UNCONVENTIONAL RESERVES – POTENTIAL, DEVELOPMENT PROSPECTS (BY THE EXAMPLE OF JSC “GAZPROM NEFT ”)

Khanty-Mansiysk May 2013
Note: resources are given in parenthesis (Tight Oil mln.t/shale gas in mlr.d.m³)

Sources: A. Zharkov, MPP, 3, 2011; JSC “VNIIZARUBEZHGEOLOGIA”
SHALE OIL (TIGHT OIL) PRODUCTION IN THE USA

Forecast: 2015 – 180 (45%), 2020 – 260 (59%), 2025 – 330 (69%), 2030 – 380 (72%)

Sources: EIA, 03.2013; JSC “VNIIZARUBEZHGEOLIO”
REGIONAL SPREAD OF BAZHENOV SUITE WITHIN KHMAD

<table>
<thead>
<tr>
<th>Petroleum district with initial total in-place resources density, thous. t/km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
</tr>
</tbody>
</table>

**Legend**
- Cities
- Bazhenov suite deposits
- License areas in operation
- JSC GAZPROM
- JSC GAZPROM NEFT
- JSC NK TOMSK NEFT
- JSC NGK SLAVNEFT
- JSC NK ROSNEFT
- JSC SURGUTNEFTEGAZ
- JSC NK LUKOIL
- JSC TNK-BP
- JSC NOVATECH
- Other subsoil users

- **Yamalo-Nenets Autonomous district**
- **Khanty-Mansiysk Autonomous district**
- **Tomsk region**
- **Sverdlov region**
- **Tyumen region**
- **Omsk region**
KEY FUNDAMENTAL FACTORS FOR SUCCESS

Bakken/Eagle-Ford, USA

Analogical facial, physical and structural features of suites

Developed oil and gas infrastructure

Bazhenov suite/Tyumen suite

High scientific, technological and staff potential

New methods of production of “hard to recover” oil (including horizontal drilling using multizone hydraulic fracturing (MZST)

Tax recession for hard-to-recover oil development

production methods of hard to recover reserves have great potential to be applied successfully

Source: LLC "Siberian NTC NiG"
OIL SHALE COMPOSITION

Green River field (USA)

Shale oil

- Organic matter 13.80%
- Mineral matter 86.20%

- Liquid hydrocarbon 2.78%
- Kerogene 11.04%

- S, N, O – 1.28%
- H – 1.42%
- C – 11.10%

- calcite, dolomite - 1.28%
- feld spar – 16.40%
- pyrite – 0.86%
- montmorillonite – 8.60%
- analcite – 4.30 %
- plagioclase,
- Illite – 12.90%
- siliceous earth – 40.00%

Bazhenov suite (Russia)

Shale oil

- Organic matter 14.61%
- Mineral matter 85.02%

- Liquid hydrocarbon 2.68%
- Kerogene 11.93%

- S, N, O – 1.33%
- H – 1.49%
- C – 11.69%

- calcite – 10.30%
- dolomite - 2.30%
- feld spar – 2.80%
- pyrite – 4.80%
- montmorillonite – 4.00%
- hydromica – 14.30 %
- kaolinite – 3.70%
- khlorite – 1.40%
- siliceous earth – 39.60%

Source: IPNG RAN
RUSSIAN VERTICALLY INTEGRATED OIL COMPANIES ARE ALREADY EXPLORING UNCONVENTIONAL RESERVES

**Rosneft**
- 15 June 2012 - creation of joint venture with ExxonMobil for commingled production of shale oil reserves
- Bazhen is one of the priority investment direction according to innovative development Program Certificate;
- As of September 2010 there were drilled near 200 wells per bed Ю0

**Surgutneftegaz**
- The company is carrying out pilot production of Bazhenov suite at Ay-Pimskoye field;
- Test projects concerning Kamysky, Ulyanovsky, Maslihovsky, Alekhinsky,3-Sakhalinsky, Rogozhnikovsky fields;
- As of September 2010 there were drilled near 600 prospecting and exploration wells per Bazhenov suite

**Lukoil**
- RITECH has launched the pilot project of Galyanovsky and Sredne-Nazymskoye fields;

**TNK-BP**
- Pilot project has been launched at S-Khokhryakovskoye field (production well was drilled in April 2012);
- There are detected 7 high priority development areas;
- TNK-BP tried to enter the joint venture for shale production in Ukraine, declaring its readiness to invest up to $7 mldr

