THE MAIN TECHNICAL AND TECHNOLOGIC DECISIONS FOR THE OB AND TAZ BAYS GAS FIELD DEVELOPMENT

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ABSTRACT

The JSC Gazprom exploration operations resulted in discovery of a number of fields with substantial gas reserves located in the water body of the Ob and Taz Bays adjacent to the Yamburg gas and condensate field. Therefore this region is a most perspective one to arrange a new gas producing area.

For the purpose to work out a concept to arrange and operate the discovered fields hydrometeorologic, engineering and geologic, environmental and other natural and climatic conditions of the Ob Bay were analyzed and with reference to these the world experience of fields development in the similar conditions was generalized and a complex method of the fields arrangement and development was offered.

The world experience analysis showed that:

1. There is no experience of developing fields in the conditions of the Arctic seas shallow waters.
2. The offshore oil and gas industry widely uses subsea production technologies.
3. There are no technical means for drilling a cluster of the production wells with subsea completion in the Arctic seas conditions.
4. The use of the subsea production technology substantially reduces capital investments for the hydrocarbon resources development.

The concept of the Ob and Taz Bays gas fields development envisages using:

1. Advanced technologies for drilling and operating directional, horizontal and multi-hole wells;
2. Subsea production complexes;
3. Structures to protect subsea production complexes from ice influence;
4. Mobile ice-resistant platforms for all year round drilling wells with subsea completion and installation of subsea production complexes;
5. Transportation of the well products without their preliminary preparation at sea;
6. Complex field arrangement.

The complex field arrangement includes:

- cooperation with the existing onshore objects of gas production;
- creation of the unified system of collection, preparation and transport for a group of fields
- creation a unified system of remote controlling subsea production complexes for a group of fields.

The priority development object is the Severo-Kamennomyss field. It is expedient to be considered as a special area to test the new technical and technologic decisions in the area of the development and arrangement of the fields.

A number of the variants to arrange the Severo-Kamennomyss field was considered. The transport scheme envisages gas delivery to the Yamburg gas compressor station and uses the existing main pipelines of the United Gas Transport System.
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1. THE MAIN TECHNICAL AND TECHNOLOGIC DECISIONS FOR THE OB AND TAZ BAYS GAS FIELD DEVELOPMENT

The JSC Gazprom exploration operations resulted in discovery of a number of fields with substantial gas reserves located in the water body of the Ob and Taz Bays adjacent to the Yamburg gas and condensate field. Therefore this region is a most perspective one to arrange a new gas producing area.

Technical and technologic decisions for developing the Ob and Taz Bays gas resources were prepared on the basis of the analysis of the science and engineering development condition in the area of developing the World Ocean hydrocarbon resources taking into account the main provisions of the JSC Gazprom Concept for operations in the RF offshore till 2030, General scheme of the gas industry development (for the period till 2030) and the Program to develop the Russian Federation offshore hydrocarbon resources till 2030, Technical and economic offers in regard of development the Severo-Kamennoyss gas field (LLC VNIIGAZ, LLC Gazflot) and the Pre-investment studies for the development of the Ob and Taz Bays and the adjacent onshore fields (LLC VNIIGAZ, LLC Gazflot).

For the purpose to work out technical and technologic decisions and specify a concept to arrange and operate the discovered and expected fields hydrometeorologic, engineering and geologic, environmental and other natural and climatic conditions of the region (Fig. 1) were considered and analyzed. The main peculiarities of the Ob and Taz region include the following:

- proximity of the Yamburg gas and condensate field production structure (less than 150 km);
- a short distance from the shore (maximum distance is less than 40 km);
- shallow waters of the water body (water depth is 8-12 m);
- no permafrost;
- a short inter-ice period (about 3 months);
- complicated natural and climatic conditions;
- complicated environmental conditions.

Fig. 1. Ob and Taz region
Possessing the information about the natural and climatic conditions and the data about the fields we have analyzed the world experience of developing fields in the similar conditions and we have offered a complex method of arrangement and operation of the fields located in the Ob and Taz Bays.

Experience of developing oil and gas fields located in the water bodies of the Mexican Gulf, the North Sea, the Okhotsk Sea, Kook Bay, the Beaufort Sea cannot be used in a complete way for the Russian arctic offshore conditions. Using structures for the Okhotsk Sea offshore, the Prirazlomnoye field and the Canada offshore is not expedient in the conditions of the Ob and Taz Bays. On the basis of the world experience analysis the following can also be noted that:

1. There is no experience of developing the fields located in the Arctic seas conditions.
2. The world marine oil and gas industry widely uses subsea production technologies.
3. There are no technical means to drill clusters of the production wells with subsea completion in the Arctic seas conditions.
4. Usage of the subsea production technologies substantially reduces capital investments for the development of the hydrocarbon resources in the conditions of the non-freezing seas and the freezing seas as well.

The costs when using the platforms and subsea systems are USD 8.43 and USD 4.05 per barrel accordingly.

The technical and technologic decisions to develop the Ob and Taz Bays are worked out considering the following:

- advanced technologies of drilling and operating wells;
- using subsea production complexes;
- creating structures for locating and protecting subsea complexes from ice influence;
- creating mobile ice-resistant platforms or their purchase and further upgrading of the existing platform of the SDC type to drill wells with subsea completion;
- transportation of the well products without their preliminary preparation at sea;
- field arrangement integration.

The complex method allows to reduce the capital investments for the arrangement of groups of fields and individual fields as well and it also allows to increase economic characteristics for the development of the Ob and Taz Bays fields (see Fig. 1).

