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Introduction: Turkmenistan’s Oil and Gas Industry

The oil and gas industry is the backbone of the economy of Turkmenistan and the driving force for the country’s economic growth and development.

Exports of hydrocarbons and their products are the main source of income and foreign currency for the country. In accordance with the government’s budget for 2008, enterprises in the oil and gas and chemical sectors were to pay taxes making up about 70 percent of the income to the state at the central level.

The gas industry of Turkmenistan, the recipient of intensive development programs during the Soviet period, holds the dominant position in the oil and gas sector. According to an appraisal by BP Statistical Review of World Energy 2008, proven reserves of gas in Turkmenistan are 1.5 percent of proven reserves worldwide and 4.8 percent of proven reserves in countries of the former Soviet Union. These figures, however, do not include recent discoveries, announced by Ashgabat, of the South Yoloten-Osman fields. The audit of these reserves has not been finalized yet.

Turkmenistan’s gas production accounts for 2.2 percent of the gas produced worldwide and 7.9 percent of the gas produced in the countries of the former Soviet Union, where it ranks second to Russia.

Table 1. Comparison of reserves and production of liquid hydrocarbons and natural gas in Turkmenistan, Azerbaijan, Kazakhstan, Russia and Uzbekistan

<table>
<thead>
<tr>
<th>Country</th>
<th>Proved reserves</th>
<th>Production</th>
<th>Gas export</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oil, billion tons</td>
<td>Gas, tcm</td>
<td>Oil, million tons</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>1.0</td>
<td>1.28</td>
<td>42.8</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>5.3</td>
<td>1.90</td>
<td>68.7</td>
</tr>
<tr>
<td>Russia</td>
<td>10.9</td>
<td>44.65</td>
<td>491.3</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>0.1</td>
<td>2.67</td>
<td>9.8</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>0.1</td>
<td>1.74</td>
<td>4.9</td>
</tr>
</tbody>
</table>

* excludes exports of Central Asian gas


Among countries of Central Asia, Turkmenistan has probably the most ambitious strategy for development of the oil and gas industry. The industry’s development program for the period through 2030, approved by the People’s Council in October 2006, envisions a multiple increase in the production and processing of oil and gas, as well in exports of crude and petroleum...
products. Long-term planning for oil and gas production in the country is shaped by the outlook for exports.

According to the program, by 2030 annual production and exports of gas are expected to reach 250 bcm and 200 bcm, respectively; production and exports of oil will reach 110 million tons and 70 million tons per year, respectively; oil refining will reach 30 million tons per year.

Table 2. Key provisions of development program for Turkmenistan’s oil and gas industry through 2030

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2015</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gas, bcm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- production</td>
<td>70.5</td>
<td>160</td>
<td>175</td>
<td>250</td>
</tr>
<tr>
<td>- export</td>
<td>48.9</td>
<td>125</td>
<td>140</td>
<td>200</td>
</tr>
<tr>
<td><strong>Oil, million tons</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- production</td>
<td>10.3</td>
<td>30</td>
<td>50</td>
<td>110</td>
</tr>
<tr>
<td>- export</td>
<td>2</td>
<td>10</td>
<td>26</td>
<td>70</td>
</tr>
<tr>
<td><strong>Oil processing, million tons</strong></td>
<td>7.0*</td>
<td>16</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

* data for 2007

Source: Government of Turkmenistan

Table 3. Milestones in the development of Turkmenistan’s oil and gas industry

<table>
<thead>
<tr>
<th>Date</th>
<th>Milestones</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 1991</td>
<td>Turkmenistan declares its independence.</td>
</tr>
<tr>
<td>July 1992</td>
<td>Saparmurat Niyazov is elected as the country’s first President.</td>
</tr>
<tr>
<td>July 1996</td>
<td>Production sharing agreement is signed with Petronas Carigali (Malaysia). This is the first PSA for an offshore project (Block-1).</td>
</tr>
<tr>
<td>December 1997</td>
<td>Turkmenistan started gas deliveries to Iran</td>
</tr>
<tr>
<td>April 2000</td>
<td>The Program for Licensing Offshore Blocks in Turkmenistan’s sector of the Caspian Sea through 2010 is presented.</td>
</tr>
<tr>
<td>April 2003</td>
<td>Intergovernmental agreement on cooperation in gas industry between Russia and Turkmenistan</td>
</tr>
<tr>
<td>2004</td>
<td>The first phase of reconstruction and modernization of the</td>
</tr>
<tr>
<td>Date</td>
<td>Milestones</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>April 2006</td>
<td>Intergovernmental agreement is signed on construction of the Turkmenistan-China gas pipeline and delivery to China of up to 30 bcm of Turkmen gas per year.</td>
</tr>
<tr>
<td>October 2006</td>
<td>The Program for Development of the Oil and Gas Complex through 2030 is adopted. Turkmenistan declares discovery of large gas reserves at South Yoloten.</td>
</tr>
<tr>
<td>December 2006-February 2007</td>
<td>President Saparmurat Niyazov dies; Gurbanguly Berdymukhamedov is elected as new president.</td>
</tr>
<tr>
<td>May-December 2007</td>
<td>Agreement is reached between Turkmenistan, Russia and Kazakhstan for construction of the Pre-Caspian gas pipeline and a trilateral agreement is signed for its realization.</td>
</tr>
<tr>
<td>July 2007</td>
<td>China National Petroleum Corporation obtains license for exploration and production at the Bagtiyarlyk contract area under a production sharing agreement. CNPC and Turkmengas sign an agreement for delivery to China of up to 30 bcm of Turkmen gas per year for 30 years.</td>
</tr>
<tr>
<td>August 2008</td>
<td>The amended Law On Hydrocarbon Resources becomes effective.</td>
</tr>
<tr>
<td>November 2008</td>
<td>Gaffney Cline &amp; Associates announces the results of its audit of the South Yoloten field; results place the probable estimate of the field’s gas reserves at 6 trillion cubic meters.</td>
</tr>
</tbody>
</table>
Chapter 1. Management of the Oil and Gas Industry

Among the Central Asian countries, Turkmenistan has the most centralized management of the oil and gas industry. Pursuant to the newly amended law On Hydrocarbon Resources, which became effective on August 26, 2008, virtually all matters concerning the industry’s management come under the jurisdiction of a special body, the State Agency for Hydrocarbon Resources Management and Use under the President of Turkmenistan. The law, in essence, introduces direct presidential rule in the oil and gas industry.

Yagshygeldy Kakaev, head of the state concern Turkmengas since February 2007 and for more than ten years a department head within the Ministry of Oil and Gas Industry and Mineral Resources, was appointed to head the agency in August 2008.

In this section, the authors recapitulate the new law and other acts and provisions in order to provide the reader with an understanding of how the oil and gas industry operates in Turkmenistan. Because wording has been drawn from normative documents, there are two areas in which the reader may need clarification: 1) under Turkmen law, “oil operations” embraces gas operations; 2) the basis on which taxes will be assessed – on “income (or profit)” – are negotiated in the agreement, but the new law does not stipulate how these terms are to be defined.

1.1. Regulatory Bodies

1.1.1. State Agency for Hydrocarbon Resources Management and Use under the President of Turkmenistan

The agency is a legal entity that owns discrete property for which it is liable. It may establish and acquire enterprises and open representative offices, including those abroad.

The agency is invested with the authority to execute the following functions:

- Set standard rules for field development;
- Hold direct (non-exclusive) negotiations with an applicant for the license of a field and the accompanying agreement and sign that agreement;
- Prepare and hold tenders;
- Supervise oil operations, oversee compliance with laws of Turkmenistan in the conduct of those operations and ensure adherence to provisions of the license and the agreement;
- Suspend, resume, extend and cancel licenses in accordance with the abovementioned law;
- Coordinate activities among contractors during the conduct of oil operations;
• Hold negotiations and conclude agreements with appropriate foreign entities on construction and operation of pipelines and other facilities for transportation of hydrocarbon resources within their territories, as well as on matters of use of such transport facilities present and utilized in those countries.

To execute the functions with which it is entrusted, the agency has the right to verify the serviceability of equipment a contractor uses; to inspect contractor’s engineering, financial and other documents related to oil operations; to take samples of hydrocarbon resources or other substances on any territory within Turkmenistan where oil operations are conducted. It is empowered to issue to contractors directives fulfillment of which is mandatory.

Prior to the adoption of the revised law On Hydrocarbon Resources, powers granted to the agency had been distributed among the Committee for the Oil and Gas Industry and Mineral Resources under the Cabinet of Ministers of Turkmenistan, the Ministry of the Oil and Gas Industry and Mineral Resources, state concerns Turkmengas and Turkmenneft and the State Agency for Foreign Investment under the President of Turkmenistan. President Berdymukhamedov dissolved the latter body.

Along with holding unprecedented administrative powers, the agency is an independent business entity with considerable economic standing. It controls powerful resources and cash flows in the form of 90 percent of the bonuses, royalties and shares of profit paid by contractors to the government under production sharing terms. Moreover, once the contractor has recouped his costs, his property passes into ownership of the agency.

1.1.2. The Government

The powers of the Cabinet of Ministers in managing the oil and gas industry have been significantly reduced. The Cabinet determines the strategy and conditions for use of hydrocarbon resources, establishes rules for their protection and may impose restrictions on oil operations to preserve religious, historical and cultural monuments. Ministries and agencies within the limits of their competency have the right to inspect businesses in the oil and gas industry; however, they must first obtain written agreement from the State Agency for Hydrocarbon Resources Management and Use on their activities. In undertaking control and inspection, these ministries and agencies may not intervene in the relations of contracting parties.

1.1.3. State Concerns and Corporations

In this context, a concern or corporation is an industrial structure within Turkmenistan’s oil and gas industry engaged in oil operations independently, within the framework of joint activities or in other forms. There are presently four state concerns operating in the oil and gas industry:

• State concern Turkmengas is engaged in development of gas fields and production and processing of gas and gas condensate throughout Turkmenistan. It also transports gas within the republic and realizes its export.
• State concern Turkmenneft (Turkmennebit in the Turkmen language) is engaged in development of oil fields, production of oil throughout Turkmenistan and production of gas in the Western part of the Republic. It transports oil and gas (Turkmenneft manages the Korpedzhe — Kurt-Kui gas pipeline.).

• State corporation Turkmengeologia ensures development of the geological industry, comprehensive studies of Turkmenistan’s subsoil, control of geological subsoil studies and collection and storage of information concerning fields containing mineral resources. It explores prospective oil- and gas-bearing blocks and structures, prepares fields for development and then transfers them to state concerns Turkmengas and Turkmenneft.

• State concern Turkmenneftegasstroy carries out all types of construction and development of the republic’s oil and gas facilities.

In accordance with the new version of the law On Hydrocarbon Resources, these concerns assist the agency in the exercise of its functions and powers. A concern may sign agreements on joint activities and be a participant in joint activities.

1.2. Licensing of Activities

Turkmenistan has a license-contract system granting contractors access to subsoil areas for exploration and production of hydrocarbons.

A license certifies the right to conduct oil operations (that is, all forms of exploration and production activities).

Unlike the earlier law On Hydrocarbon Resources, the new document applies equally to domestic and foreign oil and gas companies. A foreign company is required to open a branch in Turkmenistan before obtaining a license.

Licenses may be issued as a result of tenders or direct (non-exclusive) negotiations. Tenders may be open (admitting all interested parties) or closed (admitting parties invited by the agency). The agency determines the method it will use to issue a license.

An applicant seeking a license must submit an application before direct (non-exclusive) negotiations may commence. In the event of a tender, procedures for the competition govern submission of application for a license.

The agency determines the practicability of conducting negotiations with each particular applicant based upon assessment of applications.

Earlier, tenders were held in two stages: a qualifying selection and then submission of competing bids. The new law makes no provision for such procedure.

Exploration licenses are issued for a term of up to six years and may be extended twice for periods of up to two years (maximum, 10 years). If a field is discovered, the contractor may receive a new exploration license for the period reasonably required to complete valuation of the discovery. This provision was introduced by the new law.
If the license holder discovers a commercial field, he receives the exclusive right to a production license. Production licenses are issued for a period of 20 years with the right to extension for five years. Under exceptional circumstances, when continued production meets the commercial interests of the state and the subsoil user, the term of a production license may be extended for another 10 years. This is another new provision benefiting the investor.

Licenses for exploration and production are issued for a term equal to an exploration license plus a production license, including all possible extensions.

If the subsoil user fails to adhere to license conditions, contractual obligations, work program or legal requirements, the agency may suspend the license for the period required to correct the violations. If violations are not rectified, the license is canceled. These measures may be applied if oil operations are not begun as scheduled.

The contractor is guaranteed free disposition of his interest in hydrocarbon resources both in Turkmenistan and abroad. Under extraordinary situations, the state has the right to compulsory alienation of part or all of the hydrocarbon resources, in which case it is obligated to compensate the contractor for his share of the hydrocarbon resources. In contrast to the earlier law providing for compensation at world market prices, the revised law stipulates compensation for alienated hydrocarbon resources at “fair prices”; that is, at prices the government deems acceptable.

1.3. Agreements

The new law contains a broader list of agreements that may be concluded with subsoil users. In addition to the production sharing agreement and the agreement on joint activity, both traditionally used in Turkmenistan, the new law permits royalty-and-tax concession agreements and at-risk service agreements.

The revised law contains an article on applicable law: agreements are governed and construed in accordance with exclusively Turkmenistan’s law. In the event that discrepancies arise between laws regulating oil operations, provisions of the law On Hydrocarbon Resources prevail. Where not regulated by said law, relations are regulated by other normative acts of Turkmenistan.

The law obliges the contractor to conduct oil operations at minimum reasonable cost in order to achieve the best economic performance. In the conduct of operations, the contractor is accountable for compliance with international standards of practice. He must give preference to competitive products that are locally manufactured and hire predominantly citizens of Turkmenistan, achieving the latter requirement by providing educational and training programs. No later than one year from the moment the agreement becomes effective, the number of foreign citizens employed by the contractor may not exceed 30 percent of the workforce.

The law specifies the procedure for reimbursing the contractor for costs he has incurred in discovering a commercial field. Quarterly payments to the contractor working under a production sharing agreement may not exceed the revenue to which he is entitled during the corresponding period for his share in hydrocarbon resources. Under other circumstances,
quarterly payments are determined by provisions of the agreement. If no field is discovered, the contractor’s costs are not reimbursed.

1.4. Rules for Conducting Oil Operations

As well as acquiring a license, the subsoil user must obtain approvals for conducting oil operations prior to beginning work at the site. In accordance with the Decree of the President of Turkmenistan on Approvals for Conducting Operations (dated April 6, 1994), an approval for operations is required for virtually all types of activities associated with exploration, production and transportation of hydrocarbon resources.

In 1999 the government assisted by foreign consultants developed new Rules for Conducting Oil Operations. They serve as a form of code for oil operations and encompass essentially all aspects of engineering design work (approvals, exploration plans, drilling assessments, field development, equipment safety, and others). These rules apply to all operators, contractors, state concerns, state organizations and other entities who “conduct or administer oil operations” in the country.

1.5. Pipeline Transport

In the new version of the law, the chapter devoted to pipeline transport has been broadened and made more concrete. While export pipelines remain the state’s property, field pipelines constructed by the contractor may be his property. The contractor may also take part in construction, financing, operation and maintenance of an export main pipeline: through a separate agreement with the agency, which is the customer for construction, or as a participant in a specially created company, owned jointly by the agency, the contractor, independent enterprises (companies) or other parties.

Another new feature of the law is a provision regulating access by third parties to additional or idle export pipeline capacity. It grants such access through a tender or negotiations with the state concern owning the transportation system –Turkmengas or Turkmenneft. When this occurs, the tariff for transportation of hydrocarbon resources via the export pipeline is fixed and collected by its owner per agreement with the agency.

1.6. Taxes and Other Payments

When carrying out oil operations, the contractor pays taxes on profit and subsoil use fees only. The tax rate on profit (or income) is established in the Tax Code of Turkmenistan and fixed in the agreement. Under the current tax code, legal entities are taxed at 20 percent of profit (or
income). The tax rate may not be changed during the term of the agreement, even if the rate is
time rate is changed in the Tax Code of Turkmenistan.

The contractor’s payments for the use of subsoil may include:

- A *royalty* for production of hydrocarbon resources – a percentage of the production
  volume or of the value of resources produced, payable by the contractor in cash or with
  a portion of the hydrocarbon resources produced
- A *bonus* in the form of a one time payment upon signing of the agreement, upon
  discovery of a commercial field, upon reaching a level of production of hydrocarbon
  resources determined in the agreement and in other cases as provided in the agreement

Equipment and materials that the contractor imports to conduct oil operations as well as the
products belonging to him under the agreement that he exports are exempt from customs duties
and fees. The right to duty-free import of equipment and materials also applies to
subcontractors.
Chapter 2. Turkmenistan’s Oil Industry

The development of Turkmenistan’s oil industry began in the Cheleken (Khazar) Peninsula in the western part of the country. The first wells were drilled here in the 1870s and produced over 12,000 tons annually at the beginning of the 20th century.

Regular commercial oil production in Turkmenistan began in the 1930s when the Nebitdag field was put into operation.

The following fields were discovered from the 1940s to the 1960s in the western part of the country: Kumdag (1948), Goturdepe (1956) and Barsagelmez (1962), which formed the republic’s core oil reserves.

The liquid hydrocarbons – oil and gas condensate – produced in Western Turkmenistan have good commercial characteristics. They contain almost no aggressive chemical components such as sulfur, CO2 or H2S.

2.1. Oil Reserves Base

As of year-end 2008, estimated geological resources of liquid hydrocarbons in Turkmenistan, according to official government data, amounted to 20.3 billion tons, including 12.1 billion tons offshore.

Most of the explored liquid hydrocarbon reserves are concentrated in Western Turkmenistan where 38 oil and gas and oil-gas condensate fields (including in the Caspian Sea) have been discovered to date.

According to Turkmen geologists, as of the beginning of 2006, explored reserves prepared for development (ABC1) amounted to 154.8 million tons (approximately 1.16 billion bbls), and preliminary estimated reserves (C2) stood at 126.3 million tons (947 million bbls). Accumulated oil production reached about 490 million tons (3,675 million bbls) by 2009.

Despite the significant volume of exploration work already completed, Turkmenistan’s reserves remain to significant extent under-explored. The average depth of exploration wells in the western part of the country is less than 3,900 meters, in the eastern part even less - about 3,600 m. This means that generally only the upper reservoirs of the oil and gas fields have been explored: the Neogene in the country’s west, and the Upper Mesozoic in the east. Turkmen geologists believe that significant hydrocarbon reserves can be found in the Miocene and Mesozoic deposits in the western part of Turkmenistan, and in the Jurassic and pre-Jurassic deposits in the central and eastern parts of the country at depths from 5,500 to 7,000 meters.

