



## COMMERCIAL ASPECTS OF THE EXPORT OF GAS CONDENSATE FROM THE OB GULF

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### ABSTRACT

Development of oil, gas and gas condensate deposits of the West-Siberian oil-and-gas complex is linked primarily with the use of sea transport. Its functioning is to ensure both the vital activity of cargo production areas and the taking out of produced hydrocarbon raw materials.

Assessment of expenses for the taking out of gas condensate from the Arctic coast has been performed within the framework of the ARCDEV Programme as applied to the voyage of Finnish tanker *Uikku* (of *Lunni* type) to the Ob Gulf (Sabeta). Destination point of the delivery of cargo - Rotterdam.

Evaluation of economical results has been made by a complex of expenses and cost of the delivery of cargo.

Calculation of these indices for the voyage of tanker *Uikku* has been carried out in two stages. At the first stage, on the basis of forecast data on the route ice conditions and eventual speeds of movement of ship following the icebreaker a preliminary estimate of expenses on the delivery of gas condensate to the port of Rotterdam was obtained. At the second stage, proceeding from report data about the voyage completed, actual expenses and cost of the delivery of cargo to the point of destination were determined.

Analysis of these data and consideration of factors influencing the cost of the transportation of gas condensate from the Arctic allows directing possible ways of the reduction of cost of the taking out of the hydrocarbon raw material.

### INTRODUCTION

Development of the West-Siberian oil-and-gas complex of Russia is linked with the exploration of oil, gas and gas condensate fields of the Yamal Peninsula, Yamal region shelf, continental and shelf areas of the Ob and Tazovskaya Gulfs. Such oil and gas deposits as Tambeiskoye, Novoportovskoye, Kamennomyskoye (the Ob Gulf), Kharasaveiskoye, Kruzensternskoye and Bovanenkovskoye (Yamal Peninsula) are concentrated here. The most powerful among the above enumerated deposits are Novoportovskoye (oil and gas reserves - 690 million t. and 210 milliard cub. m accordingly) and Bovanenkovskoye - 4 400 milliard cub. m of natural gas, 106 million t. of gas condensate and 6 million t. of oil.

The industrial exploitation of these regions depends first of all on the use of sea transport. Its functioning is to provide for the vital activity of the major production and cargo concentration areas (development of these areas under permafrost conditions, advancement of the infrastructure) as well as for the taking out of the produced raw material: crude oil, gas condensate and natural gas.

The feasibility of operation of sea ships in this region of the Arctic throughout the year was demonstrated in April - June 1998 while conducting the commercial voyage of Finnish tanker *Uikku*. This voyage permitted also to preliminarily assess costs of the transportation of the hydrocarbon raw material from the Arctic to ports of the Western Europe.

## **1. PRINCIPAL ORGANIZATIONAL, OPERATIONAL AND COST ASPECTS OF ECONOMIC EVALUATION OF THE COMMERCIAL VOYAGE**

Tanker *Uikku* was chartered by the Arctic Shipping Service (ASS) for the transportation of gas condensate from the Ob Gulf (Sabeta) to the port of Rotterdam. The voyage was realized as a demonstrative experimental-commercial one. Representatives of different countries of the European Community participated in the voyage. Apart from the main task - transportation of gas condensate - quite a number of scientific experiments was carried out the purpose of which being the investigation of the ice cover of the Arctic Ocean en route.

Main principles of the organization of the transportation of gas condensate from the Ob Gulf to Rotterdam by tanker *Uikku* and initial data for the assessment of costs of such transportation are defined by the terms of the charter agreement on the ship's lease and contract relations between the Arctic Shipping Service Company and Murmansk Shipping Company.

Determination of expenses on the commercial voyage was made by the following principal groups:

- chartering of ship;
- fuel expenses;
- ship's dues in Russian ports and in the port of Rotterdam;
- icebreaker assistance of the tanker on the Northern Sea Route and at the point of loading;
- miscellaneous expenses to support the Arctic voyage.

According to the programme of the demonstrative experimental voyage ARCDEV the assessment of cost of the taking out of gas condensate raw material was made in two stages.

At the first stage, the calculation of expenses, operational and economic indices of the voyage was carried out prior to the voyage in accordance with the predicted ice conditions on the Northern Sea Route and at the point of overloading.

At the second stage, estimation was made of actual results of the commercial voyage of tanker *Uikku* on its completion all the changes which took place when the tanker was following the real route, during loading operations at Sabeta as well as actually transported volume of cargo having been taken into consideration.