The complex method of the fields arrangement includes the following:

- cooperation with the existing onshore gas production objects;
- creation of a unified system of collection, preparation and transportation for a group of fields;
- creation of a system of remote controlling offshore subsea production complexes for a group of fields.

The priority object for the development is the Severo-Kamennomyss field for which the Technical and economic offers were made where a number of variants of development and principles of arrangement of the field were considered.

The main variants of the development and arrangement principles were considered taking into account four types of platforms to drill the production wells: gravitation platform, mobile platform, mobile platform of the SDC type and the JU Amazone platform (Fig. 2).
Variant I – Drilling and operation of 28 wells with surface completion to be performed using an ice-resistant stationary platform. The bottomhole deviation from the well is is up to 2000 m and the length of the horizontal section is is up to 500 m. The design production level is 8.4 bln. m$^3$/year. A complete field preparation of the product is performed at the platform.

Variant II – Well stock is 30, 18 of them are to be drilled from the platform (mobile ice-resistant platform or SDC) and 12 wells are to be drilled from JU Amazone: four wells in a cluster. Bottomhole deviation from the well at the platform is 2000 m and at the same time the length of the horizontal section is up to 500 m. The bottomhole deviation from the well in the cluster is 500 m and the horizontal section length reaches 273 m. The design production level is 101 bln. m$^3$/year. A complete field preparation is performed at the platform.

Variant III – All the wells (32) with subsea completion can be drilled from JU Amazone: 4 wells in 8 clusters. The bottomhole deviation in the cluster is 500 m. The horizontal section length is 273 m and the design production level is 10 bln m$^3$/year.

Variant IV – All the wells can be drilled from mobile ice-resistant platforms of the mobile ice-resistant drilling platforms or SDC type.

In results of comparing technical and economic characteristics of these two platforms SDC is the main variant of the platform to drill wells with subsea completion.

The well stock is 32 including 4 cluster with 8 wells each, the bottomhole deviation in the cluster is 1000 m, the horizontal section length is 500 m, the design production level is 10.4 bln m$^3$/year.
**Variant V** – All the wells are to be drilled from SDC type platform. The well stock is 24 two-hole wells including 3 clusters with 8 wells in each. The bottomhole deviation is 1500 m, the horizontal section length is 500 m, the design production level is 15.3 bln.m³/year.

Fig. 3 represents a general picture of the subsea production complexes (SPD) scheme, structures to protect the SPD from ice-hummocks.

![Fig. 3. General scheme of subsea production complex](image)

The transport scheme of the field arrangement is being considered the following way. For **Variants I and II** gas from the platform is transported to the Yamburg gas compressor station with the initial pressure of \( P_n = 7.5 \) MPa. For **Variants III, IV and V** the raw gas is transported to the onshore site of complex preparation of gas with the initial pressure of 5.5 MPa, and from the onshore site of complex preparation of gas it is transported to the Yamburg gas compressor station with the initial pressure of \( P_n = 7.5 \) MPa.

Table 1 shows the characteristics of the variants considered. The most acceptable variant of the field development is **Variant V**.
The conceptual calendar schedule of the Severo-Kamennomyss field development is constructed only for the main variant where the commencement of gas production is planned during the seventh year from the commencement of the project development (Fig. 4).

Table 1: Technologic characteristics of the development variants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Units</th>
<th>Variants</th>
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<tbody>
<tr>
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<td>I</td>
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<tr>
<td>Maximum level of annual gas production</td>
<td>Bln m³</td>
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<tr>
<td>Maximum rate of initial gas reserves recovery</td>
<td>%</td>
<td>2,8</td>
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<tr>
<td>Well stock</td>
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<td>Gas debit of 1 well</td>
<td>thous.m³/day</td>
<td>950</td>
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<tr>
<td>- initial</td>
<td></td>
<td>730</td>
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<tr>
<td>- during first ten years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of constant production period</td>
<td>years</td>
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<tr>
<td>Gas recovery during 30 years</td>
<td>Bln m³</td>
<td>138</td>
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<td>The same in % from gas reserves</td>
<td>%</td>
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<tr>
<td>Minimum pressure at well head</td>
<td>atm.</td>
<td>10</td>
</tr>
</tbody>
</table>

The conceptual calendar schedule of the Severo-Kamennomyss field development is constructed only for the main variant where the commencement of gas production is planned during the seventh year from the commencement of the project development (Fig. 4).

Fig. 4. The conceptual calendar schedule of the Severo-Kamennomyss offshore gas field development (Variant V)
2. CONCLUSIONS

1. The offers show only a possibility to commence the development of the Ob and Taz Bays and the adjacent onshore fields from the seventh year from the commencement of the project development.

2. Arrangement of the field is offered to be performed using the advanced technical and technologic decisions including the following:
   - using directional, horizontal and multi-hole wells that provide high productivity;
   - creating subsea production complexes and structures to protect them from the ice influence using onshore systems of remote control;
   - using mobile ice-resistant platforms of the SDC type to drill all year round production wells that accelerate putting the fields into operation;
   - transportation of the product without its preparation at sea.

3. The technical offers provide the necessary level of the environmental safety.

4. The Severo-Kamennomyss field is a pioneer object of the Ob and Taz Bays water body gas resources development, it is expedient to consider it as a testing area to test new technical and technologic decisions in the area of the field development and arrangement using a complex method of its arrangement.
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Table 1. Technologic characteristics of the development variants

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Fig. 1. Ob and Taz region

Fig. 2. General schemes of the variants for the platform designs for drilling production wells at the Severo-Kamennomyss field

Fig. 3. General scheme of subsea production complex

Fig. 4. The conceptual calendar schedule of the Severo-Kamennomyss offshore gas field development (Variant V)