The first well drilled to the Miocene formations at the Akpatlavuk field (located close to the Caspian Sea in the south-western part of the country) confirmed that they are very promising. The stratigraphic well drilled to 5,500 meters yielded 207 cubic meters per day of oil and 80,000 cubic meters per day of gas.
2.2. Oil Production

The highest level of oil and condensate production in Turkmenistan during the Soviet era was reached in the mid 1970s. Crude production gradually decreased over the next two decades and then dropped significantly after the collapse of the USSR.

Chart 1. Oil production in Turkmenistan*, thousand tons

The lowest production level of 4.55 million tons was recorded in 1993. In the middle of the last decade the industry managed to recover and to reach, in 2003, the production level of 10 million tons per annum (MMta). After a period of growth, production decreased in 2005 and 2006. During 2007-2008 production was again on the rise with total production exceeding 10 million tons in 2008.

* Data for Turkmenneft includes oil production at the Khazar project, which Turkmenneft, the project’s operator, included in its reports

Source: Ministry of the Oil and Gas Industry and Mineral Resources of Turkmenistan
2.3. Industry Structure: Producers

There are three categories of producers that operate in the oil industry:

- State Concern Turkmenneft: operates in Western Turkmenistan;
- State Concern Turkmengas: produces gas condensate in Eastern Turkmenistan;
- Foreign operators working under PSAs.

At the beginning of 2009, five oil and oil and gas PSA projects with foreign participation have been operating in Turkmenistan - two onshore and three offshore.

Onshore:

- Nebitdag: operator is Burren Energy, registered in the UK;
- Khazar: JV between Turkmenneft and Mitro International, with Turkmenneft being the operator.

Offshore:

- Cheleken: operator is Dragon Oil, UAE;
• Block-1: operator is Petronas Carigali, Malaysia;
• Combined block 11/12: the project participants are Maersk Oil, Denmark, Wintershall, Germany, and ONGC Mittal, India; Wintershall is the operator).

It is important to point out that in the early 2000s onshore oil and gas fields in Turkmenistan were effectively closed to foreign investors for participation. Considering development of resources in the Caspian a high priority, the government offered to foreign companies participation in offshore projects only. The only exception is the PSA for the Bagtiyarlyk Contract Territory (on the right bank of the Amu Darya) signed in July 2007 between CNPC and the State Agency for the Management and Use of Hydrocarbon Resources. The rationale for this exception is strategic energy cooperation with China, which involves projects both in upstream (field development and drilling) and midstream (gas pipeline to China). The feasibility of a gas pipeline from Turkmenistan to China was examined as early as 1996 by Exxon and Mitsubishi, yet the project was never launched.

Chart 3. Operators of Turkmenistan’s oil/ oil and gas projects

<table>
<thead>
<tr>
<th>Turkmenneft</th>
<th>Operating companies of PSA projects</th>
<th>Turkmengas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gotur-Depeneft NGDU</td>
<td>Dragon Oil</td>
<td></td>
</tr>
<tr>
<td>Nebitdagneft NGDU</td>
<td>Burren Energy</td>
<td></td>
</tr>
<tr>
<td>Kumdagneft NGDU</td>
<td>Petronas Carigali</td>
<td></td>
</tr>
<tr>
<td>Kamyshldzhaneft NGDU</td>
<td>Wintershall</td>
<td></td>
</tr>
<tr>
<td>Chelekennfe NGDU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korpedzhe NGDU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khazarnebit NGDU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keimir NGDU</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: RPI

In 2008, Turkmenneft accounted for over 67% of all liquids production in Turkmenistan, which is a significant decrease compared with 2000, when Turkmenneft’s share of production stood at 83%.
Gas condensate production by Turkmengas has remained stable over the past few years at a level between 300,000 and 350,000 tons per year, i.e. about three percent of total liquids production.

Chart 4. Gas condensate production by Turkmengas, ‘000 tons

Source: Turkmengas

The share of oil produced within the projects operated by foreign investors has increased from 9% to about 33% between 2000 and 2008

2.3.1. Turkmenneft

As of the beginning of 2008, 25 oil and oil and gas fields were in commercial production in Western Turkmenistan. The largest fields are Goturdepe, Barsagelmez, Korpedzhe, Ekerem, Akpatlavuk, Keimir, and Gundogar (Eastern) Cheleken.

Nearly all fields in Western Turkmenistan have several reservoirs which include from several dozen to over a hundred deposits, which, in turn, are characterized by a wide variety of structure types, saturation, liquid to gas ratios, formation properties and other characteristics. For example, some sizeable oil deposits in the Gogerendag-Ekerem region in the south of Western Turkmenistan are formed as narrow oil fringes at large gas caps.
For several decades, most of Turkmenneft’s production came from two core fields – Goturdepe (pronounced as Koturdepe in Turkmen) and Barsagelmez, which were brought onstream in the 1950s and 1960s. In total, their share in Turkmenistan’s cumulative historic production is about two-thirds. Both fields are in the stage of depletion and their share in total production declines every year as new fields enter development and contribute to production. In 2000, the two core fields accounted for about 66% of total production, whereas by 2008 their share dropped to 52%.

Since the early 2000s, large-scale measures have been undertaken with the aim to stabilize and increase production in these and other mature fields. These measures include drilling new wells, re-activating idle wells, and applying production stimulation technologies such as bottom-hole treatment, artificial-lift production methods including high-pressure gas-lift, side-tracking, dual completion of wells and other technologies.

In the recent years, several new gas compressor stations were put into operation at Goturdepe and Barsagelmez with participation by Ukrainian and Italian companies. These high pressure gas lift systems allow to achieve deep levels for gas injection point and to increase the reservoir pressure.

As a result of intensive development measures, hydrocarbon production from the two fields stabilized over the last three years (2006-2008) at a level of 300,000 tons per month.

In addition to intensification of the development of old fields, more than ten new fields have been put into operation since the mid-1990s, mostly located in the south-western part of the country. New oil production centers were developed in the Gogerendag-Ekerem and Keimir-Chekishlyyar oil and gas bearing areas. Since the early 2000s, the fields located in the south-west, such as Korpedzhe, Gunorta (Southern) Gamyshlydzha, Nebitlidzha, Gundogar (Eastern) Cheleken and Keimir, have been the source of nearly all the balance of onshore oil production.

The most important fields in terms of production are the following:

- Korpedzhe, operated by Korpedzhe Oil & Gas Production Unit (NGDU), has current production of about 440,000 tons per year (1,200 t/d), or over six percent of Turkmenneft’s total production;
- Keimir and Akpatlavuk fields, operated by the Keimir Oil & Gas Production Unit, collectively have production of about 1,164 thousand tons per year (3,200 t/d), or about 17% of Turkmenneft’s total production;
- Southern (Gunorta) Kamyslydzha, Nebitlidzhe, Shatut fields, operated by the Gamyshlydzhanef Oil & Gas Production Unit, have combined production volume of over 1,500 thousand tons per year (about 4,100 t/d), or about 21% of Turkmenneft’s total production.
The Yashyldepe field, located on the right bank of the Amu Darya River, was put into operation in the autumn of 2004, which started the development of a new oil production center in the eastern part of the country. Infrastructure was constructed in a short period of time, which included oil treatment facilities, storage tanks, oil gathering station, and a 80-kilometer pipeline from Yashyldepe to Pelvert on the Amu Darya left bank, where crude is loaded into railroad tank cars and transported to the Seidi oil refinery.

Currently, a $42 million field development project is being implemented at Yashyldepe with the aim to increase oil production from 900 tons per day to 2,000 tons per day by new drilling. A contract was signed with the oilfield services division of Sinopec (China) for the drilling of six wells with a target depth of 3,100 meters. The wells are scheduled for commissioning in 2008 and 2009.

In mid-2006, Turkmenneft started commercial production at the Southern (Gunorta in Turkmen) Yoloten in the eastern part of the country. In December 2006, the concern executed a $140.5 million, three-year contract with Calyk Enerji (Turkey) for drilling at this field. According to the contract, the Turkish company is to drill 12 wells of up to 3,600 meters over three years.

Crude oil produced in Southern Yoloten is light oil with low sulfur content. The crude is transported via pipeline across the Kara Kum desert to the Soltanbent railroad terminal, where it is loaded into tank cars and transported by rail to the Seidi oil refinery.
2.3.2. Projects with Foreign Participation

2.3.2.1. Khazar

The project is developed under a production sharing agreement (PSA). The project participants are Turkmenneft (52%) and Mitro International Ltd. (registered in Panama) (48%). Under the PSA signed in 2000, the consortium is licensed to produce oil in the Khazar contract territory, including the Eastern Cheleken field, for 25 years with a right to extend it for a minimum of five years. Total investment should reach $300 million.

Khazar is the only project in Turkmenistan under PSA terms where the operator is Turkmenneft, which formed the Khazarenft production enterprise specifically for this project. Mitro International, the foreign partner, is fully responsible for project financing (under the PSA, the company is the 100% investor in the project) and for supplying required equipment and technology.

The project provides for workover and reactivation of idle wells, drilling of new production wells, including wells deeper than 4,500 meters.

The project’s implementation started in 2000. From 2001, the first full year of operations, to 2006, when production reached its peak, oil production volume grew by 60%. Over the next two years, production dropped to between 290,000 and 300,000 tons per year. The cumulative production from 2000 to the end of 2008 reached over 2.3 million tons. In 2005, the project began to provide positive returns on investment.
From the beginning of project implementation through June 2008 investment in field development and well drilling totaled about 250 million, with 30 new wells over 4,000 meters deep drilled and put into operation. Two of them – horizontal well #38 (over 4,000 meters deep with a horizontal section of 226 meters) and super-deep appraisal well #20 (6,030 meters) – are unique wells in terms of depth and design in Turkmenistan.

Formation evaluation and well logging performed during well drilling led to realization of the high efficiency of deep horizontal wells in Western Turkmenistan. The flow rate of deep horizontal well #38 was more than double the average flow rate of vertical wells with similar geological factors. Appraisal well #20 helped to determine the actual depth of Mesozoic deposits in the Cheleken area and estimate the prospects for oil and gas content in the Miocene and Eocene deposits. According to estimates by Mitro International, exploration has led to the adding of approximately five million tons of recoverable oil to the field's reserves. Further appraisal and exploration works in the block, including its shallow waters area, are planned in order to further add reserves.
2.3.2.2. Nebitdag

The PSA for the Nebitdag contract territory was signed in the summer of 1996 between the Turkmenistan government and three foreign companies, Mobil Oil, US (40%), Monument Oil & Gas, UK (35%), and Burren Energy plc, UK (25%). The PSA has a term of 25 years with an option to extend it for ten more years. In 2000, Burren Energy bought out its partners’ shares for $2 million, and became the only operator and investor in the project.

Before ENI SpA (Italy) bought the controlling interest (77.4% stake) in Burren Energy for €2.43 billion at the beginning of 2008, in terms of assets size Burren had been ranked the third largest independent oil and gas company in the UK. Apart from Turkmenistan, the company has oil assets in Egypt, Oman, Yemen, India and Congo, and ships oil across the Black Sea and the Volga-Don basin (Russia).

According to the company’s data, its proven and probable reserves at the beginning of 2007 totaled 2,168 MMbbl of oil equivalent, with more than half – 1,303 MMbbl - concentrated in Turkmenistan.

Under the PSA, the project participants have the right to produce and explore oil and gas in the 1,050 square kilometer contract territory located near Balkanabat (formerly Nebitdag). Five oil fields with long production life spans are located within the contract territory: Burun, Nebitdag, Kumdag, Gyzyklum and Karatepe.

Burren Energy has the right to produce hydrocarbons at the Burun field until 2022 (Turkmenneft is the operator at the other four fields), and the right to explore the other parts of the contract territory (the exploration license was valid until February 2007).

The investment program for the first stage of the project implementation under Burren Energy’s operatorship (up to 2004) was aimed at achieving the following:

- increase the stock of active wells through workover and re-activation of wells decommissioned earlier;
- convert wells, including deep wells (over 3,000 meters), to gas-lift production;
- upgrade production infrastructure, in particular gas-lift equipment, as well as oil treatment and storage facilities.

In 2004, the operator began a program of drilling new exploration wells. The first stage of exploration work – which included 3D seismic, data collection and interpretation – was completed in 2000. Further exploration involved 3D seismic gathering from areas in the previously unexplored south-eastern part of the contract territory, and the drilling of appraisal and exploration wells starting autumn of 2005.

From 2004 to 2007, the project operator drilled over 30 new production and appraisal wells, including a number of deep ones. In 2006 the operator discovered two new fields – Uzboy and Balkan.

The field development program resulted in a three-fold increase in oil production since 2000 – from 1,000 tons per day (about 7,500 bbls per day) to over 3,300 tons per day (about 25,000 bbls per day) at the end of 2008, or over 1.2 million tons per year. By the end of 2007 the company’s cumulative investments amounted to $500 million.
Oil is produced from the Burun, Balkan and Uzboy fields where 149 active wells operated as of the end of 2008. 84 of them were converted to gas-lift production. Oil produced in the fields is a light crude (ranges from 36° to 30° API) with low sulfur content.

After becoming the project operator, Burren decided to cut oilfield services earlier provided to the project by foreign contractors and started to use its own equipment and personnel to optimize costs. Most oilfield operations, including deep drilling, workover, logging and perforation, were performed by using own resources. The required equipment was purchased for drilling works and renovation. At the end of 2007, the company had four workover and three drilling rigs. According to Burren’s reports, the company achieved in 2005 a record low oil production cost – $1.73 per barrel.

Gas project
Initially, the Nebitdag project was targeted at producing only liquid hydrocarbons, due to the fact that until recently, Turkmengas and Turkmenneft had the exclusive right to commercially produce and market gas. The associated gas is flared. In the autumn of 2006, the government offered Burren Energy to contribute to the country’s gas production. The shift in Turkmenistan’s position regarding gas production and exports by foreign operators opens up new opportunities.
for the gas component of the project (see more details in the Chapter on the Gas industry of Turkmenistan).

2.3.2.3. Cheleken

The Cheleken project is currently the largest project with foreign participation in terms of both investment volume and oil production. The project is located offshore, in the Caspian Sea, and has been developed since 1993 when the Cheleken joint venture was formed with Larmag Energy Associates, Netherlands, (50%) and Chelekenmorneftegazprom (50%), a Turkmenneft unit. In 1997, Larmag Energy was purchased by Dragon Oil, which is registered in Ireland and whose majority owner is the Emirates National Oil Company, ENOC (52%).

In 1999, Dragon Oil changed the form of its participation in the project by executing a PSA with the Turkmenistan government for 25 years, with a right to extend it for not less than ten years. The PSA became effective in May 2000, and the project operator is Dragon Oil Turkmenistan Ltd. (DOTL).

The Cheleken contract territory occupies a 950 square kilometer area, where two fields were discovered back in the Soviet period – Jeitun (known earlier as LAM) and Jigalybek (Zhdanov). The sea depth in the fields area varies from 8 to 42 meters.

The Jeitun (LAM) field is located at the eastern end of the Apsheron Sill that crosses the Caspian Sea, and to the west of Khazar, a seaside town on the Cheleken Peninsula. The field was discovered in 1972 and first oil was produced in 1978.

The Jigalybek (Zhdanov) field is located to the north-east of Jeitun. The field was discovered in 1968 and oil production began in 1972.

Crude produced at both fields has good commercial characteristics: it is light, with gravity of 45° to 35° API.

In 2005, the project operator conducted 3D seismic studies at both fields, and the first appraisal well was drilled in Jeitun.

According to an independent audit of hydrocarbon reserves in the contract territory, conducted by Gaffney Cline, the residual recoverable proven and probable reserves as of June 30, 2008 were as follows:

- oil and condensate: 644 million bbl, with the project operator’s share – 283 million bbl;
- gas: 3.4 trillion cubic feet.

Table 4. Recoverable oil and condensate reserves in the Cheleken contract territory

<table>
<thead>
<tr>
<th>Proven recoverable and probable reserves, million barrels</th>
<th>June 30, 2008</th>
<th>June 30, 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total reserves</td>
<td>644</td>
<td>659</td>
</tr>
<tr>
<td>Share of operating company</td>
<td>283</td>
<td>324</td>
</tr>
</tbody>
</table>

Source: Dragon Oil

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Both the Jeitun (LAM) and Jigalybek (Zhdanov) fields are currently in the stage of commercial production. From 2000 to 2007 production grew from about 7,500 bopd (1,000 t/d) to 32,000 bopd (about 4,200 t/d). In 2008 Dragon achieved a 28% increase in gross production with an average daily rate of 40,992 bopd (approximately 5,500 t/d) and 45,600 bopd at the end of 2008. Dragon Oil plans to increase production to 47,000 bopd (6,300 t/d, or 2.3 million tons per year) by 2010.

**Chart 8. Oil production in the Cheleken contract territory, ‘000 tons**

The production growth achieved by Dragon Oil is mainly a result of drilling and bringing new wells onstream.

By the end of 2008, oil was produced from 52 wells on 12 production platforms, of which 31 production wells were drilled by Dragon Oil. In 2007 the operator drilled seven production wells, compared to four production wells in 2006. During 2008, nine production wells were completed.

Drilling program for 2009 is expected to spud thirteen wells, ten of which will be completed by year end. At the same time, several old wells will be decommissioned.

Historically, availability of drilling rigs has been a limitation to offshore drilling in the Caspian. In 2007, Dragon Oil used two jack-up drilling rigs and one onshore drilling rig. In 2008, the
company used the jack-up drilling rig Khazar, on lease from the National Iran Oil Company, and two drilling rigs installed on platforms. In January 2009, Dragon Oil started drilling Jeitun (Lam) L13/133, the first well drilled using its own drilling rig, Rig-40.

For the majority of wells, directional drilling is applied and separate completions are performed in several pay zones, which increases flow rates and oil recovery. The drilling depths vary from 3,000 to 5,000 meters.

Total planned investment in drilling and workover for the 2nd half of 2008 and 2009 amounts to $330 million, which equals about half of all planned investment during this period.

**Chart 9. Dragon Oil’s planned investment in 2H 2008 and 2009*, $ million**

| Infrastructure (platforms, trunkline / in field pipeline, upgrade of CPF, upgrade export facilities) | 40 |
| Development (development wells, appraisal wells, workovers) | 330 |
| Field/other | 300 |

* gas project costs are not included

*Source: Dragon Oil*

**Infrastructure.** The Central Processing Facility (CPF), located onshore and with a capacity of 50,000 bbl/day (6.700 tons per day), was commissioned in March 2007. The capacity is expected to reach 100,000 bbl/day by 2010.

In the summer of 2008, Dragon Oil executed a contract with Petro Gas FZE (UAE) for the construction of a 39.4-km oil pipeline from the contract territory to the CPF. The contract value is $170 million.
As production of crude oil continues to grow, the company has begun to reconstruct its Aladzha oil loading terminal located near the town of Khazar, to which produced oil is transported via pipeline from the oil-gathering station for further export by tanker. The first stage of work was completed in 2007. The second stage is currently underway; it’s aim is to increase the oil terminal's capacity to keep pace with the planned production increase and to allow the possibility of loading two tankers at the same time.

