PROJECT DESCRIPTION

1. Local Production/Consumption Sheberghan/Mazar-e Sharif

The oil and gas fields in the Sheberghan region of Northern Afghanistan were developed in the 1960 to 1980 period with the assistance of the Soviet Union. Approximately a dozen natural gas fields were delineated and two were developed and put into production. Production from these fields was directed primarily at the export market. At the height of production approximately 4 billion M3 per year were reportedly exported to the north via a 32-inch trunk line. This line was replaced with a 42-inch line in the late eighties. A fertilizer plant to produce ammonia and urea was constructed near Qala Jangi south of Mazar-I-Sharif in the early 1970s. This plant is fed with sweet natural gas from Sheberghan via a dedicated 18-inch pipeline. The fertilizer plant has a nameplate capacity of 105,000 MT per year of urea production. A gas treatment facility was constructed on the Sheberghan gas fields in the 1970s with a capacity to treat approximately 2.5 billion M3 per year. The gas treatment facility removes condensate and H₂S using an amine treatment facility. Major gas compression capabilities were added to the treatment plant due to an unexpected decline in gas reservoir pressure.

In the 1990s, Sheberghan natural gas was piped to Mazar-I-Sharif and other local towns for domestic, industrial and power generation. It is estimated that local retail gas consumption amounts to 400 million M3 per year, not including that used for fertilizer production which is currently approximately 250 million M3 per year. The local distribution network was locally designed and constructed using the old 32-inch export line and excess stockpile drill casing.

2. Trans-shipment of Gas

The concept of exporting Turkmenistan natural gas to markets in Pakistan and potentially India were first broached in 1992 by a consortium consisting of an Argentinean Gas Company (Bridas), the Turkmenistan and Pakistan Governments. In 1995, American UNOCAL/Delta entered in an agreement with Russia's Gasprom and the Turkmenistan Government to construct a pipeline from the Dauletad Field in Turkmenistan to markets in Pakistan. While Gasprom withdrew from participation, the consortium (Central Asia Gas Pipeline Ltd - CentGas) was expanded with the addition of Japanese, Korean and Pakistani interests. The proposed 48-inch pipeline was to have carried up to 20 billion M3 per year from the Turkmenistan fields to Multan in Pakistan a distance 790 miles, with the possibility of an extension of 400 miles into India being a consideration. The estimated cost of the line to Multan was US\$1.9 billion with an additional US\$600 million for the extension into India. The proposed route for the pipeline was from the Afghanistan/Turkmenistan border following the Herat to Kandahar road through Afghanistan crossing the Pakistani border near Quetta to tie-in with existing pipelines at Multan in Pakistan. Subsequently in 1999, UNOCAL announced its withdrawal from

the project citing a) the continuing state of war in Afghanistan and b) the disappearance of the potential market in Pakistan for Turkmenistan Natural gas as a result of the development of alternative supplies within Pakistan.

Figure 1 Geographical Location of Projects

3. Natural Gas Treatment Facility at Sherberghan

A natural gas processing plant was constructed near Sheberghan in the mid 1970s. The plant is of Russian design though considerable Western components were used as a result of supplies tied to French financing. The plant was configured to treat the gas production from both the Djar Kuduk and Khodak Guderdag fields. The plant process configuration consists of gas condensate knockout and drying and H₂S removal using an amine wash facility. Subsequently, a gas compression capability was added due to the falling reservoir pressures. The plant is self-contained producing its own power and other utility needs and allowing for power export.

The original plant design capability was 2.5 million M³ per annum when fed with both sweet Djar Kuduk gas and high H₂S content gas from the Khodak Guderdag field (0.35 percent H₂S).

The gas treatment plant was closed when the Russians left in 1988. Since that time it has continued to operate primarily as a gas condensate knockout facility. The amine wash facilities have not been restarted due to the lack of technical expertise available to operate the plant. The operating personnel indicate that the operating manuals and other technical data have been retained and are available.