## **2. PRELIMINARY ESTIMATION OF THE COST OF THE TAKING OUT OF GAS CONDENSATE FROM THE OB GULF**

The forecast estimation performed by the AARI permitted to characterize ice conditions in the western area of the Arctic in April - May 1998 as heavy ones and to trace the course of the tanker to the Ob Gulf around the cape Zhelania and from the Ob Gulf to Murmansk - through the Kara Strait. According to the routes chosen, the anticipated track lengths, ship's speeds in open water and in ice, sea days as well as the expected duration of the sailing of the

ship escorted by icebreaker were calculated. Calculation of speed and of sea days on sections ice edge - cape Zhelania - the Ob Gulf and the Ob Gulf - the Kara Strait - ice edge was made with the use of the mathematical model of the movement of ship in ice developed by CNIIMF.

Duration of the berthing time of the tanker in the Ob Gulf taking into account the delivery of cargo pumps and complicated hydrometeorological conditions of transshipment works was assumed to be equal to 5 days. Duration of the berthing time in Murmansk was assumed to be 12 hours at the beginning of the arctic voyage and 24 hours on its completion.

Calculated duration of the round voyage from the moment of chartering until the arrival to Murmansk and the following operation of ship on the agreed route of navigation Murmansk - the Ob Gulf - Murmansk with subsequent delivery of gas condensate to the port of unloading Rotterdam is presented in table 1. Supposed loading of the tanker at a density of cargo equal to 0.74 t/cub. m and under the condition of use of the capacity of all cargo tanks was taken as 12 000 t.

Expenses on the chartering of tanker *Uikku* were determined in accordance with the agreed rental rate and the duration of chartering with the Arctic Shipping Service. In accordance with terms of chartering the rental rate of tanker *Uikku* during its operation in open water and in ice remained unchanged.

While determining fuel expenses in ice, the use was made of the mathematical simulation of the mode of the movement of tanker behind the icebreaker this method permitting to estimate the ship's fuel consumption according to the power utilization factor. The expenses on fuel were calculated by average prices of bunkering of tanker in the port of Rotterdam.

Ship dues were determined in accordance with the rates of ship dues in Russian ports, effective from 01.09.95 and in the port of Rotterdam according to the reported information for this port of 1997.

Expenses on the icebreaker support of ships and on services of ice pilots were determined by the corresponding rates established by the Murmansk Shipping Company.

Payment for the icebreaker escort and ice pilot services as well as for the used fuel and possible ship's dues at points of berthing was at the charterer's account.

Administration expenses taking into account the upkeeping of the shipping company were assumed as amounting to 3 % of the principal operating expenses of tanker *Uikku* for a voyage.

Commission included the address fee amounting to 2.5% and broker commission amounting to 1.25 % of the minimum potential sum of incomes received on the delivery of cargo. Calculation of supposed expenses and of the cost price of the delivery of gas condensate from the Ob Gulf to Rotterdam is shown in table 2.

Table 1

Preliminary calculation of distance and duration of the round trip for the delivery of gas condensate from the Ob Gulf by tanker *Uikku*

| Showing                                      | Month of the year |      | Total<br>per voyage |
|--|-------------------|------|---------------------|
|  | April             | May  |                     |
| Total distance, miles                        | 2675              | 2810 | 5485                |
| - international waters                       |                   |      |                     |
| • Prior to the arrival in Murmansk           | 1530              |      |                     |
| • Murmansk - Rotterdam                       |                   | 1630 |                     |
| - Russian waters                             |                   |      |                     |
| • To the Ob Gulf (around the cape Zhelania)  | 1145              |      |                     |
| including:                                   |                   |      |                     |
| ◦ Murmansk - ice edge                        | 390               |      |                     |
| ◦ Ice edge - fast ice of the Ob Gulf         | 635               |      |                     |
| ◦ Fast ice of the Ob Gulf - Sabeta           | 120               |      |                     |
| • From the Ob Gulf (through the Kara Strait) |                   | 1180 |                     |
| including:                                   |                   |      |                     |
| ◦ Sabeta - fast ice of the Ob Gulf           |                   | 120  |                     |
| ◦ Fast ice of the Ob Gulf - the Kara Strait  |                   | 520  |                     |
| ◦ The Kara Strait - ice edge                 |                   | 360  |                     |
| ◦ ice edge - Murmansk                        |                   | 180  |                     |
| Duration of the round trip, days             | 11.1              | 17.6 | 28.7                |
| including:                                   |                   |      |                     |
| • on the move                                | 10.6              | 10.6 | 21.2                |
| ◦ in open water                              | 5.0               | 5.8  | 10.8                |
| - in international waters                    | 4.0               | 5.2  | 9.2                 |
| prior to the arrival in Murmansk             | 4.0               |      | 4.0                 |
| Murmansk - Rotterdam                         |                   | 5.2  | 5.2                 |
| - in Russian waters                          | 1.0               | 0.6  | 1.6                 |
| ◦ in ice                                     | 5.6               | 4.8  | 10.4                |
| • at berth                                   | 0.5               | 7.0  | 7.5                 |
| ◦ in Murmansk                                | 0.5               | 1.0  | 1.5                 |
| ◦ in the Ob Gulf                             |                   | 5.0  | 5.0                 |
| ◦ in Rotterdam                               |                   | 1.0  | 1.0                 |