The project envisages commercialization of produced gas. So far, the larger part of produced gas is flared offshore and onshore, a smaller portion is supplied for free to a nearby chemical plant for processing, as well as for residential use.

The gas commercialization project provides for construction of a gas processing plant onshore by the end of 2009 (capable to handle 220 mmcf per day), and a new 30.9" gas pipeline to transport gas from the fields onshore.

2.3.2.4. Block-1

The Block-1 project is the first project in Turkmenistan that has been implemented by a foreign investor under PSA terms from its very start. A production sharing agreement for the Block-1 contract territory in Turkmenistan’s sector of the Caspian was signed by Petronas Carigali (Malaysia) and the Government of Turkmenistan in 1996. The PSA is for 25 years, with a six-year exploration period (in 2002 the initial six-year period was extended for another three years).

Under the PSA, 60% of the produced oil should be used to cover costs and expenses, while the other 40% should be deemed profit and divided into two equal parts between the contractor and the Government of Turkmenistan.

Block-1 is located 50 to 100 kilometers off the coast in the Cheleken-Livanovskaya uplift zone which is the best explored portion of the southern part of the Caspian Sea with almost all oil and gas fields discovered back in the 1960s by Soviet oilmen. Over 100 exploration wells of combined drilling length of 380,000 m were drilled here.

The block area covers 1,467 square kilometers. At the time when the PSA was signed, the following three fields had been discovered in the block: Diyarbekir (former Barinov), Magtymugly (Eastern Livanov)/Ovez and Garagol-Deniz (Gubkin). The block’s hydrocarbon resources were initially estimated at 350 million tons of oil equivalent.
From 1998 to 2007, the project operator performed seismic studies (in particular, Western Geco shot over 1,000 square kilometers of 3D seismic in 2003), as well as drilled 11 exploration and appraisal wells, and two production wells. All drilled exploration and appraisal wells flowed commercial volumes of hydrocarbons, confirming significant hydrocarbon reserves in the contract territory. Daily liquid hydrocarbons (oil and gas condensate) flow rates were in the range from 400-600 tons to 1,900-2,000 tons, while daily rates for gas varied from 300,000 to 800,000 cubic meters. A new gas and oil field named Mashrykov was discovered in Block-1 in the second half of 2006.

Based on the results of exploration, the project operator revised the initial estimates of the block’s prospective resources from 350 million tons to over 1.5 billion tons of oil equivalent, including 1 trillion cubic meters of gas, more than 200 million tons of oil, and 300 million tons of gas condensate. According to press reports, the Malaysian side estimated the block’s reserves at 146 million bbls of liquids and 64 trillion cubic feet of gas.
In addition to exploration, Petronas in 2005 began preparations for the pilot production project for liquid hydrocarbons. The pilot program includes construction of a number of onshore and offshore facilities. Gas utilization is not provided for in the pilot program, as gas is continued to be flared.

Initially, the pilot project provided for early oil production to start at the Magtymugly (Eastern Livanov) field. This field is the farthest from the coast of all fields in the contract territory (the closest point of the field is 73 km from the coast, while the farthest is 100 km away). At the same time, compared to other fields, Magtymguly has smaller reservoir depths and larger flows. While preparing for pilot development, Petronas changes its approach and decided to start production at Deyarbekir, the field closest to the coastline.

Early oil production began at Deyarbekir in May 2006 after a mobile offshore production unit was installed in the production area. The unit provides for daily production of oil at up to 15,000 bbl/day and for gas at 36 million cubic feet (about 1 million cubic meters).

After separation and stabilization, liquids (oil and gas condensate) are transported to a floating storage and offloading vessel with a storage capacity of 60,000 bbl. The vessel allows loading and feather-mooring of tankers with up to 12,000 tons of DWT.

In 2006 and 2007, two wells were producing oil under the pilot production program. During the first production year, the average daily production volume was 483 tons, by 2007 it was already 630 tons (4,700 bbl). At the end of 2007, the project operator completed the extension of the production platform deck, which made it possible to increase the number of production wells to three. As a result, during 2008 the average daily production volume increased to about 1,000 tons (about 7,500 bbl). Since the start of pilot production in May 2006 to the end of October 2008, cumulative liquids production totaled 4.8 million barrels.
Initially, the pilot production program was planned until the end of 2007, after which full-scale development of the contract territory was to start. The fields have a structure which requires simultaneous commercial production of oil and gas. Due to the change in the contract territory development plan and the re-scheduling of the development of the Magtymguly field, where the main gas reserves are concentrated, the transition from the pilot development to full-scale commercial oil production in the contract territory was re-scheduled to 2010 (on the gas part of the project, see more in the gas industry section).

2.3.2.5. Combined Block 11/12

Combined block 11/12 (area: 5,663 square km) is located in the north-western part of Turkmenistan’s sector of the Caspian. The block has a number of prospective oil and gas structures. The license for hydrocarbons exploration for combined block 11/12 was issued to Maersk Oil (Denmark) at the end of 2002 for 25 years with a five-year exploration period. The prospective resources are estimated at 600 million tons of oil and 182 bcm of gas.

The configuration of project participants and functions changed significantly over time. In 2006, Wintershall (Germany) bought 20% shares in the project from Maersk Oil and next year it increased its share to 34% while also assuming the functions and obligations of the project.
operator. In 2007, ONGC Mittal Energy Ltd. (OMEL) (India) joined the project, having bought 30% of the shares from Maersk Oil.

The 2D seismic studies conducted by Maersk Oil in 2003 and 2004 revealed large oil and gas traps and the Garadashlyk prospective structure. Exploration drilling at the block is so far limited to one appraisal well in the Garadashlyk structure which was drilled behind schedule in 2006 and revealed oil and gas.

According to the previously announced plans of the operator, two appraisal wells were scheduled for drilling in 2005, and the pilot development of the licensed area was supposed to begin in 2006. Because of reported problems with leasing a drilling rig (due to Caspian Drilling Company terminating contract), drilling of the second well was postponed until 2007, and then postponed again for an indefinite time. Geological and geophysical 3D seismic studies were continued in the contract territory through 2006.

In 2005, in addition to participating in the Block 11/12 consortium, Wintershall signed an agreement with Turkmenistan’s government on technical studies of combined blocks 2-6 in the northern part of Turkmenistan’s sector of the Caspian Sea. At the beginning of 2006 Wintershall completed the first stage of the technical studies and identified prospective areas. In 2007 the second stage of the studies began in collaboration with Turkmengeologia. This stage includes detailed geochemical, petrophysical and geological studies, hydrocarbon sampling for analysis, etc. The results of these studies will determine the future development of the project.

2.3.2.6. Other Offshore Blocks

Turkmenistan counts on wide participation of foreign investors in the development of hydrocarbon resources in Turkmen sector of the Caspian Sea. Turkmenistan’s sector of the Caspian Sea covers 78,000 sq km and is considered to be one of the most prospective parts of the country and of the Caspian region as a whole even though boundaries remain in dispute. In 2000, the Program for Licensing Turkmenistan’s Sector of the Caspian Sea until 2010 was adopted with the aim of attracting foreign investment. The program outlined a total of 32 blocks for licensing of exploration and production of hydrocarbons.

Geological and geophysical data, reserves estimates, and a proposed economic model were prepared for each block. This program is primarily geared towards foreign investors; licenses could be granted as a result of direct negotiations or through tenders.
Map 2. Licensing blocks in Turkmenistan’s sector of the Caspian Sea

According to the Program, annual oil production in Turkmenistan’s sector of the Caspian Sea is expected to increase to 20 million tons by 2010, with gas production at 5 bcm; and by 2015 – to 30 million tons and 30 bcm, respectively. The expected amount of investment in upstream projects in Turkmenistan’s offshore sector in the period from 2006 to 2020 was estimated to reach $63 billion, with $25.6 billion accounting for foreign investment.

Though interest in the offshore projects was shown by many foreign companies, as of the beginning of 2009 production sharing agreements (PSAs) were signed for only two blocks
originally offered for licensing - Blocks 11 and 12. Negotiations for other blocks have been going on for periods of years, but without tangible results.

Back in 2002 Russian companies Rosneft, Zarubezhneft and Itera founded the joint venture Zarit to develop three prospective blocks – 29, 30 and 31, according to official numeration – in the south-eastern part of Turkmenistan’s offshore sector. In 2004 the JV was joined by Turkmenneft. Based on seismic studies, estimated resources in the three blocks are put at 1,171 million tons of oil and 6,556 bcm of gas. The project’s production level is expected to reach 15 million tons of oil; estimates for gas production levels could be developed after and based on results of exploration drilling. In May 2008, the three Russian companies also submitted an application for geological exploration of Block 22.

Other companies that have expressed interest in negotiating PSAs for offshore projects include:

- Berlanga Holding (Netherlands) for Block 27 with estimated oil resources of 1,033 million tons and gas resources of 725 bcm;
- LUKOIL in partnership with ConocoPhilips for Blocks 19, 20 and 21;
- Buried Hill Energy (Canada) for the Serdar field with forecasted oil reserves in the range of 80 million to 200 million tons.

The majority of blocks currently being negotiated are located in disputed sectors of the Caspian Sea, the jurisdiction of which has not been recognized by neighboring states. In particular, Iran disputes Turkmenistan’s claims to offshore territory in the south-eastern part of the area offered for licensing, which are the planned areas of activity for Zarit and Berlanga Holding. Azerbaijan rejects Turkmenistan’s claims to the Serdar field (called Kyapaz in Baku).

Since demarcation of this part of the Caspian Sea has not been resolved yet, potential investors prefer not to take risks and have generally adopted an approach where they confirm interest in certain blocks, initiate negotiations and take a wait-and-see attitude. Occasional statements demonstrating optimism about the outlook for signing an agreement are mostly expressions of this approach.

The blocks located along Turkmenistan’s coastline have better chances for progress as their jurisdiction can hardly be disputed – these are blocks 19, 20, 21 and 22, in which LUKOIL and Zarit have expressed interest.

Considering that offshore field development, as experience shows, requires at least eight to ten years from the issuing of license to first oil production, it is clear that actual oil production offshore in the mid-term will be far lower the levels planned by Ashkhabad earlier (30 million tons in 2015).

### 2.3.3. Oil Refining

Crude oil is refined in Turkmenistan at two plants: the Turkmenbashi (formerly Krasnovodsk) and Seidi oil refineries located in the western and eastern parts of the country, respectively.

The country’s main producer of petrochemical products is the Turkmenbashi oil refinery complex located by the Caspian coast. The complex was built during the second world war (it
was put into operation in 1943), and has been in different phases of reconstruction and modernization since the late 1990s.

The first stage of reconstruction of the Turkmenbashi oil refinery complex took place from 1999 to 2004, with a total cost of $1.6 billion. In fact, a new integrated petrochemical plant was established that replaced the previous enterprise. Oil refining capacity grew by 2 million tons and reached the design level of 6 million tons per year, oil processing depth (conversion factor) grew from 64% to 82%. Production of motor fuels more than doubled to reach 1.7 million tons; output of jet fuel, diesel, LPG and kerosene increased substantially: production of such new products as high-octane gasoline, hydrotreated diesel oil, polypropylene, sulfur and various types of lubricants, including motor oils (16 grades), industrial (5), transmission (4), hydraulic and turbine was launched.

Table 5. Primary refining and production of main petroleum products at the Turkmenbashi and Seidi Oil Refineries, '000 tons

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing volume</td>
<td>4,906</td>
<td>5,213</td>
<td>5,735</td>
<td>6,804</td>
<td>6,719</td>
<td>6,875</td>
<td>6,875</td>
<td>7,000</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasoline, total</td>
<td>816</td>
<td>994</td>
<td>1,383</td>
<td>1,478</td>
<td>1,673</td>
<td>1,678</td>
<td>1,682</td>
<td>1,816</td>
</tr>
<tr>
<td>Diesel fuel</td>
<td>1,453</td>
<td>1,475</td>
<td>1,509</td>
<td>1,915</td>
<td>1,803</td>
<td>1,843</td>
<td>1,977</td>
<td>2,332</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>1,549</td>
<td>1,304</td>
<td>906</td>
<td>1,161</td>
<td>846</td>
<td>1,085</td>
<td>1,152</td>
<td>1,390</td>
</tr>
<tr>
<td>Kerosene</td>
<td>338</td>
<td>401</td>
<td>409</td>
<td>476</td>
<td>502</td>
<td>478</td>
<td>528</td>
<td>539</td>
</tr>
<tr>
<td>Heating oil</td>
<td>130</td>
<td>150</td>
<td>124</td>
<td>142</td>
<td>197</td>
<td>216</td>
<td>105</td>
<td>110</td>
</tr>
<tr>
<td>Bitumen</td>
<td>60</td>
<td>52</td>
<td>58</td>
<td>72</td>
<td>82</td>
<td>83</td>
<td>94</td>
<td>95</td>
</tr>
<tr>
<td>Coke</td>
<td>112</td>
<td>144</td>
<td>178</td>
<td>160</td>
<td>180</td>
<td>219</td>
<td>169</td>
<td>164</td>
</tr>
<tr>
<td>Turkmenplen (polypropylene)</td>
<td>0</td>
<td>5</td>
<td>55</td>
<td>76</td>
<td>86</td>
<td>81</td>
<td>86</td>
<td>90</td>
</tr>
<tr>
<td>Light gas oil</td>
<td>0</td>
<td>58</td>
<td>178</td>
<td>165</td>
<td>201</td>
<td>180</td>
<td>37</td>
<td>86</td>
</tr>
<tr>
<td>Lubricating oils</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>22</td>
<td>51</td>
<td>51</td>
<td>63</td>
<td>65</td>
</tr>
<tr>
<td>Liquefied gas</td>
<td>18</td>
<td>94</td>
<td>198</td>
<td>218</td>
<td>264</td>
<td>266</td>
<td>272</td>
<td>463</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Detergent</td>
<td>0.93</td>
<td>0.05</td>
<td>0.62</td>
<td>0.44</td>
<td>0.55</td>
<td>0.55</td>
<td>0.16</td>
<td></td>
</tr>
</tbody>
</table>

Source: Ministry of the Oil and Gas Industry and Mineral Resources of Turkmenistan
About twenty foreign companies participated in the first stage of the reconstruction and modernization of the complex including Emerol (Ireland), Foster Wheeler Italiana S.p.a., Gama Industry (Turkey), Itochu Corp., Chiyoda, Nissho Iwai, Marubeni Corp. (all Japan), Merhav (Israel), National Iranian Oil Engineering & Construction Company (NIOECC), Technip (France, Germany), UOP Foxboro (USA).

The second reconstruction and modernization stage is scheduled for completion by the end of 2010. It envisages increasing primary oil processing capacity to 10 million tons of oil per year, bringing oil processing depth to 95%, and the achieving EU standards for motor gasoline.

The Seidi oil refinery, located near the town of Seidi in eastern Turkmenistan, was built in 1991 and commissioned in 1994. The design capacity of the primary refining is 6 million tons per year; the oil processing depth is 60%. The refinery’s two processing units are for primary refining and catalytic reforming (1 million tons per year), as well as auxiliary facilities.

Initially the refinery was designed to process crude oil from Western Siberia, to be transported via the Omsk-Pavlodar-Shymkent-Chardzhou (now named Turkmenabat) pipeline. After the collapse of the USSR, supplies of Russian crude were terminated, and the refinery was saved from being stopped through supplies of crude from Kokdumalak, a cross-border (Uzbekistan-Turkmenistan) field, in production from which Turkmenistan has a share, as well as through supplies of gas condensate from Turkmenistan’s own Dauletabad and Naip fields.

Because of irregular feedstock supplies during the first decade of independence, production capacity of the facility was very much under-utilized: the primary oil processing unit operated only upon accumulation of feedstock, while the catalytic reforming unit never started operating since its commissioning. The situation at the facility improved as sources of feedstock appeared. In the autumn of 2004 crude started being delivered to the Seidi refinery from the Yashyldepe field on the right bank of the Amu Darya through the Yashyldepe-Pelvert pipeline (length: 85 km) crossing the Amu Darya. Crude started also being transported by rail, after a loading terminal was built at Pelvert on the left bank of the Amu Darya. In July 2006 the Seidi refinery began receiving light crude from the South Yoloten field.

To receive growing volumes of feedstock, the refinery’s existing loading rack was reconstructed, a new rack along with six new oil storage tanks were built, and 300 railroad tank cars were replaced.

The primary refining volume at Seidi has been steadily growing from 4,638 tons in 2000 to 1 million tons in 2006 and 1.5 million tons in 2007.

The Seidi refinery reconstruction project includes addition of production capacity to produce annually 800,000 tons of high-octane gasoline, 90,000-150,000 tons of polypropylene, 200,000 tons of polyethylene and 400,000 tons of bitumen, as well as construction of a catalyst cracker for processing 1 million tons of heavy gas oil annually and installation of a diesel fuel hydro-treating unit with capacity of 1.2 million tons per year.

The government program of developing the oil and gas industry of Turkmenistan through 2030 provides for growth in oil refining to 16 million tons by 2015, 20 million tons by 2020, and 30 million tons by 2030. In conjunction with reconstructing and upgrading the two operating oil refineries, the program plans construction of three new regional oil refineries. The dates of the refineries’ construction will be determined based on oil production trends in the country. The current level of production is not enough to fully load the current refining capacities, which has
led to termination of exports of crude oil produced by Turkmenneft and re-direction of all oil to domestic refining.

2.3.4. Oil Transportation Infrastructure

2.3.4.1. Pipeline System

The oil pipeline system in Turkmenistan is mainly concentrated in the western part of the country and is used to deliver oil from operating fields to the Turkmenbashi oil refinery complex, as well as to the export terminals of Aladzha and Ekerem on the Caspian Sea.

The only pipeline in the eastern part of the country, Omsk-Pavlodar-Shimkent-Turkmenabat has not been used for deliveries to the Seidi refinery, since 1992. Oil is transported to the refinery by rail.

The operator of the oil pipeline system is Turkmenneft.

Map 3. Turkmenistan’s oil pipeline system

Source: Ministry of the Oil and Gas Industry and Mineral Resources of Turkmenistan
The total length of pipelines in Turkmenistan is about 640 kilometers. The pipeline system consists of six oil-trunk pipelines:

- Vyshka-Belek;
- Goturdepe-Belek;
- Belek-Turkmenbashi;
- Cheleken-Goturdepe;
- Turkmenistan’s section of the Omsk-Pavlodar-Shymkent-Turkmenabat pipeline;
- Korpedzhe-Balkanabat.

Five of the six pipelines were put into operation from the late 1940s to the late 1980s. During the 1990s, many pipeline sections were reconstructed with full or partial pipe replacement. In 2006, Turkmenneft commissioned the Korpedzhe-Balkanabat pipeline, the first one built since Turkmenistan became an independent state. The pipeline is to transport oil from fields in southwestern Turkmenistan – Korpedzhe, Southern Kamyshlydzha, Ekerem, Keimir and other – to the Turkmenbashi refinery. Before the pipeline was built, all crude produced in the southwestern part of the country was delivered to Turkmenbashi by sea in tankers from the terminal at Ekerem, to where oil was delivered from the fields via pipelines.