Currently the plant is treating gas from both fields. Total production amounts to approximately 700 million M³ per annum of which 400 million M³ is used for fuel purposes in the Sheberghan/Mazar area and 250 million M³ is used for fertilizer production. Gas supply to the fertilizer production facility is currently limited by H₂S specification limitations. Sour gas is blended in with the sweet gas to the extent possible while respecting the maximum H₂S limitation of 10mg per M³ dictated by the fertilizer plant ammonia loop catalyst sensitivity. The gas dispatched for local fuel usage is untreated and contains approximately 0.35 percent H₂S. No apparent ill effects have been reported from the use of sour gas by the residential consumers. Similarly there have been no reports of adverse corrosion of the gas distribution systems on account to the high H₂S content.

A limited walk-through plant inspection and discussion with the operating personnel indicates that the plant is relatively good condition and does not show evidence of plant cannibalization, massive corrosion and/or lack of maintenance as indicated by Figures 1 through 7. However, the true condition of the plant (which has stood un-operated for 14 years) can only be determined by a detailed internal and external inspection of the facilities.

Figure 2 - Amine Unit

Figure 3 – Amine Treatment Unit

Figure 4 – Amine Unit

4. Fertilizer Production Facility

A fertilizer production facility producing ammonia and urea is located at Qala Jangi some 25 kilometers south of Mazar-I-Sharif. This facility is owned and operated by the Ministry of Mines and Industry of the Government of Afghanistan. The facility was constructed by the Russians and commenced operation in 1974 and continues operation to this day, though at reduced capacity. The design of the plant and much of its equipment however dates back to the mid-sixties as there were delays encountered during the construction of the plant.

The plant production capacity is rated at 105,000 tons per year of urea, but is currently operating at less than 50 percent of capacity. It is reported that the Afghan national consumption/demand for urea is of the order of 160,000 tons per annum. The balance between the plant output and national demand, is imported from surrounding countries primarily Pakistan. The urea production from the facility is handed over to the Ministry of Agriculture, which is supposed to pay the facility its cost of production plus a 10 percent profit margin.

The plant consists of two parallel ammonia synthesis loops followed by urea production and prilling facility. The facility is self-contained with respect to processing capabilities, maintenance and utilities. This includes a 48-megawatt power station (4x12 megawatts capacity) for internal needs (16 megawatts) and export sales to the surrounding region of Mazar-I-Sharif.

The plant is fed with natural gas from the Sherberghan natural gas fields through a dedicated 18-inch gas main. The current feedstock usage is about 250 million M3 per annum. The gas feed is limited to a maximum H2S content of 10mg per M3 dictated by ammonia synloop catalyst sensitivity. Currently, the feedstock is a blend of sweet Djar Kuduk gas and high H2S content gas from the Khodak Guderdag field (0.35 percent H2S, having a blended H2S content of 7 mg per M3.

Total employment by the facility (including ancillary social and support personnel) is approximately 2700 employees.

Discussion with the facility management and an abbreviated walk-through inspection of the facilities resulted in the following observations.

The current low production rate of 40,000 tons per year is attributed to three problems:

- a) **Natural Gas Feedstock** - The total quantity of gas available to the plant is current limited by the availability of low sulfur gas from the Sherberghan gas fields. The non-operation of the amine treatment facilities at Sherberghan limits the maximum gas availability to 250,000 M3 per year. Plant Operation personnel are confident however, that they could run the facilities at rated capacity (105,000 tons per annum) if specification gas feedstock were available.
- b) **Maintenance** - The maintenance problems are primarily due to the lack of spare parts caused by the lack of money and also the difficulty of finding parts. Most of the needed spares are reportedly still available from Russian and other former Soviet State sources. The major high-maintenance areas are the ammonia loop gas compression and recycle areas, which consist of two 3-megawatt reciprocating compressors. Catalyst replacement has not been carried out for some time and a new batch (50 tons) of nickel ammonia synthesis catalyst is needed (estimated cost of approximately US\$250,000). Plant management estimates that the total cost of spare and supplies will be of the order of US\$24 million.
- c) **Operating/Maintenance Costs** - According to Plant Management, the facility is unable to obtain the necessary revenue from the Ministry of Agriculture needed to

operate the facility at capacity. This is attributed to the national fiscal problems that Afghanistan is facing.