Sources: Presentation “Oil shale, Bazhenov in Western Siberia”. By company “Royal Dutch Shell”
Business Information Network, Ukraine
(http://bin.ua/news/economics/faec/128175-tnk-vr-gotova-vlozhit-7-mlrd-v-techenie-30-let-v.html)
GENERAL INFORMATION ON TRIZ PROJECT

- Project perimeter: Fields of JSC “Gazpromneft-NNG”, affiliate “GPN-Muravlenko”, LLC “GPN-Khanton”, LLC “GPN-Vostok”
- Project area: Yamalo-Nenets Autonomous District, Khanty-Mansiysk Autonomous District, Tomsk region
- Project objective: involvement of reserves enclosed in beds and reservoirs of complicated structure. Feature low potential well flow rate and recovery rate.
- Object for 2013: Transition from pilot production to industrial introduction

### Reserves ranking

<table>
<thead>
<tr>
<th>No</th>
<th>Reserves type</th>
<th>Hard to recover reserves, thou. tons</th>
<th>Rank, N</th>
<th>Pilot production program, thou. tons</th>
<th>% of total reserves volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total 4 subsidiaries and affiliates (30 complex projects)</td>
<td>508 084</td>
<td></td>
<td>304 636</td>
<td>55.4%</td>
</tr>
<tr>
<td>2</td>
<td>Low reservoir properties</td>
<td>264 374</td>
<td>I</td>
<td>223 263</td>
<td>84.4%</td>
</tr>
<tr>
<td>3</td>
<td>High water content (ineffective development)</td>
<td>71 659</td>
<td>II</td>
<td>8 600</td>
<td>12.1%</td>
</tr>
<tr>
<td>4</td>
<td>Small oil thickness</td>
<td>59 362</td>
<td>III</td>
<td>17 300</td>
<td>29.1%</td>
</tr>
<tr>
<td>5</td>
<td>Undersaturated reserves (low values Koilgas)</td>
<td>54 844</td>
<td>IV</td>
<td>48 114</td>
<td>87.7%</td>
</tr>
<tr>
<td></td>
<td>C2 reserves (unproved reserves)</td>
<td>57 845</td>
<td>V</td>
<td>7 269</td>
<td>12.6%</td>
</tr>
</tbody>
</table>

### Reserves distribution

- Low reservoir properties
- High water content (production history)
- Small oil thickness
- Undersaturated reserves
- C2 reserves (reserves might be unproved)
IN ORDER TO GET ACCESS TO SHALE OIL RESERVES THERE WAS CHOSEN A PARTNER AND PROJECT “SHALE” WAS INITIATED

“Shale” Project: Creation of joint venture with Shell in order to get access to shale oil reserves for further development
Partner: “Royal Dutch Shell” company

Partners roles:
- GPN: Expertise in participation in RF tenders and auctions
- Shell: Expertise in shale reserves development and regional geologic studies of shale in Khanty-Mansiysk Autonomous District

Partners share in joint venture: 50 / 50

Partnership area:
(1) Khanty-Mansiysk Autonomous District
(2) Shale beds

Partnership objectives:
- Reserves: 8,3 mln t
- Cumulative production: near 300 mln t
GPN’S PROJECT STRATEGIC OBJECTIVE CONSISTS OF OBTAINING ACCESS TO NEW RESOURCES, ACQUIRING EXPERIENCE AND CREATING SHAREHOLDER VALUE

**Access to new resources**
- Considerable reserves volume: up to 8,3 mln. t*
- Significant output: up to 5,5 mln. tons (maximum level)
- Small horizon: 3-6 years before production start

**Acquiring experience**
- Acquiring experience in development of shale reserves and using it at other projects in Russia and abroad

**Creation of shareholder value**
- Expecting of RF government decree on tax concession for Development of Theory of Inventive Problem Solving
- Obtaining of cost effective areas
- “New life” of existing assets

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*Volume of shale in-situ reserves of Khanty-Mansiysk Autonomous District which can be accessible (excluding risk); 100% joint venture.*
KHANTY-MANSIYSK AUTONOMOUS DISTRICT IS A PROSPECTIVE REGION FROM SEVERAL POINTS OF VIEW

Bazhenov suite area in Khanty- Mansiysk Autonomous District and license areas

Reasons to choose Khanty- Mansiysk as a partnership area

- High potential of shale reserves in Khanty-Mansiysk Autonomous District (Bazhenov suite);
- High extent of subsoil maturation;
- Possibility to get access to shale reserves through competitions and auctions, and by acquiring finished assets with reserves;
- Both partners are present in the region as operators and subsoil users and consequently have a relevant experience;
- Developed market of service contractors which is clear for partners.