Table 6. Turkmenistan’s Oil Pipelines: Key Parameters

<table>
<thead>
<tr>
<th>Pipeline</th>
<th>Year of commissioning</th>
<th>Length, km</th>
<th>Design capacity, MMt per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vyshka-Belek</td>
<td>1947</td>
<td>90.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Goturdepe-Belek</td>
<td>1954</td>
<td>64.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Belek-Turkmenbashi</td>
<td>1960</td>
<td>82.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Cheleken-Goturdepe</td>
<td>1971</td>
<td>45.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Turkmen part of oil pipeline Omsk-Pavlodar-Shymkent-Turkmenabat*</td>
<td>1988</td>
<td>183.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Korpedzhe-Balkanabat</td>
<td>2006</td>
<td>172</td>
<td>3.0</td>
</tr>
</tbody>
</table>

* not operational since 1992

Source: Ministry of the Oil and Gas Industry and Mineral Resources of Turkmenistan

2.3.4.2. Sea Terminals

Crude oil and oil products are exported from Turkmenistan through the terminals in Aladzha and Ekerem, and through the port of Turkmenbashi.

The terminals in Aladzha and Ekerem are used for exports of oil only. The Aladzha terminal has capacity of 2.4 million tons per year and is used to export oil produced by Dragon Oil (since
1993 the terminal has been leased first by Larmag Energy and then by its successor – Dragon Oil). The terminal can service tankers of up to 5,000 tons DWT.

The annual capacity of the Ekerem oil terminal is about 1.2 million tons of oil, with the ability to service tankers of up to 7,000 tons DWT. Before the Korpedzhe-Balkanabat pipeline was put into operation, the terminal in Ekerem was used as the transshipment point for oil transported to the Turkmenbashi oil refinery complex from the fields in the south-western part of the country.

The port of Turkmenbashi handles only oil products. The port has two loading berths with total annual capacity of 3 million tons and can service tankers of up to 5,000 tons DWT. Oil products are brought to the terminal from the storage facility in Kenar (formerly Ufra). The annual throughput capacity of the Kenar storage facility is 6 million tons of oil products. From Kenar the products could also be loaded into railway tank cars for delivery to other destinations than the port of Turkmenbashi.

The port’s infrastructure is currently being reconstructed with the aim of increasing the capacity to meet the growing export needs of the country. In particular, within the Kenar facility modernization project two existing berths are being reconstructed. A third berth is being constructed, along with a LPG storage/loading terminal. Collectively, the facilities being built and reconstructed will increase the capacity of the port of Turkmenbashi for exports of oil products to 5 million tons per year.

Work is also underway to expand the sea terminals of Aladzha (with the construction of the second oil jetty) and Ekerem. In 2007, the first stage of upgrade was completed at the Ekerem terminal involving replacement of key structures. By order of Turkmenneft the Vyborg shipyard prepared a design of a large port complex for Ekerem that envisages six loading berths and a terminal for unloading, storage and shipment of oil and oil products for export. According to the design, the annual capacity of the complex is to be 10 million tons of oil and products.

Presently, the shipping of oil and oil products by sea is done on leased foreign vessels. Turkmenistan has plans for building its own fleet – its first tanker of 5,000 tons DWT was built in Turkey and received in Turkmenistan in 2001.

2.3.4.3. Railway Transportation

The throughput capacity of Turkmenistan’s railways for oil transportation is estimated at 5.5 million tons per year. Rail is used to transport oil to the Seidi oil refinery, and oil products and LPG both within the country and for export.

In order to expand exports of LPG, storage and loading terminals were built at the border railway stations of Serakhs and Serkhetabad in the south-eastern part of the country with participation of the Iranian company Pars Energy. The storage capacity of the terminal in Serakhs is 2,200 cubic meters of LPG; it can load eight rail tank cars and more trucks simultaneously. The terminal in Serkhetabad is designed to store 500,000 tons of LPG.
2.3.5. Exports of Oil and Oil Products

2.3.5.1. Oil Exports
Exports of oil from Turkmenistan started in 1996 at the level of 193,000 tons. The maximum level of 2.25 million tons was reached in 2001. After that, exports dropped to less than one million tons in 2005, then doubled the next year, reaching 1.9 million tons. In 2007 oil export from Turkmenistan increased to 2 million tons (the figure for 2008 was not available when the report was completed).

The main factors shaping the dynamics of oil exports from Turkmenistan are, on one hand, the growth of oil refining capacity that has led to a decrease in oil exports by Turkmenneft up to full termination of exports, and, on the other hand, growing oil production and exports by foreign operators of project under PSA terms.

Currently, the main exporter of oil is Dragon Oil. In 2007, the company exported 8.7 million bbls of crude (1.16 million tons), or about 60% of Turkmenistan’s total exported oil. In 2008, Dragon Oil exported 7.6 million bbls of oil (about 1 million tons).

Chart 11. Oil Exports from Turkmenistan, million tons

Source: Ministry of the Oil and Gas Industry and Mineral Resources of Turkmenistan
Oil export routes

Oil is exported from Turkmenistan via two main routes:

- to the west: by sea to Baku (Azerbaijan), then via railroad to Batumi (Georgia) and further to the Black Sea and Mediterranean basins;
- to the south: by sea to the port of Neka in Iran, and further – through swap agreements – out of the Persian Gulf to international markets.

In the past years, Turkmenneft had used the pipeline route via Makhachkala – Novorossiysk to export oil to the western markets, yet several years ago exports using this route were stopped.

Export in the western direction involves several means of transportation, which leads to high total transportation costs. Oil from the ports of Aladzha or Ekerem is transported in tankers to Baku with further re-loading into tank cars and transportation by rail to Batumi and then by sea to the countries of the Black and Mediterranean basins.

Oil is transported in the southern direction from the Aladzha terminal to the Iranian port of Neka and further, by pipeline, to the oil refineries in Tebriz and Teheran. Oil from Turkmenistan and other Caspian countries relieves Iran of the need to deliver its own oil produced in the south to refineries located in the north. Exporters from Turkmenistan swap oil supplied to Neka for equivalent volumes for export out of the terminal on the Kharg Island in the Persian Gulf.

The major exporter in the southern direction is Dragon Oil. The company reports that it sends approximately 80% of its crude oil through Neka under a swap agreement with the National Iran Oil Company, as it offers higher netbacks compared to the western route. Still, in order to maintain marketing flexibility, Dragon Oil ships approximately 20% of its crude through Baku, Azerbaijan. For reasons of export diversification, Dragon Oil has been assessing the possibility of opening additional routes through Makhachkala in Russia and the BTC pipeline initiating at Baku, Azerbaijan.

2.3.5.2. Exports of Oil Products

Turkmenistan oil refining capacity significantly exceeds the domestic demand for oil products – historically, oil refineries in Turkmenistan were designed to satisfy the demand in other Soviet republics, as well as the Soviet armed forces in Afghanistan (the construction of the Seidi refinery in the 1980s was partially driven by this factor).

Because of the surplus refining capacity, even when production at both oil refineries dropped after Turkmenistan became an independent state, the country was in a position to export part of its oil refinery output. The export volumes and range of products increased as the utilization of refineries – primarily, the Turkmenbashi oil refinery complex - went up, the range of products expanded and the products’ competitiveness improved.

From 1996 to 2007, the total volume of exported oil products grew by 60% from 1.8 million tons to 3.0 million tons. The structure of exports has also changed: the share of fuel oil, being two thirds of total products exports in 1996, dropped to less than a half; the share of diesel also decreased. At the same time, the share of gasoline grew from less than 3 percent in 1998 to 20 percent in 2007, while the share of kerosene increased from 2 to 13 percent. Lubricating oils have emerged as a new type of exported oil products.
Table 7. Oil products exports from Turkmenistan, '000 tons

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>2.1</td>
<td>82.8</td>
<td>434.7</td>
<td>519.0</td>
<td>636.7</td>
<td>636.2</td>
<td>582.0</td>
<td>628.5</td>
</tr>
<tr>
<td>Straight-run gasoline</td>
<td>68.0</td>
<td>182.6</td>
<td>72.4</td>
<td>273.1</td>
<td>462.5</td>
<td>260.3</td>
<td>318.6</td>
<td>331.3</td>
</tr>
<tr>
<td>Diesel fuel</td>
<td>808.3</td>
<td>978.9</td>
<td>811.5</td>
<td>1,232.6</td>
<td>1,126.7</td>
<td>1,100.2</td>
<td>1,325.0</td>
<td>1,625.0</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>1,397.5</td>
<td>1,169.6</td>
<td>836.4</td>
<td>972.8</td>
<td>1,005.7</td>
<td>835.5</td>
<td>1,148.0</td>
<td>1,330.0</td>
</tr>
<tr>
<td>Kerosene</td>
<td>176.2</td>
<td>243.7</td>
<td>248.1</td>
<td>359.6</td>
<td>375.9</td>
<td>369.1</td>
<td>427.5</td>
<td>436.0</td>
</tr>
<tr>
<td>Heating oil</td>
<td>96.3</td>
<td>114.0</td>
<td>96.7</td>
<td>124.0</td>
<td>181.8</td>
<td>186.6</td>
<td>91.8</td>
<td>97.4</td>
</tr>
<tr>
<td>Bitumen</td>
<td>0.6</td>
<td>0.1</td>
<td>3.2</td>
<td>3.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Coke</td>
<td>107.6</td>
<td>140.4</td>
<td>178.3</td>
<td>158.1</td>
<td>178.2</td>
<td>215.0</td>
<td>169.1</td>
<td>164.0</td>
</tr>
<tr>
<td>Turkmenplen (polypropylene)</td>
<td>-</td>
<td>-</td>
<td>47.2</td>
<td>80.4</td>
<td>84.3</td>
<td>67.5</td>
<td>85.6</td>
<td>90.0</td>
</tr>
<tr>
<td>Light gas oil</td>
<td>-</td>
<td>45.7</td>
<td>167.5</td>
<td>144.2</td>
<td>208.4</td>
<td>170.1</td>
<td>46.5</td>
<td>56.4</td>
</tr>
<tr>
<td>Lubricating oils</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
<td>4.0</td>
<td>9.0</td>
<td>30.0</td>
<td>38.8</td>
<td>41.6</td>
</tr>
<tr>
<td>LPG</td>
<td>7.8</td>
<td>84.8</td>
<td>194.3</td>
<td>214.3</td>
<td>258.6</td>
<td>250.0</td>
<td>226.2</td>
<td>396.6</td>
</tr>
</tbody>
</table>

Source: Ministry of the Oil and Gas Industry and Mineral Resources of Turkmenistan

LPG is becoming an increasingly important export item. Its total production increased from 18,000 tons at the beginning of the decade to 463,000 tons in 2007. Turkmenistan's domestic needs for LPG do not exceed 12,000-13,000 tons per year, with the surplus being exported.

Export Routes of Oil Products

Unlike oil exports, the main markets for Turkmenistan's oil products are the nearby countries to the west, namely Georgia, Azerbaijan, Ukraine and Turkey. Oil products are exported in this direction using a combined transportation scheme similar to the one for oil exports, with the difference that products are shipped out of the Turkmenbashi port. The second most important group of markets are the countries to the south and south-east of Turkmenistan, in particular Iran, Afghanistan, Pakistan and certain former Soviet republics (Kyrgyzstan and Tajikistan). Oil products are exported to the south-east by rail.

The key buyer of LPG is Iran, as it has a fuel deficit in the northern regions of the country. The contract signed in 2001 between Turkmenneftegaz and Pars Energy provides for the supply of
150,000 tons of LPG per year for ten years. 30% of this volume is supplied as a return on Iran's investments in the construction of gas storage and transshipment terminals in Serakhs, Serkhetabad and Kiyany (in the Turkmenbashi port).
Chapter 3. Turkmenistan’s Gas Industry

3.1. Brief History

Gas production in Turkmenistan started in the 1960s. During the next two decades, the Turkmen gas industry grew rapidly and the republic became the second largest gas producer in the former USSR after Russia.

About 99 percent of all gas produced in the Turkmen Soviet Socialist Republic was produced by the Turkmengasprom All-Union Industrial Association. The association was created after the Odzhak field was discovered in February 1966 in the south-eastern part of the republic. In November 1966, eight months after the field was discovered, gas was first transported from the field to Russian industrial centers through the Bukhara-Urals gas pipeline.

The discovery of the Kyukyurtly, Naip, Eastern and Western Shatlyk fields between 1968 and 1970 were important stages in the development of the Turkmen gas industry. After the Shatlyk field was brought onstream, gas production in the republic doubled.

Gas production increased further after the giant Dauletabad field was discovered (1974) and brought onstream (1983). Its recoverable resources exceeded 1.6 trillion cubic meters. Gas production began in the Uchadzhi, Seirap and Shorkel fields in 1984 and in the Malai and Samandepe fields in 1986, raising annual gas production to 85.5 bcm by 1989.

Table 8. Initial reserves of Turkmenistan’s key fields put into production during the Soviet period

<table>
<thead>
<tr>
<th>Field</th>
<th>Initial reserves (ABC1), bcm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dauletabad</td>
<td>1,625</td>
</tr>
<tr>
<td>Malai</td>
<td>201</td>
</tr>
<tr>
<td>East and West Shatlyk</td>
<td>489</td>
</tr>
<tr>
<td>Samandepe</td>
<td>101</td>
</tr>
<tr>
<td>Naip</td>
<td>178</td>
</tr>
<tr>
<td>Kerpichly</td>
<td>162</td>
</tr>
<tr>
<td>Kyukyurtly</td>
<td>94</td>
</tr>
</tbody>
</table>

Source: Ministry of Oil and Gas Industry and Mineral Resources of Turkmenistan
However, since 1992 gas production decreased steadily until it leveled off just above 13 bcm in 1998. The main reasons for such a severe production slump were a reduction and then complete cessation of gas supplies from Turkmenistan to the former Soviet republics, primarily to Ukraine, plus the absence of direct gas export routes to European markets bypassing Russia.

Historically, Turkmenistan’s gas was integrated into the Soviet Union’s gas balance, comprising a large share of Ukraine’s consumption. In addition, Turkmenistan had an annual quota of 11 bcm as part of Soviet exports to the European market.

In 1994 Russia cancelled Turkmenistan’s export quota to Europe, leaving it with deliveries to the markets of Ukraine and other former Soviet republics. As the debts incurred by those countries for gas supplies grew, Ashkhabad had to cut and then suspend deliveries to those countries.

In November 1995 the Turkmenrosgas Joint-Stock Company (51 percent owned by Turkmenistan, 45 percent by Gazprom, 4 percent by Itera) was founded and in 1996 it assumed responsibility for marketing all gas exported from Turkmenistan. However, this did not help resolve the problem of non-payments. Unsatisfied with Turkmenrosgas’ performance, Turkmenistan’s government terminated its activities, which led to a collapse in gas exports to 6.5 bcm in 1997 (for comparison, equal to the gas volume supplied in Q1 2007) and to 1.8 bcm in 1998, all of which was exported to Iran.

After exports were curtailed in the second quarter of 1997, Turkmenistan reduced the number of active production gas wells from 3,000 (level maintained since the early 1990s) to 622 in 1998, leading to a nearly 80% cut in production.

The steep decline in gas production and exports resulted in a sharp decrease in foreign currency flows into the country and, consequently, in investment into the gas industry. The limited funding was mainly used to shut down wells.
Gas supplies to Ukraine were resumed in 1999, and a new export route to Iran began operating at the end of 1997, with the commissioning of the Korpedzhe - Kurt-Kui gas pipeline. These developments helped reverse the decline in gas production, gradually increasing it to over 70 bcm in 2008, which exceeds the level of production in the first years of independence.
Chart 13. Gas production in Turkmenistan from 2000 to 2008, bcm

Source: Ministry of Oil and Gas Industry and Mineral Resources of Turkmenistan

3.2. Natural Gas Reserves, Development Potential

According to official data, 155 gas and gas-condensate fields were discovered in Turkmenistan by the beginning of 2008, including in the Caspian Sea.

The current geological resources are estimated at 22.4 trillion cubic meters. Cumulative gas production has reached over 2.2 trillion cubic meters. Data on current explored reserves – ABC1+C2, according to classification used by Turkmenistan, or proved and probable reserves (according to international classification) are not disclosed by official sources, which gives rise to differing estimates and speculations in respect to the size of proved reserves.

Thus, the Energy Information Administration of the U.S. Department of Energy estimates Turkmenistan’s proved gas reserves to be 2 trillion cubic meters. BP’s and Cedigaz’s assessments are higher – 2.67 trillion cubic meters and 2.9 trillion cubic meters, respectively.
Independent estimates of the current proved gas reserves are based on data from Soviet geologists, which indicated that as of the beginning of 1991 (the last year of the USSR), explored reserves in the republic amounted to 2.74 trillion cubic meters. By the beginning of 2006 (the latest available official data), the residual reserves of major onshore fields amounted to 2.55 bcm, including the Yashlar field discovered in the early 1980s but not developed since then (see Residual gas reserves of major onshore fields in Turkmenistan). Approximately 200 bcm of gas have been extracted from 2006 through 2008. The increase in explored reserves (mainly at offshore fields) by the beginning of 2006, according to the official data, was about 400 bcm. Thus currently, the residual explored reserves of major onshore and offshore fields can be estimated at 2.75 bcm.

Table 9. Gas reserves of major onshore fields in Turkmenistan (as of the beginning of 2006)*

<table>
<thead>
<tr>
<th>Field</th>
<th>Reserves, bcm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dauletabad</td>
<td>1,000</td>
</tr>
<tr>
<td>Yashlar</td>
<td>750</td>
</tr>
</tbody>
</table>

Source: EIA DOE, BP, Cedigaz
<table>
<thead>
<tr>
<th>Field</th>
<th>Reserves, bcm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malai</td>
<td>115</td>
</tr>
<tr>
<td>Garabil-Gurukbil</td>
<td>90</td>
</tr>
<tr>
<td>Darvaza-Zeagly</td>
<td>68</td>
</tr>
<tr>
<td>East and West Shatlyk</td>
<td>64</td>
</tr>
<tr>
<td>Samandepe</td>
<td>60</td>
</tr>
<tr>
<td>Garashsyzylygyn</td>
<td>60</td>
</tr>
<tr>
<td>Byashgizyl</td>
<td>54</td>
</tr>
<tr>
<td>Yelgui</td>
<td>52</td>
</tr>
<tr>
<td>Naip</td>
<td>31</td>
</tr>
<tr>
<td>Severnyi Balguyi</td>
<td>29</td>
</tr>
<tr>
<td>Kerpichly</td>
<td>29</td>
</tr>
<tr>
<td>Kyukyurtly</td>
<td>21</td>
</tr>
<tr>
<td><strong>Western Turkmenistan</strong></td>
<td></td>
</tr>
<tr>
<td>Korpedzhe</td>
<td>84</td>
</tr>
<tr>
<td>Barsagelmez</td>
<td>20</td>
</tr>
<tr>
<td>Goturdepe</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,545</strong></td>
</tr>
</tbody>
</table>

* excluding South Yoloten-Osman

Source: Ministry of Oil and Gas Industry and Mineral Resources of Turkmenistan

The above cited official and independent gas reserves estimates do not account for recent field discoveries in the south-eastern part of the country – South (Gunorta in Turkmen) Yoloten-Osman.