Figure 5 - Ammonia Reactors

Figure 6 - Ammonia Loop Recycle Compressors

Figure 7 - Fertilizer Plant - Qala Jangi

5. Sheberghan/Kabul Natural Gas Pipeline

The city of Kabul is currently supplied with electrical power from two hydroelectric power plants located at Serabi (Mahli Par and Naghlu) with a total generating capability of 100 Megawatts. Supplemental power has in the past been provided by gas turbine driven generators in Kabul supplemented by power imports from Uzbekistan. This combination of power supply has meant that the city is susceptible to shortages in drought periods and the city must supplement power generation with expensive imported diesel fuel for the gas turbine.

The MMI would like to expand the supply of power for the city of Kabul from new generating capacity based on Afghanistan domestic natural gas reserves. This would require the construction of new generating capacity located either at the gas fields near Sheberghan in the north, or in Kabul if the gas were to be piped to the city. In the latter case, natural gas would also be available for distributed to residential, commercial and industrial consumers in Kabul. The Ministry estimates that the immediate gas market within the city is of the order of 1.5 billion M³ per year. In addition there would be

opportunities for the consumption of natural gas along the pipeline including some major energy users i.e. cement works.

The pipeline from Sheberghan to Kabul would be approximately 450 kilometers depending on the route taken and would pass through some rough mountainous terrain. A study of the potential routes was carried out by the Soviets in the 1960s, and may still be available at the MMI.

6. Crude Oil Refining

In addition to the natural gas discoveries in Northern Afghanistan limited discoveries of crude oil were made in the 1960 to 1980 period. The main fields discovered and developed are Kashkari, Ak-Darya and Angot all in the province of Sare-pul. Total oil reserves are estimated to be of the order of 18 million tons.

Currently limited amounts of crude oil are being refined in a number of local batch type retorts. These are rudimentary batch distillation/cracking facilities as shown in Figures 8 and 9. The Ministry would like to centralize the crude refining operation by constructing a small refinery (1,000 to 5,000 BPD) in the vicinity of the Sheberghan Gas Treatment plant.

The Central Asian Gas and Oil Company, a private Russian/Tajikistan entrepreneurial company, has been working with both the previous Taliban government and the current AIA to build a 5000 bbl per day refinery in the Sare-pul area. The company has carried out a preliminary feasibility study with the assistance of Ventech in the US and is currently looking for financing for the project.

Figure 8 - Crude Processing Retorts

Figure 9 - Crude Processing – Condensers

While it appears that preliminary feasibility studies have been made of the refinery itself, these do not appear to have addressed the underlying factors of future Afghan crude oil production capabilities, petroleum product market demands, petroleum policies, pricing and economics that are needed to support a commercial private sector project today.

B. DEVELOPMENT IMPACT

The AIA continues to stress that the immediate stability and future of the country will depend on the ability to reconstruct the basic infrastructure of the country, including

transportation, power, energy and water. The projects under consideration in this DM report are central to this reconstruction effort. The revitalization of the gas treatment and fertilizer plant in the north will in short order increase the domestic utilization of natural gas and more than double the output of fertilizer production. This will replace expensive imported fertilizer that will result in a saving of foreign exchange. In the longer term the use of domestic natural gas reserves piped to Kabul for power generation will result in a decrease in the foreign exchange drain on the country resulting from the import of power and/or diesel oil for power generation and would stimulate national industrial development and regional integration.

C. PROJECT SPONSOR'S COMMITMENT

The Minister of Mines and Industry, in a letter to the Ambassador of the United States in Kabul dated 7th August 2002, expressed the AIA's desire for arranging the speedy start of a feasibility study of the gas pipeline between Sare-pul/Mazar-I-Sharif and Kabul. He stressed that the actions already taken with the World Bank in developing the institutional framework indicates the country's desire to proceed with the development of the oil and gas sector in Afghanistan.

D. IMPLEMENTATION FINANCING

World Bank Funding - The World Bank has recently approved a US\$33 million grant for the Emergency Infrastructure Reconstruction Project to the AIA, including the oil and gas section. The AIA envisions development of the country's oil and gas potential as an important source of potential revenue, and has recognized the critical role the private sector can play. Through this grant, the Bank plans to fund policy related technical assistance in this sector directed at developing an institutional framework conducive to private sector development. This Definitional Mission served to identify areas for infrastructure development concurrent with the Bank's policy work.

E. U.S. EXPORT POTENTIAL

Fertilizer Plant – Qala Jangi - The Plant Management estimates that the total cost of spare and supplies needed for current operations is of the order of US\$24 million. A detailed listing of these requirements is shown in the Appendix of this report. Most of these spare parts would however be sourced from Soviet sources or from neighboring countries that are operating similar equipment.

