Status of Refining and Petrochemical Projects in Russia. New Challenges set by the Current Political Situation.

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Gubkin Russian State Oil & Gas University,
Head of the Oil Refining Technology Department;
RF Honoured Scientist

Moscow, April 2015
Crude run: 288.9 MTA (+6.0%) (3th position in the world)

Produced:
- Gasoline: 38.3 MTA (-1.0%)
- Kerosene: 10.9 MTA (+5.4%)
- Diesel fuel: 77.3 MTA (+7.4%)
- Fuel oil: 78.3 MTA (+1.8%)

Mean utilization: 95.0% (global mean value: 82%)

Conversion level: 72.3%

Amount of investment in oil refining in 2014 is 290 billion rubles.

Produced:
- Olefins: 4.7 MTA (+9.3%)
- Polyethylene: 1.88 MTA (+10.0%)
- Polypropylene: 1.05 MTA (+22.0%)

Investments in the RF petrochemical sector increased by 13% and amounted to 139 billion Rbls in 2014.

The volume of petrochemical feed processing increased by 12% and was 10.0 MTA.
MAJOR CHALLENGES IMPEDING THE GROWTH OF REFINING AND PETROCHEMICAL SECTORS IN RUSSIA

- Ambiguity of the governmental tax policy in the field of oil-refining and petrochemical industries
- Financial sanctions imposed by the USA and EC
- High import dependence in the industry
- Increase in equipment cost due to the weakening rouble
- Conservation of imbalance of a raw material component of the industry and production of base intermediate products and polymers
- Deterioration of the competitiveness of domestic petroleum and gas chemical products due to:
  - the establishment of large-scale capacities in the countries having large resources of relatively cheap feedstock and manpower (Saudi Arabia, Iran, China, South Korea etc.)
  - delivery of imported high-value added products to the Russian oil and gas, refining, chemicals, petrochemicals market.
PROCESS UNITS IMPROVING THE OIL PRODUCT QUALITY PLANNED TO BE PUT INTO OPERATION IN 2015

- **Isomerization**
  - OAO Kuibyshevsky Refinery - 280 kTA
  - ZAO Ryazan Oil Refinery Company - 800 kTA
  - OAO Astrakhan Gas Plant - 300 kTA
  - OAO Gazpromneftekhim Salavat - 470 kTA

- **Alkylation**
  - OOO LUKOIL-NizhegorodNOS - 367 kTA
  - OAO NK Rosneft – Angarsk Petrochemical Company - 130 kTA

- **Diesel Hydrotreating**
  - OOO LUKOIL-PermNOS - 1,5 MTA
  - ZAO Antipin Refinery – 2,6 MTA

- **Reforming**
  - OAO Kuibyshevsky Refinery - 1 MTA, revamp
  - OAO Novokuibyshevskiy Refinery – 1,2 MTA
  - OAO Syzran Refinery - 600 kTA, revamp

- **Catcracked Gasoline Hydrotreating**
  - OOO LUKOIL-NizhegorodNOS 1,1 MTA
POSTPONEMENT OF COMMISSIONING THE PROCESS UNITS IMPROVING THE OIL PRODUCT QUALITY

<table>
<thead>
<tr>
<th>Process</th>
<th>Company</th>
<th>Capacity</th>
<th>Start Year</th>
<th>End Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isomerization</td>
<td>OOO Tuapse Refinery</td>
<td>800 kTA</td>
<td>2016</td>
<td>2019</td>
</tr>
<tr>
<td>Alkylation</td>
<td>OAO Angarsk Petrochemical Company</td>
<td>130 kTA</td>
<td>2015</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>OAO Syzran Refinery</td>
<td>158 kTA</td>
<td>2016</td>
<td>2018</td>
</tr>
<tr>
<td>Diesel Hydrotreating</td>
<td>OAO Angarsk Petrochemical Company</td>
<td>4.4 MTA</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>OOO Tuapse Refinery</td>
<td>4.3 MTA</td>
<td>after 2019</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OAO Novokuibyshevsk Refinery</td>
<td>2.7 MTA</td>
<td>2015</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td>OOO RN-Komsomolsk Refinery</td>
<td>1.6 MTA</td>
<td>2016</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td>OAO Syzran Refinery</td>
<td>2.5 MTA</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>OAO Achinsk Refinery</td>
<td>1.6 MTA</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td></td>
<td>OOO Afipsk Refinery</td>
<td>2 MTA</td>
<td>2015</td>
<td>2019</td>
</tr>
<tr>
<td></td>
<td>ZAO Ryazan Oil Refinery Company</td>
<td>2 MTA</td>
<td>2015</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td>OAO Surgutneftegaz</td>
<td></td>
<td>2015</td>
<td>2016</td>
</tr>
<tr>
<td></td>
<td>(2 units – 1.9 and 1.3 MTA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OOO Mari El Refinery</td>
<td>1.2 MTA</td>
<td>2015</td>
<td>2018</td>
</tr>
<tr>
<td></td>
<td>OOO Ilsk Refinery</td>
<td>1.2 MTA</td>
<td>2015</td>
<td>2018</td>
</tr>
</tbody>
</table>
POSTPONEMENT OF COMMISSIONING THE PROCESS UNITS IMPROVING THE OIL PRODUCT QUALITY