In October 2006 Turkmenistan declared discovery of large gas reserves in South Yoloten. According to a 2008 audit by Gaffney, Cline & Associates, the reserves in the Southern Yoloten-Osman field are estimated to be between 4 trillion and 14 trillion cubic meters, with 6 trillion cubic meters considered the most probable estimate. The second phase of audit by Gaffney, Cline & Associates completed in the beginning of 2009, according to the auditor, confirmed that the most probable estimate of S.Yoloten-Osman reserves amounts to 6 trillion cubic meters. Based on these estimates, the South Yoloten-Osman gas reserves are expected to be 3.5 times greater in volume than the largest field in production, Dauletabad, which would make Yoloten-Osman the fourth or fifth largest field in the world by the volume of reserves.

According to Gaffney, Cline & Associates, the gas reserves in another audited field, Yashlar, are estimated to be between 250 bcm and 1.5 trillion cubic meters, with 675 bcm considered the most probable estimate.
Table 10. Gas reserves estimate for South Yoloten and Yashlar, trillion cubic meters

<table>
<thead>
<tr>
<th>Field</th>
<th>Minimal estimate</th>
<th>The most probable estimate</th>
<th>High estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Yoloten-Osman</td>
<td>4</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Yashlar</td>
<td>0.25</td>
<td>0.675</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: Gaffney, Cline & Associates

Taking into account the reserves from the recently discovered field, South Yoloten-Osman the country’s current proved and probable gas reserves can be put at about 9 bcm.

3.3. Territorial Distribution of Resources/ Gas Reserves

According to government estimates, about 25 percent (5.5 trillion cubic meters) of the total estimated gas resources of 22.4 trillion cubic meters are concentrated in Turkmenistan’s sector of the Caspian Sea.

Chart 15. Onshore and offshore gas distribution

Source: Ministry of Oil and Gas Industry and Mineral Resources of Turkmenistan, RPI estimate
3.4. Gas Industry Structure: Key Players and Projects

At present, all of Turkmenistan’s gas is produced by two state-owned companies (concerns) – Turkmengas and Turkmenneft. Turkmengas is the main gas producer in the country with an 80 percent share of all gas production.

Chart 16. Gas production by state concerns, bcm

source: Ministry of Oil and Gas Industry and Mineral Resources of Turkmenistan

Unlike the oil industry, where the entry of foreign companies in the mid 1990s and early 2000s played a significant role, the gas industry has been closed to foreign investments until recently. The first foreign commercial gas production project was the offshore Block-1. It initially began as an oil project, though once significant gas reserves were found within the contracted territory, the project shifted much of its emphasis towards gas (see details below). CNPC became the first foreign company to participate in onshore gas production at the Bagtiyarlyk project.
3.4.1. Turkmengas

Turkmengas develops gas and gas-condensate fields in Eastern Turkmenistan, which is historically the key gas producing region in the country. The Dauletabad, Shatlyk, Malai, Samandepe, Naip and other fields are located there. These fields account for nearly 70 percent of Turkmenistan's gas. More than half of all gas currently produced in Turkmenistan comes from the Dauletabad field.

3.4.1.1. Dauletabad

Reserves, development and planned production level

The Dauletabad field was brought onstream in 1983. Initial reserves of the field were over 1.6 trillion cubic meters. According to official data, residual reserves at the Dauletabad field were about 1,000 bcm at the beginning of 2006. Taking into account that at least 100 bcm of gas was produced from the field from 2006 to 2008, residual reserves at the Dauletabad can be estimated at approximately 0.9 trillion cubic meters.

Development Plans

The field design production level is between 35 bcm and 38 bcm per annum. New booster compressor and gas-compressor stations have been built or upgraded since the late 1990s to maintain production at this level. At the same time, 50 production wells have been worked over and re-activated.

From 1998 to 2003, sulfur removal facilities and glycol gas dehydration units were upgraded at the Dauletabad-3 field, which helped reduce H2S content in commercial gas to 5 mg/m³, and the dew point was reduced to - 8°C. In 2003 the gas compression and processing facility with 20 bcm annual capacity was commissioned at Dauletabad-2. In May 2008, the Dauletabad-3 booster compressor station with 10 MMcm daily capacity started operating, which increased field production capacity by 3.7 bcm per year.

The construction of another booster compressor station at Dauletabad-2 is planned for completion by 2010. The station is being constructed by ENEX (Belgium) at a cost of over €130 million. The new booster compressor station will increase production capacity by another 4 bcm of gas per year.

Transportation

At present, Dauletabad is the main source of gas supplies via the CAC-1, -2 and -4 pipelines in the northern direction. At the same time, the link between Dauletabad and Malai (see below) allows gas deliveries from Dauletabad to Kazakhstan, Uzbekistan and China.

3.4.1.2. Malai

Reserves, development and planned production level

The initial field reserves were 201.9 bcm, production began at the field in the late 1980s. Malai's residual reserves of gas as of the end of 2008 were about 110 bcm.

The field's current annual production level is between 6 bcm and 7 bcm per annum. The second-stage booster compressor station will be built to maintain the current production level.
Transportation

Gas produced at the field is delivered to the CAC system. At the same time, Malai is the starting point for the Turkmenistan-China gas pipeline, which is currently under construction. The length of the Malai-Bagtiyarlyk Turkmenistan’s section is 188 km, the pipe diameter is 1,420 mm, and the pipeline is designed to transport 30 bcm per year. The general contractor responsible for design, supplies and construction of the Malai-Bagtiyarlyk pipeline is Stroytransgaz (Russia). The project is ordered by Turkmengas.

The pipeline construction contract, valued at over €395 million, also includes the construction of metering units, gas driers, and a compressor plant (its construction was contracted to ENEX).

3.4.1.3. Garabil-Gurrukbil

The Gurrukbil, Eastern Gurrukbil and Western Garabil gas-condensate multi-reservoir fields, located along the Mugrab river valley, were discovered in 1990. Their proximity to the largest gas-condensate fields – Dauletabad-Donmez in the north-west and Garabil in the east – suggests that they may all belong to the same accumulation area, which opens additional prospects for discovering new satellite gas reservoirs.

The combined reserves of these fields are estimated at 90 bcm. Production is planned to start in 2009 and is expected to reach up to 2 bcm during the first year, and 4 bcm by the end of 2010.

As of the beginning of 2009, the field was being prepared for pilot production; ground infrastructure and new wells were being constructed. Gas treatment facilities will be built and connected to three pipelines of 5 MMcm per day and a gas collector with 90 km of 720 mm pipes to transport gas from the field to Dauletabad. The simultaneous construction of the Gurrukbil-Dauletadad road is being accelerated.

An additional gas source will be the nearby Takhtabazar-1 field with annual production capacity of about 1 bcm.
3.4.1.4. Right Bank of Amu Darya River

The right bank of Amu Darya is one of the most promising regions for hydrocarbon production in the country. According to Turkmen geologists, a strong reserves base for future gas and oil production projects is located in the Yashyldepe, Samandepe, Metedzhan, Gendzhibek and other fields discovered during and after the Soviet period. According to the results obtained by Turkmen and Chinese specialists in 2006 and 2007, the total gas reserves on the Amu Darya’s right bank are estimated at 1.7 trillion cubic meters. This figure exceeds by several times the Soviet period gas reserves estimates of about 200 bcm.

Currently, the Yashyldepe, Samandepe, Metedzhan, and Gendzhibek, along with some adjacent prospective areas (Pirguyi, Chashguyi, Beshir, Yangui, and Bereketli) located mostly in the central part of the Amu Darya’s right bank, are included in the Bagtiyarlyk Contract (PSA) Territory. The PSA operator is CNPC International Turkmenistan, a subsidiary of China National Petroleum Corporation (CNPC) (for more details see section on Projects with Foreign Operators: Bagtiyarlyk).
3.4.1.5. South (Gunorta) Yoloten-Osman

South (Gunorta) Yoloten-Osman is in all likelihood one of the largest gas and oil fields in the world. The field is located 50 km from the Mary regional center in south-eastern Turkmenistan.

The field was discovered by Turkmengeologia in 2003, active exploration in South Yoloten began in 2005. The first few wells drilled in 2006 and 2007 by Turkmen geologists in the areas under exploration yielded commercial gas flows of between 1.2 and 1.3 MMcm per day. Formation evaluation revealed that nearly every well had up to five production horizons located at depths from 3,900 to 4,500 meters.

Drilling results in another prospective area – Osman – also turned out to be very impressive. The area is located 40 km from South Yoloten. In March 2007, when an exploration well was drilled to a depth of 4,777 meters, a gas geyser with a daily flow rate of 5 MMcm came up from the well. According to assessments of Turkmen geologists, the natural gas reservoirs discovered in Osman and in South Yoloten are part of the same formation.

According to preliminary estimates, the total oil and gas accumulation area covers 1,800 square km, the pay zone is 450 to 500 meters at Osman and over 600 meters thick at S. Yoloten. The total reserves potential of the field is between 4 trillion and 14 trillion cubic meters.

Map 5. Geological profile of South Yoloten – Osman field

Source: Turkmengas
In mid-2006, to accelerate the exploration of S.Yoloten, Turkmengeologia announced an international bid for drilling oil and gas exploration wells in the field. CNPC’s oilfield services subsidiary won the contract for drilling 12 gas wells up to 5,000 meters deep. The project is scheduled for three years and the contract value is $151.8 million.

According to the S.Yoloten field development project designed by Turkmengas, the field will be developed in stages, with the first stage designed to produce up to 20 bcm of gas per annum. Gaffney, Cline & Associates, according to official Turkmen press reports, recommends a more gradual gas production growth – with 10 bcm of gas per annum at the project first stage and further increase of this level to 20, 30, 50, and finally 70 bcm per year at subsequent stages.

According to initial plans of Turkmengas, the start of gas production at the field was scheduled for 2009. However, the lack of information over the course of 2007 and 2008 about the field’s development (construction of gas treatment facilities or transport infrastructure) gives grounds for an estimate that the field will be commissioned at a later date.

One reason for this delay might be the lack of progress in attracting a strategic investor for the field’s development. In the autumn of 2006, former president Saparmurat Niyazov offered to Gazprom to participate in the development of South Yoloten, but subsequent negotiations proceeded slowly. The agreements for Gazprom’s participation in Turkmenistan’s gas projects reached in July 2008 have so far proved to be largely of a declarative nature and been limited to coordination of key specifications for the construction of Turkmenistan’s section of the Pre-Caspian gas pipeline and for the installation of a gas treatment facility at South Yoloten.

The details of the agreement have not been disclosed by the Russian and Turkmen parties. Given that construction specifications for the gas treatment facility were approved in December 2008, as well as that a gas pipeline from the field to the Central Asia-Center pipeline system (about 250 km) is yet to be constructed, gas supplies from South Yoloten are unlikely to begin before the end of 2010 or the beginning of 2011. This schedule will additionally depend on the expansion of Uzbekistan’s pipeline capacities through construction of a new CAC line of 26 bcm to 30 bcm per year, as envisaged by the agreement reached between Russian Prime Minister Vladimir Putin and the Uzbekistan’s President Islam Karimov in September 2008.

In case of significant delays with implementation of projects aimed at exporting South Yoloten gas to the north, Turkmenistan has an alternative to connect South Yoloten-Osman to the Turkmenistan-China pipeline, currently under construction. As noted in the section on the Bagtiyarlyk Contract Territory, the current reserves base for this pipeline is insufficient for its full loading.
3.4.1.6. Yashlar

The Yashlar field is located in the Amu Darya river basin to the east of S. Yoloten–Osman. The field was discovered in the early 1980s, but has not been developed since that time. According to the most probable estimates of Gaffney, Cline & Associates, the field’s gas reserves are about 675 bcm. The potential annual level of gas production at the field could reach about 20 bcm. Yashlar is relatively close to S. Yoloten; therefore, it is likely to be connected to the transportation infrastructure from the South Yoloten field.

3.4.1.7. Zeagli-Darvaza

The Zeagli-Darvaza (pronounced in Turkmen as Zyakly-Derveze) group of fields is named after the Zeagli-Darvaza elevation of the Central Karakum arch where they are located. Exploration conducted back in the 1960s revealed gas reservoirs. Now this area is famous for its Darvaza gas flare.
Darvaza flare

Exploration drilling was resumed in the Zeagli-Darvaza area in the 1990s. To date, 14 fields have been discovered in the elevation, located 15 to 20 km apart and with reserves of each field at 2 to 6 bcm. The combined reserves of the fields of the Zeagli-Darvaza group are estimated at 67 bcm, the planned gas production level – at about 5.5 bcm per year. Gas-bearing reservoirs are at depths less than 1,000 meters; the gas contains almost no sulfur and has low concentration of carbon dioxide.

Production is expected to begin in 2010 or 2011. The Takyr field – the largest field of the group – will be put into production first. In 2008, the workover of well 201 started at the field with anticipated flow of 250,000 cubic meters per day. The construction of a low-temperature gas separator (design capacity – 15 MMcm per day) has also started; it is planned that over 60 wells will be connected to it.

A booster compressor station and a liquefied gas plant will be built close to the low-temperature separator. The construction sites have already been defined.
Map 7. Zeagli-Darvaza group fields

Transportation
Gas from the Zeagli-Darvaza group will be evacuated through the yet-to-be-built 250-km main pipeline to the Yilanly compressor station and then to the CAC pipeline.

Source: Petroleum Economist World Energy Atlas 2007, RPI research
3.4.2. Turkmenneft

Turkmenneft produces gas in Western Turkmenistan, the country's key oil-producing region. Until recently, gas production there was limited to associated gas, a by-product of the development of oil and oil-and-gas fields. In the last several years production of natural gas was started in Western Turkmenistan along with associated gas production.

The reserves base of associated and natural gas production is comprised of a few oil and gas and gas-condensate fields: Goturdepe, Barsagelmez, Korpedzhe, Ekerem, Ordekli, Akpatlavuk, and Keimir. The residual onshore reserves of associated and natural gas are estimated at 200 bcm.

The two core fields of Turkmenneft – Goturdepe and Barsagelmez – have yielded the largest portion of associated gas over the past few decades. Since the end of the 1990s, the Korpedzhe field has been the largest contributor to the increase in gas production in the western part of the country.

3.4.2.1. Korpedzhe

Deposits of natural gas, oil and condensate were discovered in Korpedzhe in the early 1980s; however, hydrocarbon production there was suspended because of insufficient funding and equipment, as well as absence of market.

Commercial development of the field’s oil reservoirs began in the summer of 1995. A small low-temperature gas separator and a booster pump station were built for gas processing.

Large-scale gas production at the field was made possible with the commissioning of the Korpedzhe – Kurt-Kui (Iran) gas pipeline in December 1997. So far, it is the first and only direct link to an international market for Turkmen gas. The gas sales and purchase contract between Turkmenistan and Iran secures hydrocarbon supplies to the northern provinces of the neighboring state for 25 years.

The National Iranian Oil Engineering and Construction Company (NIOECC) was the general contractor for the $195 million project which included the construction of a gas pipeline and a gas processing facility. The gas pipe is about 200 km long, of which 135 km goes through the territory of Turkmenistan; the pipe diameter is 1,020 mm and the working pressure is 7.4 MPa. The gas pipeline's design capacity is 8 bcm of gas per year, but can be increased to 14 bcm. The gas processing facility's throughput capacity is 8.5 bcm per year.

In 2005, construction of a new integrated gas treatment complex was completed. The project’s cost is about €114 million, it includes a gas compressor station (with capacity of 4 bcm of compressed gas per year), cleaning, drying and cooling units, as well as a 8 MW gas-turbine power plant, a water desalination unit with reservoirs, and an automated control dispatching station. The complex was built by MAN Ferrostaal Industrieanlagen GmbH (Germany), NIOECC participated as a subcontractor. The complex is being used for utilization of associated gas produced at Korpedzhe and South (Gunorta) Kamyshlydzha, a nearby field. Before that, such gas was being flared.

According to reports by Turkmen media, over 20 MMcm of natural gas and 9 MMcm of associated gas are produced at Korpedzhe daily.
The Korpedzhe Oil and Gas Production Unit, a specialized division within Turkmenneft’s corporate structure, was created in 1998 to produce and market of gas from Korpedzhe. Subsequently, Korpedzhe Oil and Gas Production Unit’s responsibilities were expanded to include the development and utilization of gas resources not only at Korpedzhe, but also at other fields in the Gogerendag-Ekerem region, namely Ekerem, Shatut, Akpatlavuk, Chekishlyar and Keimir.

3.4.2.2. Other Fields

Turkmenneft’s gas production expansion program includes construction of a low-temperature separator at Chekishlyar, a gas processing facility at Akpatlavuk, and a booster compressor station at Keimir.

In particular, the gas-lift compressor station being built at Keimir with annual capacity of 960 MMcm will compress associated gas to 12 MPa and deliver it to the field’s gas-lift system. If necessary, surplus gas will be collected at the Keimir gathering station and via the Akpatlavuk processing facility will enter the Korpedzhe — Kurt-Kui pipeline. The $135 million project is being implemented by GP Global Equipment Ltd. (UK). The station completion is scheduled for the beginning of 2009.

Khazar

A contract to construct a compressor station in the Khazar contract territory, concluded with Frunze NPO of Sumy (Ukraine), includes construction of a 2 bcm per year booster compressor station. The station will compress associated gas with excess pressure up to the level of 2.5 MPa and will send it to the Goturdepe compressor station via the Khazar-Goturdepe gas pipeline for further transportation through the CAC-3 pipeline.

3.4.3. Projects with Foreign Operators

3.4.3.1. Bagtiyarlyk (onshore)

The project operator is CNPC International Turkmenistan, a subsidiary of China National Petroleum Corporation (CNPC). CNPC was granted an exploration and production license for the Bagtiyarlyk contract territory under the PSA signed in July 2007 with the State Agency for the Management and Use of Hydrocarbon Resources under the President of Turkmenistan. At the same time, CNPC and Turkmengas signed an agreement for the sale and purchase of natural gas. Under the agreement, gas delivery from Turkmenistan to China is to start in 2009.

Earlier, in April 2006, when the former President of Turkmenistan Saparmurat Niyazov visited China, an intergovernmental arrangement was signed to authorize the construction of the 7,000 kilometer Turkmenistan-China pipeline and deliveries of up to 30 bcm of Turkmen gas per year. The current President of Turkmenistan, Gurbanguly Berdymukhamedov, has since declared an intention to increase gas deliveries to China to 40 bcm per year.