Longer term it is not clear at this stage whether a major revamp of the existing plant or major replacement will be the best alternative to satisfy Afghanistan's longer term fertilizer needs. It can be speculated however that as a minimum the major high maintenance equipment, such as the recycle gas compressors will have to be replaced at a cost of approximately US\$ 50 million.

Sare-pul/Mazar-I-Sharif to Kabul Pipeline

The total investment required for the pipeline will depend to a large extent on the ultimate route taken and especially the obstacles that the pipeline will have to cross. A preliminary capital requirement was estimated to be of the order of US\$ 330 million and US\$440 million. This does not include the cost of gas distribution and utilization in Kabul or branching along the route from Sheberghan to Kabul. Based on this estimate an anticipated breakdown of components that could be imported from the US is as follows:

Table 1 – Pipeline Cost Estimate and Potential US Exports

<i>Component</i>	<i>Capital Cost</i>		<i>Potential US Export</i>
	<i>Million US\$</i>	<i>Percent</i>	<i>Million US\$</i>
Pipe and Freight	28.1	0	0.0
Coatings and Materials	11.9	50	5.9
Compressors	26.4	80	21.1
Controls and SCADA	7.4	80	5.9
Construction	128.3	50	64.2
EPCM	23.8	80	19.0
Security	30.0	30	9.0
Contingency	76.7		37.5
Total	332.6		162.7

Crude Oil Refinery

Preliminary estimates for a refinery in the 5 to 10,000 BPD range would be of the order of US\$10 to \$30 million, depending on configuration, infrastructure requirement and other factors. The potential US export component could be fairly large for a refinery this size since the use of prefabrication modules can be expected, which could be sourced out of the U.S.

F. FOREIGN COMPETITION

While currently there is a reluctance for most foreign countries to get involved in the development of the oil and gas sector in Afghanistan, this can be expected to change when stability and security is re-established in the country. The foreign interest and competitiveness that can then be expected, can be illustrated by the makeup of the CentGas consortium, which planned to build the pipeline across Afghanistan. This consisted of Unocal (U.S.), Gasprom (Russia), Delta Oil Company (Saudi Arabia),

INPEX and ITOCHU Exploration (Japan), Hyundai Engineering and Construction (Korea), the Crescent Group (Pakistan), and the Government of Turkmenistan.

G. IMPACT ON THE ENVIRONMENT

The construction of the Sare-pul to Kabul pipeline will allow the utilization of domestic natural gas for power generation and also for direct commercial residential and industrial usage. Natural gas will displace the use of fuel wood and charcoal in the capital city with a beneficial impact on the city's air quality as well as impacting the potential for the country's deforestation.

H. IMPACT ON US LABOR

Afghanistan does not currently export either natural gas and/or fertilizers. It does import urea fertilizer from its immediate neighbors. It is thus highly unlikely that the projects contemplated in this report will have an adverse impact on either the oil and gas or fertilizer sectors in the U.S.

I. QUALIFICATIONS

The contractor(s) to be considered for these projects should have the following qualifications:

- Experience in Gas Processing technology especially in Amine Treatment units
- Experience in Ammonia/Urea fertilizer production facilities
- Experience in the revamp/construction of Soviet designed processing facilities in the Eurasia region
- Experience in the design and construction of natural gas pipelines
- Experience in Natural Gas distribution and consumption

J. JUSTIFICATION

The projects covered in this report fit into the expressed policy of the AIA of strengthening the infrastructure of the country, which they consider a fundamental necessity for the rehabilitation of the country. The execution of these projects will have beneficial economic and social implications for the nation as well as for specific regions, and will foster inter-regional cooperation between the northern and central regions of the country.

K. TERMS OF REFERENCE

Separate Terms of Reference have been prepared for each of the four proposed areas of interest:

- a) Gas Treatment Plant Technical Assistance
- b) Fertilizer Plant Revamp
- c) Sare-pul/Sheberghan to Kabul Natural Gas Pipeline, and
- d) Crude Oil Refining facilities.