Table 2

Preliminary calculation of the cost  
of delivery of gas condensate by tanker *Uikku*  
during the experimental voyage in April-May 1998

| Showing   | Total amount |
|---|--------------|
| Cargo transported, ths. t   | 12.0         |
| Total expenses on the delivery of cargo<br>to Rotterdam, ths. USD | 796.1        |
| comprising:   |              |
| ◦ lease of ships  | 459.3        |
| including:  |              |
| • Russian waters  | 296.1        |
| • international waters  | 163.2        |
| ◦ fuel expenses   | 67.4         |
| including:  |              |
| • Russian waters  | 44.3         |
| • international waters  | 23.1         |
| ◦ ship dues   | 37.9         |
| ◦ icebreaker support  | 178.9        |
| ◦ services of ice pilots  | 5.7          |
| ◦ administration expenses   | 16.9         |
| ◦ commission  | 30.0         |
| Cost of delivery of cargo, USD/t                                  | 66.3         |

### 3. CORRECTION OF THE PRELIMINARY CALCULATION OF PRINCIPAL OPERATIONAL AND ECONOMICAL INDICES BY RESULTS OF THE EXPERIMENTAL COMMERCIAL VOYAGE

Correction of the preliminary calculation of operational and economical indices of the delivery of gas condensate was made in accordance with the reported information about the duration of the round voyage of tanker *Uikku* to the Ob Gulf, about the consumption of different types of fuel by sections of the route, ship and icebreaker dues and other expenses.

Reported information needed for the calculation was obtained directly during the experimental voyage (duration of the round trip), in the processing of captain's reports (fuel consumption) and from accounts given to the charterer (payment for ice pilot services and icebreaker support etc.).

Amount of gas condensate carried in the real experimental voyage of tanker *Uikku* was 10 655 t that is more than by 10 % less than the calculated figure.

The ship was escorted along the Northern Sea Route by icebreakers *Rossia* and *Kapitan Dranitsyn*. The channel in the Ob Gulf was made by shallow draft nuclear icebreaker *Vaigach*.

Actual duration of the round trip of tanker *Uikku* is shown in table 3.

Table 3

Calculation of the actual duration of the round trip for the delivery of gas condensate by tanker of the *Uikku* type under the escort of icebreakers *Rossia* and *Kapitan Dranitsyn*

| Showing                                      | Duration of the voyage, days |            | Totally per Voyage |
|--|------------------------------|------------|--------------------|
|  | in ballast                   | with cargo |                    |
| Total distance, miles                        | 3280                         | 2892       | 6068               |
| - international waters                       | 1530                         | 1630       |                    |
| - Russian waters                             |                              |            |                    |
| • to the Ob Gulf (around cape Zhelania)      | 1750                         |            |                    |
| ◦ Murmansk - ice edge                        | 340                          |            |                    |
| ◦ Ice edge - fast ice of the Ob Gulf         | 1289                         |            |                    |
| ◦ Fast ice of the Ob Gulf - Sabeta           | 121                          |            |                    |
| • from the Ob Gulf (through the Kara Strait) |                              | 1262       |                    |
| ◦ Sabeta - fast ice of the Ob Gulf           |                              | 121        |                    |
| ◦ Fast ice of the Ob Gulf - ice edge         |                              | 829        |                    |
| ◦ Ice edge - Murmansk                        |                              | 312        |                    |
| Duration of the round trip, days             | 12.8                         | 15.2       | 28.0               |
| • on move                                    |                              |            |                    |
| ◦ in open water                              | 5.2                          | 6.2        | 11.4               |
| - international waters                       | 4.0                          | 4.8        | 8.8                |
| - Russian waters                             | 1.2                          | 1.4        | 2.6                |
| ◦ through ice                                | 6.9                          | 3.4        | 10.3               |
| • at berth                                   | 0.7                          | 5.6        | 6.3                |
| ◦ in Murmansk                                | 0.7                          | 0.7        | 1.4                |
| ◦ in the Ob Gulf                             |                              | 4.0        | 4.0                |
| ◦ in Rotterdam                               |                              | 0,9        | 0,9                |