For the first phase of the project, the production sharing agreement envisages exploration and appraisal work at the Samandepe, Yashlydepe, Metedzhan and Gendzhibek fields in the Bagtiyarlyk contract territory, their development and accelerated commissioning, upgrading of existing facilities, and construction of new gas field infrastructure.
In particular, the exploration program includes additional geophysical 3D surveys. Rehabilitation of 27 idle wells and drilling of 40 new exploration and production wells were scheduled for 2008 and 2009.

Total investment under the first phase of the project is expected to exceed $6 billion. Upon completion of the first phase, natural gas production is to reach 13 bcm per year. This figure is expected to grow as new fields are brought onstream in the future.

Map 8. Bagtiyarlyk contract territory

Source: CNPC

Samandepe

The most significant reserves base in the contract territory is in the Samandepe field. The field’s residual reserves are estimated at 60 bcm. Maximum gas production level at the field according to the field development plan prepared by Turkmengas before Samandepe was included in the Bagtiyarlyk contract territory is 3 bcm.

The new project operator reportedly plans to increase annual production to 5 bcm. According to statements made by CNPC International, a total of 30 wells – 23 rehabilitated and 7 newly constructed - will be ready for production at Samandepe by the end of September 2009, while exploration drilling is also being conducted at the Pirguyi, Yanguyi, Chashguyi and Beshir fields.
Gas from Samandepe (similar to gas from other fields in this region) has high sulfur content, and during the Soviet period it was transported via pipeline and processed at the Mubarek gas processing plant in Uzbekistan. After the USSR collapsed, the gas production from the fields on Amu Darya’s right-bank stopped, since no agreements were reached with Uzbekistan regarding the use of the pipeline. To solve the problem of processing Samandepe gas, a gas processing facility is planned to be built at the field with a design capacity of 5 bcm of dry gas, 170,000 tons of gas condensate and 210,000 tons of high quality sulfur extracted from the gas.

The construction of the gas processing facility began in the middle of 2008, commissioning is scheduled for the end of 2009 so to coincide with the commissioning of the Turkmenistan-China gas pipeline.

A second similar gas processing facility with capacity of 8 bcm will be put into operation at the end of 2010. The facility is to be built at the Altyn Asyr field located near Yashildepe. Both gas processing plants will be connected by a 68-km pipeline with a diameter of 914 mm.

As a result of the described measures, 13 bcm of gas for exports to China will be produced in the contract territory by the end of this decade. It is also planned that during the first phase of the project, the 17 bcm of gas required for full loading of the pipeline will be supplied by TurkmenGas from the Malai and Uchadzhi fields.

An additional source of gas for the pipeline may be the Yashyldepe field where a gas processing complex is being built. The complex’s design capacity is 1 bcm of marketable gas, 50,000 tons of liquefied gas and 200,000 tons of condensate per year. The complex is being constructed by Caspro Pipeline Service AG (Liechtenstein), Thermo Design Engineering (Canada) and units of TurkmenVostokneftestro and Lebapneftegazstro. Initially, construction was scheduled to conclude in 2008, but did not meet this schedule.

### 3.4.3.2. Nebitdag (onshore)

Burren Energy produces about 1.5 MMcm to 2.0 MMcm of associated gas per day at the Burun field, which makes 600 to 700 MMcm per year. So far, the produced associated gas has been flared. In the autumn of 2006 Turkmenistan’s government offered to Burren to participate in gas production in the country, following which the company prepared and submitted to the government a plan for gas production and utilization within the contract territory.

According to the company’s estimates, putting suspended gas wells back into production, re-completion of existing wells in gas-bearing pay zones and drilling of new wells would allow commercial gas production to start in 2009. In 2008, Burren prepared necessary production infrastructure for gas utilization.

During the first year, gas production is planned to be 1.5 bcm and to reach the stable level of 2.0 bcm per year during the second year.

### 3.4.3.3. Block-1 (offshore)

The Block-1 project has the greatest production potential of all offshore projects with foreign participation: gas resources in the contract territory are estimated by project operator Petronas Carigali to be about one 1 trillion cubic meters, with proved reserves of about 180 bcm.
As mentioned on the section of the oil industry, pilot commercial development of the Deyarbeikir field began in May 2006. So far, only liquid hydrocarbons have been produced, while associated gas is being flared. However, in the near future Petronas may become one of the first independent commercial gas producers and exporters in Turkmenistan.

The transition to full-scale oil production and commercial gas production is scheduled for early 2010 when the Magtymugly (Eastern Livanov) field is planned to be brought onstream. Design production capacity for the first year is 2.5 bcm. As the Ovez field will begin operating during the next year, gas production will grow by another 2.5 bcm and will reach its maximum of 10 bcm in 2012, maintaining this level at least through 2020.

The construction of a gas processing facility started near the settlement of Kiyanly in mid-2007. At the facility gas condensate and gas will be separated, gas will be dried, gas condensate will be stabilized and stored, and monoethylene glycol will be regenerated. Three 73-km pipelines will be laid from the fields to the gas processing plant: a 660 mm gas pipeline, a 305 mm condensate pipeline for delivering gas and condensate from the field, and a 102 mm pipeline to pump monoethylene glycol for enhanced oil and gas recovery.

Processed gas will be delivered to the CAC-3 trunk pipeline via a 610 mm pipeline and then transported through Turkmenistan’s section of CAC-3 to Kazakhstan. A preliminary agreement on gas transit was reached and a memorandum of understanding was signed between Petronas and KazTransGaz in 2006.

3.4.3.4. Cheleken (offshore)

Gas commercialization is an integral part of the project. Gas reserves are estimated by Dragon Oil at 3.4 trillion cubic feet (over 95 bcm). The current daily gas production level is about 100 MMcf/d (2.8 MMcm/d.).

So far, the majority of produced gas is flared, though part of it is delivered free of charge via a small pipeline to the nearest chemical plant for processing and for residential consumption.

According to Dragon Oil’s gas commercialization project schedule, the following facilities are targeted for completion at end of 2009: onshore gas processing plant initially designed to process up to 220 MMcf/d of sour gas (2.25 bcm per year) and a 40–km, 760 diameter gas pipeline for transportation of produced gas to the shore. Gas condensate will be separated from propane-butane fractions and about 2 bcm of natural gas and liquefied gas will be produced. The target liquefied gas production level has not been specified yet, but according to initial estimates it may reach 75,000 to 100,000 tons per year.

Similar to Petronas, Dragon Oil intends to transport its commercial gas via the CAC-3 gas pipeline.
Table 11. Expected gas production volumes of foreign operators, bcm

<table>
<thead>
<tr>
<th>Operating company</th>
<th>2009</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNPC International</td>
<td>0</td>
<td>5.0</td>
<td>13.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Burren Energy</td>
<td>1.5</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Petronas</td>
<td>0</td>
<td>2.5</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Dragon Oil</td>
<td>0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1.5</td>
<td>11.5</td>
<td>27.0</td>
<td>34.0</td>
</tr>
</tbody>
</table>

Source: Companies’ data, RPI estimate

3.5. Gas Processing

During the Soviet era no gas processing plants were built in Turkmenistan. All produced gas was prepared for transportation (i.e. dried, cleaned) at gas treatment units located at the fields, and then pumped into pipelines.

After Turkmenistan became an independent country, the creation of a gas processing industry became a high priority in developing the oil and gas industry. The program adopted in the early 2000s envisaged construction of not less than 20 on-site LPG mini-plants with total capacity of 2 million tons per year. According to the Program for developing the oil and gas industry of Turkmenistan through 2030, adopted in October 2006, the schedule for reaching this production target level, was extended to 2020.

The large-scale plans for LPG production have a basis in the high share of “wet” gas in explored reserves: turning “wet” gas into commercial gas requires gas processing involving separation of gas condensate and propane-butane fractions, cleaning etc.

By the end of 2008 the total capacity of gas processing facilities in the country was about 500,000 tons of LPG per year. Over two thirds of this represents the share of the Turkmenbashy oil refinery complex – the capacity of its unit for liquefied gas production is 345,000 tons per year. Other gas liquefaction facilities were built by Turkmengas directly at the fields: Naip (three units with a total design capacity of 112,500 tons of LPG per year and actual capacity of 130,000 tons per year and 72,000 tons of gas condensate per year) and Bagadzha (22,000 tons of LPG and 18,000 tons of gas condensate per year).
3.6. Gas Transportation Infrastructure

Turkmenistan’s gas transportation infrastructure consists of gas pipelines with a total length of 8,000 km (measured by single line) and 10 compressor stations with a total capacity of 800 megawatts. Turkmengas is the operator of almost the entire gas pipeline system in Turkmenistan, with the exception of a 135-km section of the Korpedzhe — Kurt-Kui gas pipeline operated by Turkmenneft.

Apart from the Korpedzhe — Kurt-Kui gas pipeline, all trunk gas pipelines were built between 1962 and 1986. As a result of long operation, the gas transportation system, including field gas
pipelines, the rural distribution network and compressor stations, has a high rate of wear, which reaches 90 percent of the average design operating period.

Turkmenistan does not have underground gas storages; gas is processed at gas treatment units built at the fields and is pumped into the gas transportation system.

3.7. Export pipelines

Turkmenistan currently exports gas in two directions: to the north (to Russia and then to Ukraine) and to the south (to Iran). To deliver gas via the first route, which is the main export channel for Turkmenistan's gas, the Central Asia-Center (CAC) pipeline system is used. CAC consists of CAC-1, CAC-2, and CAC-4 (the Turkmen name for the system is Turkmenistan (Deryalyk) – Europe). Gas is exported in the southern direction via the Korpedzhe — Kurt-Kui gas pipeline.

3.7.1. CAC-1, 2 and 4

The CAC-1, 2 and 4 gas pipeline systems have the following gas pipelines located in Turkmenistan:

- Dauletbad – Shatlyk – Khiva: consists of two lines in the section from Dauletbad to the Khiva compressor station in Uzbekistan; the length of Turkmenistan's section is 574 km, pipe diameter is 1,420 millimeters;
- Khiva – Beineu (Kazakhstan): consists of three lines; the length within Turkmenistan's territory is 186 km;
- Khiva – Kungrad (Kazakhstan): consists of two lines; the length within Turkmenistan's territory is 230 km, pipe diameter is 1,220 millimeters;

Apart from CAC-1, 2 and 4, the Bukhara-Ural gas trunk pipeline crosses Turkmenistan with two lines of 118 km length, pipe diameter - 1,020 millimeters.

The combined design throughput capacity of the sections of the CAC-1, 2 and 4 pipelines that run within Turkmenistan is 55 bcm per year; however, the actual throughput capacity of this transportation route at the beginning of 2000s, according to a Gazprom estimate based on 2003 audit results, decreased to between 44.0 and 47.5 bcm of gas. However, in the following years Turkmengas completed a significant amount of work aimed at modernizing and expanding the gas pipeline system (see more details in the section on Upgrade and Expansion of Existing Infrastructure below).

The design capacity of the Bukhara-Ural gas pipeline is 15 bcm of gas per year, its current capacity according to different estimates varies from 3.5 bcm per year at Uzbek section to 7.5 bcm per year at Russian section. The pipeline is mainly used to transport Uzbek gas.
3.7.2. CAC-3 (Okarem-Beineu)

The Okarem-Beineu gas pipeline (the Turkmen name is Turkmenistan (Bekdash) - Europe pipeline) was initially designed to deliver gas from the western part of the republic to the European part of the USSR. The pipeline starts from Okarem (Ekerem in Turkmen pronunciation) and goes along the Caspian coast to the Beineu compressor station in Kazakhstan. The pipeline’s length within Turkmenistan from the Ekerem compressor station to the Bekdash compressor station is 540 km, with pipe diameter between 529 and 570 millimeters and design capacity of 10.5 bcm of gas per year.

In the years of independence, CAC-3 was taken out of service and remained idle for several years before being rehabilitated and used to deliver gas to settlements in the Balkan velayat (the north-western part of the country). The pipeline’s current capacity is estimated at 4.5 to 5.0 bcm of gas per year, and the actual throughput in recent years was between 0.4 and 0.5 bcm of gas per year.

3.7.3. Korpedzhe – Kurt-Kui

Korpedzhe – Kurt-Kui began operating in December 1997 as the first export pipeline which provides Turkmenistan with direct access to a foreign market. As noted before, the gas pipeline’s reserves base is the Korpedzhe (the initial point) and Gamshylydzha fields in Western Turkmenistan. The length of Turkmenistan’s section of the pipeline is 135 km, pipe diameter is 1,020 millimeters, design capacity is 8 bcm of gas per year with the potential to increase it to 14 bcm.
Table 12. Key characteristics of Turkmenistan’s export gas pipelines

<table>
<thead>
<tr>
<th>Gas pipeline</th>
<th>Length, km</th>
<th>Pipe diameter, mm</th>
<th>Design throughout capacity,bcm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dauletabad-Shatlyk-Khiva (2-3 lines)</td>
<td>574</td>
<td>1,420</td>
<td>40.0</td>
</tr>
<tr>
<td>Khiva-Beineu (3 lines)</td>
<td>186*</td>
<td>1,420</td>
<td>35.0</td>
</tr>
<tr>
<td>Khiva-Kungrad (2 lines)</td>
<td>230</td>
<td>1,220</td>
<td>22.0</td>
</tr>
<tr>
<td>Ekerem-Bekdash (2 lines)</td>
<td>540</td>
<td>520, 720</td>
<td>10.5</td>
</tr>
<tr>
<td>Bukhara-Ural (2 lines)</td>
<td>118</td>
<td>1,020</td>
<td>15.0</td>
</tr>
<tr>
<td>Korpedzhe — Kurt-Kui (1 line)</td>
<td>135</td>
<td>1,020</td>
<td>8.0</td>
</tr>
</tbody>
</table>

* within Turkmenistan’s territory

Source: Turkmengas, RPI research

3.8. Program for Development of Transportation Infrastructure

As noted above in the current report, the program for developing Turkmenistan’s oil and gas industry through 2030 envisages significant growth of gas production and exports. Gas exports are planned to reach 100 bcm in 2010, and between 140 and 150 bcm in 2020.

Based on the country’s geographical position, Turkmenistan’s government follows a diversification strategy for exports of energy resources. In cooperation with the governments of several countries, international banks and other international organizations, several options for gas export pipeline projects have been developed, including the Pre-Caspian and Trans-Caspian gas pipelines, Turkmenistan-China and Turkmenistan-Afghanistan-Pakistan-India.

However, taking into account the existing agreements between Turkmenistan and Russia on gas cooperation, Russia will remain the primary export market for Turkmen gas in the foreseeable future. In accordance with the agreement signed in April 2003 on cooperation in the gas industry, supplies of Turkmenistan’s gas to Russia are to increase to between 70 and 80 bcm per year by the end of this decade.
3.8.1. Existing Infrastructure

To ensure gas exports in volumes provided for by existing contracts and framework agreements, Turkmenistan is implementing a number of projects for the development and reconstruction of existing gas transportation networks. In 2007 a $396 million project was completed to upgrade Turkmenistan (Deryalyk) – Europe, Turkmenistan’s section of the gas pipeline system which transports gas to the north. Most of the budget went into construction of bypass pipelines and linear compressor stations.

3.8.1.1. Turkmenistan (Deryalyk) – Europe

In order to increase gas transportation capacity from the fields in the eastern part of the country, the Turkmenistan (Deryalyk) – Europe pipeline reconstruction project was implemented between 2001 and 2007, which involved construction of 165.7 km of bypass pipelines (near Khiva) and of the Yilanly and Deryalyk linear compressor stations (90 megawatt each). A glycol gas dehydration unit with a capacity of 64 bcm of gas per year was installed at the Deryalyk compressor station.

As a result of reconstructing the Turkmenistan (Deryalyk) – Europe gas pipeline system, the trans-border capacity of Turkmenistan’s pipeline system, according to official data, reached 80 bcm of gas per year. In addition, the construction of two gas lines of 1,420 millimeters bypassing the Khiva compressor station in Uzbekistan allows to transport up to 64 bcm of Turkmen gas without crossing the Uzbekistan territory at this section of the pipeline route.
Map 10. Bypass pipelines near Khiva

Source: Turkmengas
3.8.1.2. Pre-Caspian Gas Pipeline

The agreement to implement the Pre-Caspian gas pipeline project was reached during a meeting of the presidents of the Russian Federation, Turkmenistan and Kazakhstan in May 2007, and the inter-governmental agreement between the three parties was signed in December of the same year. The document has a framework nature and was concluded in order to develop and implement a trilateral energy initiative between Russia, Kazakhstan and Turkmenistan.

According to the agreement, the Pre-Caspian gas pipeline will run from the Belek compressor station in Turkmenistan through Kazakhstan to the Aleksandrov Gai gas-measuring station in Russia. The pipeline is about 1,700 km long with 500 km in Turkmenistan and 1,200 km in Kazakhstan.

Initially it was planned that Turkmenistan would reconstruct the existing Okarem-Beineu pipeline, which connects gas fields in the western part of Turkmenistan with the CAC-3 trunk pipeline at Beineu, or alternatively build a new pipeline to the border with Kazakhstan with a capacity of up to 10 bcm of gas per year. With this, the Turkmen side would guarantee the supplies to Gazprom of the same gas volumes in this direction. For its part, Kazakhstan took upon itself to deliver additional 10 bcm of its gas and to increase the capacity of this route within its territory to 20 bcm per year. Russia guaranteed to purchase the respective gas volumes and to implement required CAC expansion within its territory. The project was scheduled to begin in the second half of 2009 and to be concluded in 2010.

In July 2008 Gazprom’s CEO Alexei Miller and the President of Turkmenistan, Gurbanguly Berdymukhamedov, signed an agreement on Gazprom’s participation in investment projects in Turkmenistan’s gas industry. In particular, the agreement envisages Gazprom’s participation in the financing and construction of new gas trunk pipelines, field development, as well as an increase of the capacity of Turkmenistan’s section of the Pre-Caspian gas pipeline to 30 bcm per year. In December, Gazprom and Turkmengas developed the Terms of Reference for the Turkmen section of the Pre-Caspian gas pipeline.

Judging by statements made by Russian and Turkmen officials, the Pre-Caspian gas pipeline project in its current configuration involves (a) an increase of the capacity of Turkmenistan’s section of the Okarem-Beineu gas pipeline to its original design capacity of 10.5 bcm of gas per year, and (b) construction of a new parallel line with capacity of 20 bcm per year.