These four projects are inter-related and some activities will depend on the work of others. A combination of the four efforts could result in some saving of time and effort. A combined budget for the four projects has been prepared that reflecting this synergy.

a) Terms of Reference – Gas Treatment Plant

The objective of this study will be to a) determine the current condition of the natural gas processing plant, b) determine the requirements needed to bring the plant back on line consistent with the short term gas requirements for fertilizer production, and c) define the longer term needs for gas processing in the area.

Task 1	The contractor will review the currently available gas supply capabilities and the potential short-term gas consumption needs to define the gas treatment loads required from the plant. This shall include the options of expanding production from new or existing gas fields and include the longer-term potential of supplying natural gas to the Kabul region.
Task 2	The contractor will carry out an onsite inspection of the current assets of the plant processing facilities.
Task 3	Based on the results of Task 1 and 2 the contractor will define the minimum requirements needed to bring the facility back on line consistent with the short-term needs of natural gas in the region. This will include defining the hardware needs, technical assistance, training, and other requirements.
Task 4	The contractor shall analyze and define the long term needs to bring the facilities up to acceptable international standards of operation, consistent with the longer term gas consumption needs of the region and the potential expansion of gas supply to the Kabul area.
Task 5	The contractor will prepare a strategy for the revamp of the plant consistent with the short and long term requirements for gas treatment in Afghanistan

Task 6	The contractor will prepare a report detailing the result of Task 1 through 5
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b) Terms of Reference – Fertilizer Plant

The objective of the feasibility study/technical assistance program will be:

- a) To determine the needs of the fertilizer plan in the short term to bring production up to rated capacity of 105,000 Tons per year of urea
- b) To ascertain the longer term needs to allow sustainable operations at the plant to satisfy Afghanistan’s fertilizer needs

The feasibility study will consist of the following tasks:

Task 1	<p><i>Fertilizer Plant Overview</i> The contractor will meet with representatives from the Ministry of Mines and Industry and the Ministry of Agriculture in Kabul and Regional Agencies in Sheberghan to review the overall institutional and operational performance and potential future requirements of the plant within the context of natural gas supply/demand and the fertilizer requirement of the country.</p>
Task 2	<p><i>Plant Operations</i> The contractor will carry out an onsite inspection and discuss current and future operating experience and problems with the plant management of the fertilizer plant at Qala Jangi.</p>
Task 3	<p><i>Project Requirements</i> The contractor will review, analyze and recommend the necessary changes that are needed to bring the existing plant operations up to full existing rated capacity. This will include the defining of spare part needs, changes in operation, changes in management and any other institutional changes needed at both the plant and national level.</p>
Task 4	<p><i>Long Term Strategy</i> The contractor shall prepare recommendations for the longer term operations of the fertilizer plant including the potential need to replace high maintenance equipment (compressors, instrumentation) if warranted as well as the consideration of future expansion and/or replacement needs. This shall include preliminary cost estimates of the various options studied.</p>

Task 5	<p><i>Final Report</i> The contractor will prepare a final report giving the details of the results of Task 1- 4 and including a recommended strategy for both the short and longer-term requirement of the Fertilizer Plant to meet the needs of the Afghanistan agricultural requirements.</p>
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c) Terms of Reference - Kabul Natural Gas Pipeline

The AIA is interested in the supply of additional power to the city of Kabul based on power generation using Afghanistan’s natural gas resources, which are located in the north of the country. In addition to power generation there is a substantial demand for natural gas for industrial, commercial and residential utilization in the city of Kabul as well as the areas along the potential pipeline.

The feasibility study will look at the options of generating power either at the existing gas fields in the Mazar-I-Sharif area or in Kabul, as well as the distribution and utilization of natural gas for other purposes. The study will determine the gas demand for the various options, what natural gas production facilities additions/modifications that will be needed to satisfy the new demands, identify the potential routing options and cost for the pipeline to Kabul, as well as defining the potential natural gas demand requirements both in Kabul and the immediate pipeline route areas.