<table>
<thead>
<tr>
<th>Active license areas</th>
<th>Prospective partnership area</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSC GAZPROM</td>
<td>prospective oil bearing area</td>
</tr>
<tr>
<td>JSC GAZPROM NEFT</td>
<td>small subsoil users</td>
</tr>
<tr>
<td>JSC NGK SLAVNEFT</td>
<td>tender areas</td>
</tr>
<tr>
<td>JSC NK ROSNEFT</td>
<td></td>
</tr>
<tr>
<td>JSC SUTGUFKAIKIA NK</td>
<td></td>
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<tr>
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<tr>
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<td></td>
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<tr>
<td>JSC BASHKIRSKAYA TK</td>
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<td></td>
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<tr>
<td>Prospective oil bearing area of Bazhenov suite</td>
<td></td>
</tr>
</tbody>
</table>
PARTNERS COOPERATION ZONE IS SPECIFIED IN AGREEMENT ON JOINT ACTIVITY AREA (AJAA)

Bazhenov suite spread in Khanty-Mansiysk Autonomous District

Stratigraphic column of Khanty-Mansiysk Autonomous District

Joint activity area:

- **Area boundaries:**
  - lateral: Khanty-Mansiysk Autonomous District
  - vertical:
    - Black shale of Abalak and Bazhenov suites
    - Dense terrigenous rock of Achimov and Frolov suite

- **Areas:**
  - Areas nominated for tender / auction by RF Ministry of Natural Resources
  - Areas nominated for tender / auction by partners
  - Distributed reserves areas

- **All areas are divided into 2 categories:**
  - Areas with mostly unconventional reserves;
  - Areas with profitably to develop traditional oil resources;

- Areas with mostly unconventional reserves shall be accessible only in a joint manner;
- Any party is entitled to acquire areas with profitably to develop traditional oil resources independently;
- The license for new acquired areas with profitable traditional reserves can be held only by a dedicated legal body with no other assets/obligations;

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BAZHENOV PROJECT STARTUP

1 year
Preliminary estimate/ACCESS

Up to 2 years
ESTIMATE

Up to 2 years
SELECTION

Creation of process band for bazhen project

Process band for 3-5 years

Geological model
Exploitation concept
Infrastructure development concept
Selection of well design
Preparation of project document
Selection of completion options and multi-stage hydraulic fracturing
Economic model

Cycle 3 - 5 years

Geologal model
Exploitation concept
Infrastructure development concept
Selection of well design
Preparation of project document
Selection of completion options and multi-stage hydraulic fracturing
Economic model

1. Creation of competence center (core) in NTC
2. Creation of process band, competence development in scientific organizations and service companies on long-term basis
INNOVATIONS USED AT FIELDS WITH HARD TO RECOVER RESERVES

Salym Petroleum Development (bazhen) Palyanovsky project (bazhen, abalak) Shell (bazhen)

Geology

- 3D of high density
- Fractured area forecast based on 3D data
- Integrated approach to regional modeling using geomechanical modeling
- Development of hypotheses for spread and localization of producing areas of Bazhenov and Abalak suites

Development

- Development system with irregular grids adapted for distribution of reservoir properties on the field area

Drilling

- Horizontal wells orientation based on fracturing direction
- Using intellectual liners
- Drilling at controllable pressure
- Horizontal wells with multistage hydraulic fracturing

Infrastructure development

- Necessary to make separate accounting
- Designing and building infrastructure for abnormally high formation pressure
WELL 153P OF PALLYANOVSKY AREA OF Krasnoleninskoye Field

Completed on 15.02.2013

Brought into production: 13.03.2013, Qliq/Qoil – 100m³/82t

As of 17.05.2013:
\[\sum Q_{liq}/\sum Q_{oil} = 4009m³/3302t;\]
\[Q_{liq}/Q_{oil} = 98m³/80t\]
THANK YOU FOR YOUR ATTENTION