Expansion of Turkmenistan’s section of the Okarem-Beineu gas pipeline includes modernization (equipment replacement) of the Belek and Goturdepe compressor stations, as well as of the 70-km long pipeline from to Khazar to Goturdepe compressor station - this line was designed to deliver gas from Caspian littoral and offshore fields to the trunk pipeline system.
Map 11. Pre-Caspian gas pipeline route

Source: KazMunaiGaz
3.8.2. New Gas Transportation Routes

3.8.2.1. Turkmenistan-China Gas Pipeline

The pipeline's total length is about 7,000 km, including 188 km in Turkmenistan (the Malai-Bagtiyarlyk section of the gas pipeline). From Bagtiyarlyk, the gas pipeline goes through Uzbekistan and Kazakhstan and then crosses the Chinese territory from west to east ending in Guangzhou. The design capacity of the pipeline is 30 bcm of gas per year, but Turkmenistan has already declared that it is ready to increase it to 40 bcm per year. (See section on Bagtiyarlyk for more details on the pipeline's resource base).

The commissioning of the pipeline is scheduled for the end of 2009. However, considering the scale of the project and the complexity arising from the participation of several member states the territory of which the pipeline is planned to cross, it is unlikely that the pipeline will become operational strictly on schedule. During the first several years of operation, the pipeline will be significantly under-utilized: in the first year the pipeline will operate in test regime pumping 3 to 5 bcm of gas, with gradual increase to 30 bcm by 2014.

3.8.2.2. Turkmenistan-Afghanistan-Pakistan-India (TAPI) Gas Pipeline

The project dates back to early 1990s, when Argentina's Bridas (which at that time held exploration and production licenses for two blocks in Turkmenistan, including Yashlar) proposed to the Turkmenistan government a project to construct the pipeline through Afghanistan for gas
deliveries to Pakistan. Later US Unocal/Delta became the major driving force of the project. In 1998, after the Taliban movement established control of the most part of the Afghan territory, the American company left the project and until the overthrow of the Taliban regime in Afghanistan in late 2001 the project has been dormant.

The intergovernmental agreement on gas pipeline construction was signed by heads of state of Turkmenistan, Afghanistan and Pakistan in 2002. In 2006, at a meeting of the Steering Committee, India also confirmed its participation in the project. The meeting participants signed an amendment extending the duration of this agreement on gas pipeline construction by three years.

The Dauletabad field is seen as the reserves base for the pipeline; its residual reserves are considered to be sufficient for the project's viability. The project's feasibility study was prepared by Penspen (UK) in 2005. The pipeline is seen as having a diameter of 56 inches (1,420 millimeters), working pressure of 9.8 MPa, six compressor stations and design capacity of 33 bcm of gas per year.

The pipeline route starts at Dauletabad and goes to Fazilka at the Pakistan-India border. The pipeline's length is 1,680 km, including 145 in Turkmenistan, 735 in Afghanistan and 800 in Pakistan. The project cost was initially estimated at $3.3 billion, but this figure was later increased to $7.6 billion.

Despite intergovernmental agreements and numerous meetings held by representatives of the parties involved, up to now the future of the project looks very uncertain, given the serious obstacles to its implementation. (see more in the section Scenarios of Gas Production and Exports).

Map 13. TAPI gas pipeline
3.8.2.3. Trans-Caspian Gas Pipeline

The Trans-Caspian gas pipeline project was initiated by the United States in the late 1990s when, in opposition to construction of the Blue Stream pipeline across the Black Sea, an alternative project to transport gas from Turkmenistan to Turkey was proposed. This project included construction of a 260 km long sub-sea pipeline (at depths of 200 to 300 meters) across the Caspian Sea to Baku and further through Azerbaijan and Georgia to Erzurum (Turkey); an extension through Turkey to the Balkans and Italy was planned in the longer term. The initial capacity of the pipeline was designed at 30 bcm per year. The U.S. Trade and Development Agency funded a $750,000 feasibility study for the pipeline.

A framework agreement on the Turkmenistan-Turkey-Europe gas pipeline project was signed by the presidents of Turkmenistan and Turkey in October 1998. Under this agreement, 30 bcm of gas was to be transported annually, out of which 16 bcm was intended for Turkey and the balance for other European countries. The gas purchase agreement, which provides for the supply of 16 bcm of gas per year to Turkey for 30 years, was signed by Botas (Turkey) and the Competent Body for the Use of Hydrocarbon Resources (Turkmenistan) in May 1999. Therefore, Turkey currently has an effective agreement for a minimum annual supply of 16 bcm of gas from Turkmenistan.

Despite an intergovernmental agreement was signed and a PGS consortium was formed for the construction and operation of the Trans-Caspian gas pipeline consisting of General Electric, Bechtel, and R/D Shell, the project never materialized. The initial plan was to use the pipeline not only for deliveries of gas from Turkmenistan, but also for gas produced in Azerbaijan at the Shakh-Deniz field discovered in 1999. After results came in revealing that the reserves of Shakh-Deniz greatly exceeded earlier estimates, Azerbaijan demanded an increase of the quota for its gas in the projected supplies to Europe. Disputes on this, as well as other issues between Baku and Ashkhabad effectively laid the project to rest.

However, at the beginning of 2006 the EU and the USA sought to revive the project for supplying gas from Central Asia to Europe and declared that Kazakhstan should be brought in as a project participant. Preliminary estimates show that ideally construction of the gas pipeline with a preliminary design capacity of 26 bcm to 32 bcm per year may start at the end of 2010 and finish in 2013, when Stage 2 of the offshore Shah Deniz gasfield in the Azerbaijan sector of the Caspian Sea comes on-stream.

Statements by official sources in Kazakhstan and Turkmenistan concerning the Trans-Caspian pipeline may be interpreted as cautiously supportive of the project. However, neither party has so far gone further than broadly stating its interest and potential participation in the project.
3.8.3. Export Directions: Potential Capacities

Combined potential gas export capacities from Turkmenistan in the northern, southern (Iran) – and eastern directions by 2010 can be estimated at about 134 bcm of gas per year of which 67 percent is the share of the northern route. For 2020 the capacity in the northern, southern and eastern directions would be the same. Additionally, the implementation of the TAPI and Trans-Caspian projects would increase the country's transportation capacities to 197 bcm of gas per year.

3.8.3.1. Northern Export Direction

Russia and other FSU countries are a traditional market for Turkmen gas. During the Soviet era, most of gas supplied from Central Asia to the European part of the country was of Turkmen origin. The Soviet-era infrastructure for gas transportation from Turkmenistan (CAC 1-4) is directed to Russia, from where Turkmen gas may be routed in several directions:

- to the Russian domestic market (Aleksandrov Gai – Petrovsk – Central European Russia);
- to the Northern Caucasus (via the Makat – Northern Caucasus gas pipeline);
• to European countries (via the Orenburg – Novopskov gas pipeline, Soyuz pipeline and via the pipelines from Western Siberia to Ukraine and then to Europe).

After the USSR disintegrated, Turkmenistan continued supplying gas to the newly independent countries, mainly to Ukraine. In May 2001, Ashkhabad and Kiev signed a medium-term agreement for the supply of 250 bcm of Turkmen gas to Ukraine from 2002 through 2006.

An agreement on large-scale deliveries of Turkmen gas to Ukraine did not fit into Gazprom’s strategy in Central Asia, aiming to establish control over gas supplies from this region. In April 2003 the presidents of Russia and Turkmenistan signed an agreement on cooperation in the gas industry. Pursuant to the agreement, Gazprom and Turkmenneftegaz (the state corporation which at that time was responsible for the marketing of Turkmen gas) signed an agreement under which Turkmenistan assumed the obligation to supply gas to Gazprom for 25 years starting with 5 bcm in 2004 and reaching the level of 70-80 bcm for the period beyond 2009. Initially the agreed price for gas was $44 for 1,000 cubic meters, where 50% of gas price was to be paid in money and the other 50% through equipment supplies for Turkmenistan’s gas industry.

**Chart 18. Gas supplies from Turkmenistan in 2000-2007, bcm**

* RPI estimate

*Source: Gazprom, Turkmengas*
In September 2006 Gazprom and Turkmengas (which by that time assumed the responsibility for the marketing of Turkmen gas) signed an addendum to the gas supply contract which specified the Turkmen gas price and supply volumes for 2007-2009. The gas deliveries during this period were to reach 50 bcm per year; the price for gas was fixed at $100 per 1,000 cubic meters through the end of 2009.

As prices for energy products grew in 2007, Turkmenistan demanded an increase of the gas price. As a result of negotiations, the price for Turkmen gas was established at $130 per 1,000 cubic meters for the first half of 2008, and at $150 for the second half of 2008. Starting January 1, 2009, the price for Turkmen gas is determined by a formula linked to European prices for gas.

Despite the significant price increase for Turkmen gas since 2004, the volumes supplied to Russia have not reached the pre-agreed figures. In 2007 Gazprom received 42 bcm from Turkmenistan; in 2008, according to RPI estimates, the volume of supplies was approximately at the same level (official data was not available at the time of the report’s writing).

The main reason for the deliveries falling short of the agreed volumes is the limited capacity of the CAC gas system. According to statements by Turkmenistan’s officials on new facilities put into operation in the course of reconstruction of the CAC-1, 2 and 4 pipelines, annual pipeline capacity in the northern direction has reached 80 bcm. However, it does not resolve the full range of transportation issues.

Turkmenistan is located at the very beginning of the gas transportation chain and its exports in the northern direction are dependent on the transit capacities of the CAC pipeline sections of Uzbekistan and Kazakhstan. These transit capacities are managed by Uzbekistan and Kazakhstan on a availability basis (i.e. equal to how much gas is left in the pipe after it is filled with own gas).

At present, the capacity of Uzbekistan’s and Kazakhstan’s CAC 1, 2 and 4 sections is estimated at 54-55 bcm. As noted above, in September 2007 Russia and Uzbekistan agreed to build a new gas pipeline with a capacity of 26-30 bcm along the route of CAC-1 and CAC-2. This project will increase the total capacity of the CAC transport system in Uzbekistan to 81-85 bcm. Kazakhstan is also at work to expand its CAC section to 80 bcm per year by 2010 and 100 bcm per year by 2012. In light of Uzbekistan’s plans to increase gas exports, the issue of capacities for Turkmen gas transit through Uzbekistan and Kazakhstan remains far from clear. In addition, construction of a new pipeline in Uzbekistan so far lacks the requisite legal framework, and the time period for construction has not been determined either.

Starting 2007, Turkmenistan has boosted its efforts to expand the capacity of another route in the northern direction – the one along the Caspian coast – and has made it a high priority. Turkmenistan’s government considers the main advantage of this route, as compared with CAC-1, 2 and 4, to be the possibility of bypassing Uzbekistan, thus substantially diminishing Turkmenistan’s dependence on left-over transit capacities.

The reconstruction of CAC-3 and the construction of the new Pre-Caspian gas pipeline would provide for an increase in capacity in the northern direction by another 30 bcm. However, it is not clear which fields will serve as the reserves base for the Pre-Caspian route.

Traditional onshore fields in the western part of the country that contain residual gas reserves estimated at of 200 bcm can provide up to 10 bcm for a short time period. In the long term, offshore fields may become a new large source of gas, but in the near future offshore gas
production will be limited to the Petronas Carigali and Dragon Oil projects. These projects may collectively provide up to 12 bcm of gas per year. Another 2 bcm per year can be supplied from the onshore Nebitdag project. This means that in the near term the potential gas production level in Western Turkmenistan will at best be at 24 bcm per year; this figure is likely to be still smaller, considering the anticipated decline in gas production at Turkmenneft's fields, probable delays in implementing new projects and other factors.

In light of the challenges with expanding the capacity of both CAC routes, the outlook for a significant increase in supplies of Turkmen gas to Russia in the near future, let alone reaching the level of 80 bcm per year as provided by the 2003 agreement, seems unrealistic.

3.8.3.2. Southern Export Direction

Iran

In February 2009 at a meeting between Iran’s and Turkmenistan’s presidents an agreement was reached to increase supplies of Turkmen gas to Iran to 10 bcm per year, i.e. roughly by 50 percent. Neither party revealed when this level was expected to be reached. According to available information, the price for gas will be determined in further negotiations.

Iran purchases gas from Turkmenistan at prices that are close to those paid by Gazprom. As a rule, after raising prices for the Russian gas monopoly, Ashkhabad requests that the price for gas purchased by the National Iranian Gas Company also be increased. Between December 2007 and April 2008 supplies to Iran were suspended, which coincided with the period of negotiations between Turkmenistan and Iran. Deliveries of Turkmen gas are very important for the northern parts of the country where Iran does not have any of its own gas sources or an alternative to gas from Turkmenistan. Therefore, Ashkhabad may expect high profitability from gas supplies in this direction.

However, the gas reserves of Korpedzhe and other developed fields of the Gogerendag-Ekerem area that are currently the reserves base for the Korpedzhe — Kurt-Kui gas pipeline, do not seem to be sufficient to increase supplies of Turkmen gas to Iran by 50 percent, thus making use of additional resources necessary. This assessment is supported by the fact that the agreement between Iran and Turkmenistan to increase gas supplies also provides for Iran’s participation in the development of a new field in Turkmenistan (the field name has not been disclosed).

Pakistan, India

Construction of the TAPI gas pipeline could increase gas exports in the southern direction by 33 bcm per year. Projected offtake of gas by Afghanistan would be 0.14 bcm during the first two years of the pipeline’s operation and 5.1 bcm starting with the third year. The remaining gas would be distributed between Pakistan and India in equal shares.

The length of the TAPI pipeline is 1,680 km, which is shorter than the Iran-Pakistan-India pipeline (about 2,000 km), its competitor in this region. However, the military and political situation in Afghanistan has been, and remains, the weakest point in the TAPI project: The
project has little chance for success unless the situation in this country stabilizes, which is currently hard to predict.

It appears that Pakistan and India might be using the TAPI project as a tool in their bargaining with Iran over gas prices, while India is also pressing Pakistan for lower transit fees for transportation of Iranian gas through Pakistan. The future of TAPI is likely to be determined if and when the parties settle this set of issues.

3.8.3.3. Eastern Export Direction

China is a new and promising market for Turkmenistan’s gas. Under a July 2007 contract, annual supplies of gas via the Turkmenistan-China gas pipeline, currently under construction, should total 30 bcm per year for 30 years. China offered Turkmenistan the highest price among other export options at the time the contract was completed – $195 per 1,000 cubic meters. However, Beijing decided that this price was acceptable given the range of benefits from the project’s implementation.

The gas sale and purchase contract for Turkmenistan’s gas was signed together with a PSA for the Bagtiyarlyk contract territory, where CNPC had performed exploration that confirmed significant gas reserves. Thus, CNPC has an explored reserves base that guarantees long-term gas supplies to China. At least 13 bcm of the 30 bcm of contracted gas is expected to be produced at Bagtiyarlyk. For this reason the Chinese company is partially hedged against a sharp rise in prices for exported gas. In addition, Beijing obtained guarantees from Ashkhabad for the balance of gas supplies from other fields developed by Turkmengas. This possibility is ensured through construction of the Malai-Bagtiyarlyk gas pipeline. In this manner, the Chinese side has managed to minimize project risks.

The activity of Chinese companies in other Central Asia countries, particularly in neighboring Kazakhstan, shows that Beijing aims to create a reliable reserves base along its borders. For this purpose, it pursues a long-term strategy of deep penetration into the oil and gas industries of those countries.

Turkmenistan, being a holder of large hydrocarbon reserves, is undoubtedly viewed as a key resource supplier. It would be logical to assume that Bagtiyarlyk is a first step in penetrating the oil and gas industry of this country. Beijing’s interests are unlikely to be limited by fields and prospective blocks on the right bank of Amu Darya.

In its search for strategic investors, the Turkmenistan government is likely to strive for a certain balance of interests between the main competitors for Turkmenistan’s energy resources – Gazprom and CNPC – or Russia and China. However, if agreements with Gazprom on participation in field development (to provide an additional reserves base for gas exports to Russia) and infrastructure construction do not materialize in the near future, (for example, because of financial considerations), these agreements may become invalid and CNPC may take Gazprom’s place.

So far, Ashkhabad has offered Beijing to increase gas supplies to China from 30 bcm to 40 bcm per year. In September 2008 Turkmengas and CNPC signed a framework agreement that provides for revision of previously agreed supply volumes. At the present stage of the project’s implementation, the framework agreement is likely to be predominantly a declaration of intentions. Filling it with actionable content would require resolving a number of issues, primarily
related to additional reserves base and transportation capacities. It is possible that if Kazakhstan builds the Beineu-Bozoi-Samsonovka gas pipeline (construction was scheduled to start in 2008, but was postponed due to insufficient financing and current deficit of reserves base), Turkmenistan could possibly use this route to export gas to China.

3.8.3.4. Western Export Direction

Turkmenistan has been striving to gain access to the European market via a route that would be an alternative to CAC, one example of which was participation in the aborted Trans-Caspian gas pipeline project. Despite the project's failed start in the early 2000s, Ashkhabad has indicated that it remains interested in it.

An obvious reason for this position is Turkmenistan's unwillingness to keep its own gas production plans dependent on Gazprom's requirements for Central Asian gas volumes and related transportation capacities. The situation is made even more complex by the necessity for Turkmenistan to coordinate its plans and activities with the transit countries – Uzbekistan and Kazakhstan. Finally, the gas conflict between Gazprom and Naftogaz (in fact, between Russia and Ukraine) at the beginning of 2009 that suspended gas supplies to Europe and directly affected the interests of Central Asian gas producers, raised doubts about the reliability of this export route.

Ashkhabad's interest in gas supplies to the European market is actively supported by potential buyers of Turkmenistan's gas, firstly the European Union, as well as by the USA. The Trans-Caspian gas pipeline is seen as the main gas source for the Nabucco pipeline to transport gas from Central Asia and Azerbaijan to Turkey and further on to the countries of south-eastern and central Europe.

However, the distance between expression of interest on the part of Ashkhabad in the Nabucco project and its participation in the project's actual implementation could be quite long, since a range of issues needs to be resolved to mitigate risks for potential buyers of Turkmen gas and for Turkmenistan itself.

Turkmenistan sees its possible participation in the project as a gas supplier. From Ashkhabad's perspective, this means that apart from the pipeline's section located on Turkmenistan's territory, the construction of the Trans-Caspian gas pipeline and its sections in Georgia and Turkey would be the responsibility of interested western companies. From the point of view of potential project participants, a prerequisite for the Trans-Caspian gas pipeline construction would be obtaining guarantees from potential suppliers for sufficient gas volumes to fill Nabucco.

Considering that so far Azerbaijan has been the only Caspian state that guaranteed annual supply to Nabucco of 8 bcm of its gas (planned to be produced when Stage 2 of the offshore Shah Deniz gas field comes on-stream), it means that additional 18 to 24 bcm of gas are needed to fill the pipe to its annual design capacity of 26-32 bcm. Kazakhstan's potential to narrow this gap with its own supplies is minimal in the short- and medium-term perspective, if any. Hence, the expectations that potential project sponsors place on Turkmenistan.

However, Turkmenistan's sources of potential gas volumes that could fill the Nabucco gas pipeline in the near term are not clear at the moment. Statements about large reserves in Turkmenistan's sector of the Caspian Sea present a picture that is too general, since only the
reserves of the two active offshore projects have been confirmed, while all other projects are yet to be explored and developed.