The objective of the feasibility study will be to prepare a Bankable document that will allow the Ministry of Industry and Energy to approach potential investors for funding of the pipeline. The study will include the following tasks:

Task 1	<p><i>Site Visits and Data Review</i> The contractor will meet with the relevant Ministries (Mines and Industries, Ministry of Power and Water) in Kabul and the Regional Ministries in Sheberghan to review the existing data, information and plans relative to the existing facilities, past studies and plans for energy supply and utilization in Afghanistan.</p>
Task 2	<p><i>Gas Demand Determination</i></p>

	<p>The contractor shall carry out a survey of the potential gas demand in Kabul and along the gas pipeline route from wellhead to final consumer. There currently exists an extensive network and gas distribution system in the Sheberghan/Mazar-I-Sharif area. The contractor will review the current patterns of gas utilization in this area to help in determining the future market demand patterns in other areas. The contractor together with the Ministries (MMI and MPW) will jointly assess the future demand for gas based power generation for the various options to be studied.</p>
<p>Task 3</p>	<p><i>Natural Gas Supply</i> Based on the results of Task 2 and the existing gas needs, the contractor will ascertain the total gas production needs from the existing gas facilities. The contractor together with the MMI and Regional agencies in Sheberghan /Mazar-I-Sharif will review the current gas production capabilities, and ascertain the expansion needs for both production and treatment facilities. This assessment shall include the potential resurgence of an export market for Afghani natural gas through the existing pipeline facilities.</p>
<p>Task 4</p>	<p><i>Pipeline Route(s)</i> The contractor will review available prior pipeline routing studies. The contractor, with the assistance of the MMI and Regional Agencies will identify potential route(s) from the gas fields to Kabul taking into consideration the gas supply/ demand profiles determined in Tasks 2 and 3, topographic and geographic considerations, and other social, risk and environmental factors. For the selected route(s), the contractor will identify the route and the reasons for its choice, identify any special considerations that will impact the construction of the pipeline and detail length and size, location of compression stations and branch spur lines. The survey will include maps, photographs, aerial and on-site surveys of critical areas and any other details that will significantly impact the construction and costs of the pipeline.</p>
<p>Task 5</p>	<p><i>Capital Cost Estimate - Pipeline</i> The contractor shall prepare a conceptual design of the selected pipeline in sufficient detail to allow an off-take and cost estimation of major equipment and supplies. The contractor shall pay specific attention to the construction cost estimate component of the pipeline in view of the special topographic and social aspects of the terrain that the pipeline will traverse.</p>

Task 6	<p><i>Capital Cost Estimate – Distribution System</i> The contractor shall prepare a conceptual design of the gas distribution within the city of Kabul and prepare a cost estimate of the system. This will include any specific requirements for major industrial consumers such as cement plants etc.</p>
Task 7	<p><i>Economic Analysis</i> The contractor shall prepare an economic cost estimate of the various options for producing power and delivering natural gas to the city of Kabul. The analysis shall include all cost aspects from wellhead to final consumer and shall include a comparison with the alternative sources of energy supply such as the import of power and fuel oils.</p>
Task 8	<p><i>Financial Analysis</i> The contractor shall identify and explore potential sources of financing for the project taking into consideration the special circumstances of Afghanistan. The contractor shall prepare a preferred strategy for the funding of the pipeline and ancillary distribution networks.</p>
Task 9	<p><i>Environmental Impact Statement</i> The contractor will prepare a preliminary Environmental Impact Statement.</p>
Task 10	<p><i>Final Report</i> The contractor will prepare a final report including the details of the project and presenting a recommended strategy for the financing and implementation of the project.</p>

d) Terms of Reference - Crude Oil Refinery

Crude oil is produced at several locations in the Sur-pul province of northern Afghanistan. This crude oil is currently being processed into finished products in a number of small batch processing plants by various entities. The MM&I would like to centralize and upgrade the crude processing efforts through the construction of a small (1000-5000 BPD) refinery.

These Terms of Reference (TOR) covers a pre-feasibility study directed at defining the feasibility of building a small refinery in Northern Afghanistan. The objectives of the study will be to:

- Review the current and future potential of oil production in the Northern Afghanistan Region.
- Define the optimum size, location, and configuration of the refinery based on current and future oil supply/demand in Afghanistan.
- Develop the cost and economics of the refinery and its impact both regionally and nationally.
- Develop a strategy for the implementation of the refinery if it proves to be viable.