Reported data on the voyage duration of tanker *Uikku* have shown that the deviation of actual time from the calculated figure under different changes of its components was 2.3 %. Real route of the convoy (icebreakers *Rossia*, *Kapitan Dranitsyn* and tanker *Uikku*) on course ice edge - cape Zhelania - the Ob Gulf - Kara Strait - ice edge made around heavy ice, even if being longer, provided for higher speeds of movement through ice. Actual distance covered by the tanker from Murmansk to the point of loading, if compared with the calculated one, increased more than by 50 % and from the point of loading to Murmansk (return trip) - by 7 %. However the average increase of actual speeds of the movement of ship in the ice by 1.5 knots (or almost by 20 %) led to the fact that actual time of the ship's running in the Arctic increased only by 24 hours (that is by 8.6 %). This increase of the steaming time was levelled by the reduction of the berthing time of tanker in the Ob Gulf and of the duration of passage from Murmansk to Rotterdam. Loading of the cargo available in the Ob Gulf was accomplished not for 5 days, as it was planned, but for 4 days. The passage of ship from Murmansk to Rotterdam took 4.8 days and not 5.2 days.

In accordance with the reported duration of the round trip and actually transported amount of cargo more accurate information on operational expenses of the voyage was obtained and actual costs of the delivery of cargo were calculated.

As results of the calculation presented in table 4 have shown, total operational expenses for the transportation of gas condensate by tanker *Uikku* turned out to be by 1.6 % lower than those calculated. In this case the cost of the delivery of cargo is higher almost by 10%. Main reason of such cost increase - inadequate use of the ship's cargo-carrying capacity.

Table 4

Calculation of the actual cost  
of the delivery of gas condensate by tanker *Uikku*  
escorted by icebreakers *Rossia* and *Kapitan Dranitsyn*  
during the experimental voyage in April-May 1998

| Showing  | Totally per voyage |
|--|--------------------|
| Cargo transported, ths. t                                      | 10.7               |
| Total expenses on the delivery of cargo to Rotterdam, ths. USD | 783.5              |
| comprising:  |                    |
| ◦ lease of ships   | 448.8              |
| including:   |                    |
| • Russian waters   | 294.5              |
| • foreign waters   | 154.3              |
| ◦ fuel expenses  | 65,7               |
| including:   |                    |
| • Russian waters   | 42.2               |
| • foreign waters   | 23.5               |
| ◦ ship dues  | 37.7               |
| ◦ icebreaker support   | 180.2              |
| ◦ provision for the arctic voyage                              | 4.9                |
| ◦ administration expenses                                      | 16,8               |
| ◦ commission   | 29.4               |
| Cost of the delivery of cargo, USD/t                           | 73.5               |

## CONCLUSION

The calculations made permitted to assess real (for the present time) operational expenses and cost values of the delivery of gas condensate from the Western area of the Arctic and to direct ways of the improvement of schemes of the taking out of cargo and of the reduction of transportation costs. Prior to the beginning of the industrial exploitation of hydrocarbons with a small concentration of cargo to be transported it is possible to use traditional schemes of loading of sea tankers: using river barges in summer and temporarily laying down of a pipeline over the fast ice to the ship's side during the extended period. Both versions are expensive. While taking out cargo during the summer period of navigation the downtime of sea ships pending loading is long. Winter transportation of cargo is expensive because of the loading technology.

In the industrial exploitation of deposits of the Yamal Peninsula, Yamal shelf, Ob and Tazovskaya gulfs the cape Krugliy area may be considered as the most promising one. Guaranteed depths here at a distance of 1 km from the shore are about 10-11 m. Both gas condensate and liquefied natural gas can be taken out of these areas. In this case it will be necessary to build up a developed transshipment complex, port storage facilities, to construct a factory on the processing and liquefaction of gas as well as lay a 70 km pipeline from places of the extraction of the Yamburgskoye deposit. Later on, when developing the infrastructure of this region and laying a pipeline from Urengoi to Yamburg 250 km long it will be possible to take out gas condensate of the Urengoi deposit.

In a more distant future, along with the above deposits, it is intended to use reserves of the Yamal shelf situated near the Kharasavei river. At present, alternatives of the shelf extraction of the hydrocarbon raw material in this area are as yet at the stage of scientific studies.

In parallel with the construction of a transshipment complex in the Ob Gulf, it will be necessary to build tankers to provide for the transportation of crude oil, gas condensate and products of the gas processing factory. For this purpose one should perform the feasibility study of optimum (by the architectural and structural type as well as by the cargo-carrying capacity) tankers capable to efficiently operate in shallow areas of the arctic shelf.