In terms of economic risks, the issue of price which buyers are willing to pay is still open. In turn, the gas price will depend on the final cost of the project. After Gazprom agreed to purchase gas from Central Asia starting in 2009 at prices related to those in Europe, the economic feasibility of the Trans-Caspian project has become more doubtful.

On the project's political risks, it should be noted that Iran and Russia oppose the construction of the Trans-Caspian gas pipeline – and Ashkhabad cannot completely ignore their position. On the other hand, recent military action in the Caucasus showed that the route via Georgia and Turkey has certain geopolitical risks.

However, the very existence of the idea of the Trans-Caspian pipeline project has contributed to Turkmenistan receiving tangible economic benefits, since it heats up competition between pipeline projects. Without this factor, it is less than certain whether Ashkhabad would have been able to obtain such high gas purchase prices from Gazprom, its largest buyer for now and in the foreseeable future.
Chapter 4. Scenarios of Gas Production and Exports from Turkmenistan

4.1. Methodology

In this section, the authors examine three scenarios for producing gas in Turkmenistan and exporting it from that Central Asian country. At the base of each rests an assumption about the price of oil worldwide – high, moderate or low.

The study *CIS Natural Gas: Outlook for International Impact*, published by RPI in February 2009, contains a comprehensive analysis of these scenarios. In this section, we provide only its key findings and a general introduction.

The scenarios are founded on the following price levels:

- High: the price of oil will exceed $70 per barrel;
- Moderate: the price of oil will range from $55 to $70 per barrel;
- Low: the price of oil will range from $40 to $55 per barrel.

The key factors that were taken into account and analyzed in developing the scenarios are the following:

(1) Demand

Demand for Turkmen gas on the part of consumer countries is confirmed by (a) long-term contracts between Turkmenistan and companies in those countries, and (b) declarations of market players about their intent to purchase gas if and when it becomes available.

To date Turkmenistan has concluded four sales and purchase contracts for natural gas. These are with Gazprom (Russia), the National Iranian Gas Company, the China National Petroleum Corporation and Botas (Turkey). Only two of these contracts – with Gazprom and NIGC – are currently active. The contract with CNPC will take effect when construction of the Turkmenistan-China gas pipeline is completed. The contract with Botas, although signed in 1999, cannot be implemented because a means of transport (gas pipeline via the Caspian Sea) for the gas does not exist. Potential gas supply under these four contracts, in case of 100-percent offtake, is estimated at 106 bcm per year.

(2) Supply

Each of the three scenarios for exports of gas bears the underlying premise that international oil prices will have no significant influence on domestic demand for gas: for all practical purposes, no market for gas in Turkmenistan exists. That is, internal demand for gas will remain more or less constant, and the export potential (the difference between gas production and domestic demand) will be determined almost entirely by the pace of growth in gas production.
Gas consumption domestically will grow largely as a result of development of the gas transport system (utilizing gas as a fuel for compressor stations) and the electric power industry. According to RPI’s projections, by 2020 internal consumption of gas could reach approximately 29-30 bcm per year, nearly 40-45 percent that of the current level of 19 to 21 bcm annually.

Proceeding from the hypothesis that internal gas consumption will remain relatively constant, and that export potential will be determined by the rate at which gas production increases, potential resources for export in 2020 for the three scenarios are as follows:

- High oil prices: 110 bcm;
- Moderate oil prices: 96 bcm;
- Low oil prices: 76 bcm.

The full (hypothetical) potential of gas production in Turkmenistan (under the condition that all upstream projects are implemented without limitations from the side of demand), as well as the full (hypothetical) potential of gas exports (based on all potential market demand for Turkmenistan’s gas) are higher than the corresponding levels in the highest of the scenario described below. In reality, actual demand on export markets will keep the levels of gas production under the full (hypothetical) potential level.

### Table 13. Turkmenistan’s full (hypothetical) levels of gas production and exports, bcm

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential production</td>
<td>72.0</td>
<td>82.8</td>
<td>140.2</td>
<td>145.2</td>
</tr>
<tr>
<td>Potential exports (based on demand)</td>
<td>51.0</td>
<td>60.6</td>
<td>113.2</td>
<td>116.4</td>
</tr>
</tbody>
</table>

Source: RPI research

### (3) Competitiveness (effectiveness) of supplies

The comparative economic effectiveness of supplying gas from Turkmenistan is calculated on the basis of (a) sales & purchase prices tied to international prices for energy (Europe, Russia), or (b) fixed prices in agreements between the parties (China), or (c) price levels in end markets (Southern Asia), as well as (d) estimates of cost of gas transportation. Such analysis makes it possible to compare netback prices for gas in various markets by linking them to one geographic point – the Shatlyk field.

Detailed analysis of the economic effectiveness of gas supplies from countries of the Caspian region, including Turkmenistan, is included in the *CIS Natural Gas: Outlook for International Impact* study. Calculations made for that study, show that highest effectiveness in exporting Turkmen gas is reached through deliveries to China, followed, in falling order of effectiveness, by Russia, the countries of South-Eastern Europe and, finally, the markets of Southern Asia.
(Pakistan, India). In the current report, the authors present only physical parameters of gas exports from Turkmenistan.

(4) Political factors
Among numerous political factors, military operations in Afghanistan are of foremost concern: without their end, and reconciliation of political conflict within the country, construction of a gas pipeline in Southern Asia is not feasible.

(5) Regional competition
Turkmenistan is situated at the beginning of a transportation chain whose primary direction at this time is export to the north. Export of Turkmenistan’s gas via that route is dependent on the gas transit capacity of the Uzbekistan’s and Kazakhstan’s sections of the Central Asia-Center gas pipeline. Uzbekistan and Kazakhstan determine that capacity on a residual basis; that is, how much volume the pipeline can handle after it is filled with their own gas.

(6) Investment potential
The attractiveness of investment in gas production and transportation projects is greatly influenced by international energy price levels. With low prices, it is possible that Turkmenistan could repeat its experiences of the mid-90s when, in search of financing, the oil and gas sector had only its own resources on which to rely. There are, of course, differences between today’s situation and that of the not-too-distant past. Today the government has at its disposition considerable financial resources obtained from gas export, which it could devote to the development of the oil and gas sector.
4.2. High Scenario

4.2.1. Production

This scenario proceeds from the premise that the price of oil will exceed $70 per barrel, and Turkmenistan will realize its export potential to its greatest extent. The Yoloten and Osman fields will be the driving force for the country’s gas production growth. By the start of the next decade, state-owned Turkmengas will implement the first phase of its project – development of the gas reserves most prepared for exploitation. The company will reach production of 20 bcm per year and begin realizing the project's second phase. In addition, it will commission the Yashlar field, where the base level of gas production could reach 21 bcm per year.

The Garabil and Gurrukbil fields will be linked to the Dauletbad field and the Zeakli-Darvaza group of fields will be commissioned. Their operations will compensate for scheduled decline in gas production at the Dauletbad field.

Until 2010 those fields already under exploitation will retain stable production levels; thereafter, production will begin to fall. Through investment in drilling new wells and constructing booster compressor stations it will be possible to avoid a sharp decline in production; the process will be a smooth one.

On the right bank of the Amu Darya River, the China National Petroleum Corporation will attain its planned production level of 13 bcm of gas production per year on schedule.

In the western part of Turkmenistan, impetus for gas production increases will come from offshore projects at Block 1 and Cheleken. By 2020 these fields will yield 12 bcm of gas annually. Roughly 2 bcm per year will be added from production at the Nebit Dag project.

Production at the Gogerendag-Ekerem group of fields is expected to remain at its current level to 2012, followed by decline in production as the Korpedzhe field reserves become depleted. At new fields, the level of production will not be sufficient to compensate for production decline at Korpedzhe.
Total gas production in 2020 will reach 140 bcm, a level generally correspondent to international and domestic demand. This would mean almost a doubling of production, which stood at over 70 bcm in 2008. By developing the new fields – Yashlar and the Yoloten-Osman group – Turkmenistan could reach the production level of 130 bcm by 2017, with slower growth to the end of the decade. The production could be potentially raised to as much as 145 bcm, but will be kept lower by demand.

4.2.2. Exports

According to the High scenario, the diversification of export routes will be successfully realized. The construction of gas pipeline between China and Turkmenistan will be completed on schedule (the end of 2009) and CNPC will start to ship gas from the beginning of 2010. The construction of the Trans-Caspian gas pipeline will be completed at the end of 2013 and starting 2014 gas supplies from Turkmenistan will come to Turkey via Azerbaijan and Georgia.

The Turkmenistan-Afghanistan-Pakistan-India (TAPI) project will be realized in 2015 with the start of deliveries to India and Pakistan in 2016. Under this scenario, the political situation in Afghanistan will be stabilized, which will be most important factor for the project. The importance of this factor is higher then the role of gas prices in South Asia. At the same time, gas consumption on target markets will be affected by higher levels of gas prices, resulting in demand for Turkmenistan’s gas being lower than the country’s export potential.
Turkmenistan will deliver its gas via all existing export routes. 42.5 bcm of gas supplies will flow to Russia via the CAC pipeline system, including the reconstructed CAC-3 as part of the Pre-Caspian pipeline. Another 24 bcm will be delivered to China at a minimal take-or-pay level. Turkey-bound gas will be supplied under a deferred 1999 contract between Turkmenistan and Botas under somewhat modified pricing terms. The Turkish company may use part of this gas for re-export to other South East European countries via Nabucco pipeline.

In addition, full-scale deliveries will take place along the southern routes, to Pakistan and India. Pakistan-bound gas will be sold at the Turkmen-Afghan border. India-bound gas may be handed over to a third party, since Turkmenistan has no plans of changing its sell-at-the-border strategy, while India is not willing to buy gas in third-party jurisdictions without transportation guarantees. The third party’s main goal will be to transport gas via Afghanistan and Pakistan to Indian consumers, and this party could become one of the pipeline project’s sponsors. According to the high scenario, India and Pakistan will collectively consume 21 bcm in 2020. The deliveries to Iran will be stable at the level of 10 bcm per year.

Chart 20. Outlook for gas exports from Turkmenistan 2009–2020, High scenario, bcm

Nevertheless, under this scenario Turkmenistan will not be able to fully utilize its export potential. In 2020, this country’s export capacity will be 110.3 bcm.
Table 14. Turkmenistan's gas balance in 2008-2020. High scenario, bcm

<table>
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<tr>
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<th>2007</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>72.0</td>
<td>73.7</td>
<td>116.3</td>
<td>140.0</td>
</tr>
<tr>
<td>Consumption</td>
<td>21.0</td>
<td>22.5</td>
<td>27.0</td>
<td>29.7</td>
</tr>
<tr>
<td>Exports</td>
<td>51.0</td>
<td>51.2</td>
<td>89.3</td>
<td>110.3</td>
</tr>
</tbody>
</table>

*Source: RPI research*
4.3. Moderate Scenario

4.3.1. Production

This scenario proceeds from the premise that the price of oil will range between $55 and $70 per barrel, resulting in a lower level of gas production compared with the High scenario.

Lower production will be due to delays in implementing a number of projects (associated with pauses in making final investment decisions) and as Turkmengas reduces the pace of drilling at currently active fields. Production could be lower by more than 15 percent.

By concentrating investment resources in development of the Yoloten-Osman group of fields, Turkmengas will bring them onstream at the beginning of the next decade, compensating for the production currently producing fields. Production growth at new fields will go on at a slower pace than that under the High scenario. As a result, their reaching of base production levels will require a longer period. Development of the Yoloten-Osman group will be limited to the first phase of the project; phase two will be delayed to a later date.

Reserves of the Yashlar field could enter commercial production in 2015, but will not reach the plateau level in the next decade.

Lower earnings would bring about delays in realizing the Block 1 and Cheleken offshore projects. The onshore Nebitdag project will start production as scheduled. The Bagtiyarlyk project proceeds as planned because the business plan for the project guarantees profit to the investor, while planned production volume has been contracted by the Chinese side that is developing the field.

The Moderate scenario anticipates that by 2020 production of gas will reach 125 bcm per year.
4.3.2. Exports

According to the Moderate scenario, the strategy of gas exports diversification will be realized only in the most important strategic and commercially effective directions. As in the High scenario, the Turkmenistan-China pipeline will be completed on schedule and start deliveries to China. The construction of the Trans-Caspian gas pipeline will be completed successfully in 2014, but its utilization level will be relatively low. Low gas prices in India and Pakistan and the political situation in Afghanistan will hamper the realization of the TAPI project.

For economic reasons and due to existing contracts, Turkmenistan will continue to favor Russia and China as its key export destinations. These offtake levels for supplies to these markets will be in the range between 95 and 100 percent of contracted volumes (50 bcm for Russia and 30 bcm for China, respectively). Supplies to China will demonstrate higher returns at the fixed price of $195 per 1000 cm compared to the supplies to Russia where prices will be linked to European gas prices. This factor will contribute to lower gas offtake by Russia of Turkmenistan’s gas for a short period in 2013. After 2013 Russia will continue to receive the full contracted volume of 50 bcm, utilizing CAC-1, -2 and 4 pipelines and the first phase of the Pre-Caspian pipeline. China will receive a 100% of required gas from Turkmenistan starting from the middle of 2010s.

The European Union will promote the Trans-Caspian pipeline and finance a large part of its construction cost, yet the pipeline utilization rate considering the deferred contract with Botas
will be quite low – in the range from 4.4 bcm to 6.5 bcm, or the maximal level of 21% of pipeline capacity. The filling of the rest of the pipeline’s capacity will be under question due to less attractive prices for Turkmenistan in comparison with Russia, China and Iran. A higher price premium and guarantees of offtake could influence Turkmenistan to reverse additional gas flows in the direction of Europe. In the foreseeable future, Iran will increase gas offtake to the level of 8 bcm to 10 bcm to supply its northern regions.

Chart 22. Outlook for gas exports from Turkmenistan in 2009–2020, Moderate scenario, bcm

Source: RPI research

Under the Moderate scenario, there will be no gas shipments to Southern Asia due to a lack of export capacity, which will turn India and Pakistan to seek alternative sources of gas supplies, primarily LNG, to meet their domestic demand.

According to the Moderate scenario, Turkmenistan will realize its gas export potential (96.5 bcm in 2020) in full.
Table 15. Turkmenistan's gas balance in 2008-2020. Moderate scenario, bcm

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>72.0</td>
<td>81.0</td>
<td>115.7</td>
<td>125.5</td>
</tr>
<tr>
<td>Consumption</td>
<td>21.0</td>
<td>22.3</td>
<td>26.4</td>
<td>29.0</td>
</tr>
<tr>
<td>Exports</td>
<td>51.0</td>
<td>58.7</td>
<td>89.3</td>
<td>96.5</td>
</tr>
</tbody>
</table>

Source: RPI research
4.4. Low Scenario

4.4.1. Production

The scenario linked to low oil prices is based on the premise that oil will sell at $55 per barrel or lower. This will lead to curtailment of gas production to the minimum level possible.

To prevent a drop in production resulting from natural decline at fields currently under development, Turkmengas will be forced – as under the Moderate scenario – to concentrate investment resources in developing the Yoloten-Osman group of fields. Insufficient investment, however, will lead to delays in bringing the fields into exploitation.

Development of the Yashlar field could be postponed for an indefinite period since the field's entry into production at these price levels might not be economically justifiable.

The fall in prices for energy resources will not influence the course of realization of the CNPC project at Bagtiyarlyk because Central Asian gas is vitally important to China; therefore, CNPC will invest in the project even if it is temporarily unprofitable. The project's business plan minimizes potential loss to the state-owned company via realization of gas in China's domestic market and through participation in the project along the entire value chain.

Due to insufficient financial resources and problems attracting debt finance, other gas projects in which foreign operators participate will lag behind schedule notably or even be suspended. Accordingly, reaching planned levels of production on schedule will not occur.

Investment in development of currently operating fields that today provide for the base gas production in Turkmenistan, will decline significantly. Capital programs will proceed only where their reduction would bring about sharp declines in production. Priority will go toward supporting gas production at its current level at the Dauletabad field and its smooth decline looking forward. Small fields with depleted reserves will be left to their own fates.

Under this scenario, total production of gas in Turkmenistan in 2020 will be about 105 bcm.
4.4.2. Exports

According to the Low scenario, the deficit of financing could freeze the strategy of gas exports diversification to new markets. The Chinese route currently under development will be the single large alternative to gas supplies to Russia. The Turkmenistan-China pipeline will be commissioned with slight delay and gas deliveries will start in 2011.

For reasons of economic efficiency and due to existing contracts, Turkmenistan will favor Russia and China as its key export destinations. Exports along the Chinese route will demonstrate higher returns, therefore Russia-bound shipments will only increase to 2011, until the gas pipeline from Turkmenistan to China becomes operational. Thereafter, gas exports to Russia will decrease to 42.5 bcm per year (the minimal contracted volume) and remain flat at this level. The construction of the new Pre-Caspian gas pipeline with annual capacity of 20 bcm will be suspended due to of lack of gas to fill the pipe. Gas deliveries to China in the period starting 2014 will be in the range from 26.2 bcm to 29.1 bcm, In 2020 China will receive around 28.7 bcm of natural gas and will stabilize gas deliveries at that level. Iran will be the last country in line to receive Turkmen gas. The lack of gas volumes to provide for delivery to Iran at the level of 10 bcm will mean that supplies to this country will be twice lower compared to volumes negotiated in February 2009, or only 5 bcm per year. The decrease of gas deliveries to Iran will be due to lack of investment and gas reserves base to fully support Turkmenistan’s third export direction.
Under the Low scenario there will be no direct gas shipments from Turkmenistan to South-Eastern Europe or Southern Asia, as new pipeline systems will not be constructed. The EU will not provide financing for construction of the Trans-Caspian pipeline, limiting itself to political support of the project, and the project will fail to attract sponsor companies. Low economic attractiveness compared to supplies to Russia and China will make Turkmenistan neutral to EU initiatives. In the absence of the Trans-Caspian pipeline, the contract between Turkmenistan and Turkey will be deferred again without concrete time of execution.

The TAPI pipeline will not find support from Turkmenistan and the potential sponsors of this project. The gas prices in India and Pakistan will be at the level of $2.5-3 per MMBTU, which will not be high enough to make attractive the gas supplies from Turkmenistan to these countries.

Turkmenistan will realize its export potential (76.2 bcm in 2020) in full under the Low scenario.
Table 16. Turkmenistan's gas balance in 2008-2020. Low scenario, bcm

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td>Production</td>
<td>72.0</td>
<td>75.7</td>
<td>100.1</td>
<td>105.3</td>
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<tr>
<td>Consumption</td>
<td>21.0</td>
<td>22.4</td>
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<td>29.1</td>
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<tr>
<td>Exports</td>
<td>51.0</td>
<td>53.3</td>
<td>73.7</td>
<td>76.9</td>
</tr>
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</table>

Source: RPI research