The study will include the following tasks:

Task 1	<p><i>Kick off Meetings</i> The contractor will meet with the MMI in Kabul and with the appropriate Regional agencies in Northern Afghanistan to review the prior and current work done to establish the supply/demand of crude oil, refinery configuration and product needs of the country.</p>
Task 2	<p><i>Petroleum Supply and Demand Analysis</i> The contractor will review and analyze the current and potential future reserve and production of crude oil from the northern Afghanistan oil fields, and define the potential supply capabilities that should be used for the refinery design basis.</p>
Task 3	<p><i>Refinery Siting</i> The contractor will analyze potential alternative locations for the refinery taking into consideration all aspects from wellhead to final consumer delivery, and will recommend the optimum location for the refinery.</p>
Task 4	<p><i>Conceptual Design</i> The contractor will prepare a conceptual refinery-processing scheme including crude oil gathering and delivery to the refinery and allowing for all supporting off-sites and provision for product storage and dispatch.</p>

Task 5	<p><i>Cost Estimation</i> The contractor will prepare capital and operating cost estimates for the refinery and crude oil gathering and delivery facilities based on the conceptual design prepared in Task 4.</p>
Task 6	<p><i>Economic Analysis</i> The contractor will prepare overall economics for the refinery and compare the cost of petroleum products relative to imported products into Afghanistan</p>
Task 7	<p><i>Financial Analysis</i> The contractor will identify potential sources of financing and will prepare and analyze alternative options of financing on the viability of the project.</p>
Task 7	<p><i>Environmental Impact</i> The contractor will provide a preliminary environmental assessment of the operation of the refinery, taking into account the environmental impact of current operations that the refinery would replace</p>
Task 8	<p><i>Implementation Strategy</i> The contractor will prepare a recommended strategy for the implementation of the refinery (if warranted)</p>
Task 9	<p><i>Final Report</i> The contractor will prepare a report that will include the details of the above Tasks and will recommend the next steps needed to develop the project</p>

Combined Project Budget Estimate

	<u>ManDays</u>	<u>Rate</u>	<u>Total</u>	
A. Labor Costs				
Process	197	\$1,200	\$236,400	
Geologist	16	\$800	\$12,800	
Pipeline	153	\$800	\$122,400	
Mechanical	78	\$800	\$62,400	
Instrument	29	\$800	\$23,200	
Estimating	100	\$700	\$70,000	
Procurement	20	\$700	\$14,000	
Finance	30	\$1,000	\$30,000	
Environmental	70	\$1,000	\$70,000	
	693		<u>\$641,200</u>	
Hazardous Premium			\$160,300	
Total labor cost			<u>\$801,500</u>	
B. Other Costs				
Travel				
Trips	International	13	\$6,000	\$78,000
	Days/per Diem	352	\$200	\$70,400
Local -US		5	\$200	\$1,000
Afghanistan Trips		13	\$200	\$2,600
	Car Rental	45	\$200	\$9,000
Interpreters (days)		240	\$100	\$24,000
Communications FAX/Phone				\$9,000
Reproduction				\$11,000
Visas & other				<u>\$3,500</u>
Total other costs				<u>\$208,500</u>
C. Security			\$100,000	
<u>Total Cost</u>			\$1,110,000	

L. RECOMMENDATIONS

The in-country review of the existing natural gas sector in the Sheberghan/Mazar area in the north of Afghanistan indicates that significant short and long-term improvements could be made with relatively little capital expenditure. The re-commissioning of the gas treatment plant and revamp of the fertilizer plant would in short order double the fertilizer production output, and arrest the corrosion of the existing gas distribution system due to the non-treatment of sour gas.

Longer term, the construction of the natural gas pipeline to Kabul would provide much needed energy and power requirements for the capital city and would result in the inter-regional integration and optimization of energy use in the country. It would also serve as a basis for further industrial development as gas becomes available through out the country.

Funding is therefore recommended for the following four activities:

- a) A Feasibility Study/Technical Assistance Grant directed at re-starting the Gas Treatment Facility at Sheberghan,
- b) A Feasibility Study and Technical Assistance Grant to improve both the short and longer term operations of the fertilizer plant located near Mazar-I-Sharif,
- c) A Feasibility Study to investigate the viability of constructing a natural gas pipeline from Sare-pul/Mazar-I-Sharif to Kabul including power generation and gas distribution facilities in Kabul,
- d) A pre-feasibility study for the construction of a small Crude Oil refinery located in the Sare-pul/Sheberghan area.

The total budget to carry out above four activities is estimated to be US\$1.11 million.

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