**MTBE**
- OAO Angarsk Petrochemical Company 42 kTA 2015 → 2016
- OAO Ryazan Oil Refinery Company 55 kTA 2017 → 2019
- OAO Kuibyshevsk Refinery 40 kTA 2015 → 2016
- OAO Syzran Refinery 40 kTA 2015 → 2018

**Catcracked Gasoline Hydrotreating**
- OAO Angarsk Petrochemical Company, 500 kTA 2015 → 2017
- ZAO Ryazan Oil Refinery Company 950 kTA 2017 → 2019

**Reforming**
- OOO Tuapse Refinery 1,5 MTA after 2019
- OAO Achinsk Refinery, 1 MTA after 2020
DEEP CONVERSION UNITS PLANNED TO BE PUT INTO OPERATION IN 2015

- **Catalytic cracking**
  - OAO Gazpromneft-Omsk Refinery, 2,5 MTA (revamp)
  - OOO LUKOIL-Nizhegorodnefteorgsintez – 2.0 MTA

- **Visbreaking**
  - OAO Khabarovsk Refinery

- **Hydrocracking**
  - OAO Achinsk Refinery – 2,0 MTA
  - OOO RN-Komsomolsk Refinery – 2,0 MTA
  - OAO Novokuibyshevsk Refinery - 2,0 MTA
  - ZAO RNPK - 2,2 MTA
  - OOO RN-Tuapse Refinery - 4,0 MTA
  - OAO Slavneft-YANOS - 2,0 MTA

- **Catalytic cracking**
  - OAO Ryazan Oil Refinery Company after 2020
  - OAO Gazpromneftekhim Salavat 1,1 MTA
  - OAO Syzran Refinery 1,1 MTA
  - OAO Novokuibyshevsk Refinery 1,1 MTA

RESCHEDULING OF DEEP CONVERSION UNIT COMMISSIONING

- OAO Achinsk Refinery – 2,0 MTA
  - 2016→2017
- OOO RN-Komsomolsk Refinery – 2,0 MTA
  - 2016→2018
- OAO Novokuibyshevsk Refinery - 2,0 MTA
  - 2016→2018
- ZAO RNPK - 2,2 MTA
  - 2019→2020
- OOO RN-Tuapse Refinery - 4,0 MTA
  - 2016→2020
- OAO Slavneft-YANOS - 2,0 MTA
  - 2020→2022
- OAO Ryazan Oil Refinery Company
  - after 2020
- OAO Gazpromneftekhim Salavat 1,1 MTA
  - 2015→2016
- OAO Syzran Refinery 1,1 MTA
  - 2015→2017
- OAO Novokuibyshevsk Refinery 1,1 MTA
  - 2015→2016
HYDROCONVERSION OF HEAVY RESIDUES ON NANO-SCALE CATALYSTS

Developers: RAS INKhS, RAS IPKhF AND RAS URAL BRANCH IMET

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process conditions:</td>
<td></td>
</tr>
<tr>
<td>- pressure, MPa</td>
<td>7,0-8,0</td>
</tr>
<tr>
<td>- temperature, °C</td>
<td>440-450</td>
</tr>
<tr>
<td>Conversion, wt %</td>
<td>95,0</td>
</tr>
<tr>
<td>Catalyst concentration in the reactor, wt %</td>
<td>0.05</td>
</tr>
<tr>
<td>Feed volumetric flow rate hr⁻¹</td>
<td>0.5 - 2.0</td>
</tr>
</tbody>
</table>

Information by Institute of Petrochemical Synthesis, Russian Academy of Sciences

Implementation:

- OAO Tatneft - 50 kTA
  (Basic Design completed)
Capacity: 850 KTA

Licensors: Axens

OAO VNIPIneft’s scope of work: development of Detailed Engineering Documentation

Project status:
- Detailed Engineering to be finished in August 2015.
- Completion degree 97%

Time of putting into operation end 2015 – beginning 2016
Owner - AO NK KazMunaiGaz
Capacity – 5,2 MTA
Licensor – UOP
General Designer – Rominserv S.R.L.
Configuration:
- Phase 1 (new construction) – 2 process units and 12 Off-site facilities
- Phase 2 (revamp) – 12 process units and 7 Off-site facilities
- Phase 3 (revamp) – 2 process units and 1 Off-site facility

Capital investments are estimated at 700 mln USD
VNIPIneft’s scope of work - Authority Engineering and Detailed Engineering Documentation

Project status:
- Development of Phase 1 Authority Engineering Documentation is complete;
- Authority Engineering Documentation for Phases 2 and 3 will be complete in June 2015
- Detailed Engineering Documentation will be complete by July 2016
DIESEL FUEL HYDROTREATMENT.
OAO ANGARSK PETROCHEMICAL COMPANY

- Capacity: 4 MTA with producing the Euro 5 diesel fuel
- Licensor and Basic Design developer: Exxon Mobil
- OAO VNIPIneft’s Scope of Work: Basic Design Acceptance, Detailed Engineering, and Supervision
- New engineering solutions:
  - Use of a technology combining hydrotreating and hydrodewaxing of the diesel fuel
  - Two streams:
    - 1 – summer diesel fuel
    - 2 – winter & summer diesel fuel
  - Catalyst cycle length:
    - 1st stream: 3 years
    - 2nd stream: 4 years
- Project status:
  - Detail Engineering is completed
  - Procurement is 96% completed
  - Installation and construction work is ~ 65% completed
- In-service date is 2016
- General Designer: OAO VNIPIneft

- Configuration:
  - Ethylene Plant - 1500 kTA (Licensor: Linde)
  - Polyethylene Plant - 1500 kTA (Licensor: INEOS)
  - Polypropylene Plant - 500 kTA (Licensor: LyondellBasell)

- Project Status:
  - Detail Engineering Documentation of the Complex is under development
    (Ethylene Plant – Linde; Polyethylene Plant - Technip; Polypropylene Plant - UHDE; Off-Site Facilities - OAO NIPIgazpererabotka)
WEST-SIBERIAN CLUSTER
OOO NOVY URENGOY GAS CHEMICAL COMPLEX

- General Designer: OAO VNIPIngazdobycha
- Configuration:
  - Ethylene Plant - 420 kTA (Licensor: Linde)
  - LDPE Plant - 400 kTA (Licensor: Basell)
- OAO VNIPIneft’s scope of work:
  - Updating of Civil & Construction Detail Design for Ethylene and Polyethylene Plants and warehouses
  - Participation in Field Supervision
- Project status:
  - Construction of the process units is underway; the Complex is ~ 60% ready.
- To be put into operation in 2017
Client – OAO NK Rosneft

1st Stage Configuration:
- Ethylene Plant – 1,3 MTA.
- Polyethylene Plant – 0,875 MTA.
- Polypropylene Plant – 0,700 kTA.
- Ethylene Oxide Plant – 0,5 MTA.
- MEG Plant – 0,7 MTA.

Feed capacity – 3,4 MTA

General Designer – OAO Angarskneftekhimproekt

Project status:
- Licensor are selected: Pyrolysis – CB&I, Polyethylene and Polypropylene Plants – INEOS
- Authority Engineering Documentation is under development

Year of putting into operation – 2022 (long-term project)
Client – OAO Gazprompererabotka /ZAO Sibur Holding

Configuration:
- Gas Processing, 48 BCMA of commercial gas, 3 MTA of ethane
- Helium production, 60 MCMA.
- Ethylene 2,4 MTA.
- PE 2,4 MTA.

Project Status:
- Authority Engineering Documentation of the Gas Processing Plant is under development
- Final configuration of the Gas Chemical Complex is under resolution

Planned time of putting into operation:
- Gas Processing Plant 2019-2020-2022
- Gas Chemical Complex 2022-2024
Client: OAO LUKOIL

Projects in progress:
- Revamping of a 350-kTA ethylene plant
- Construction of a new petrochemical complex:
  - Ethylene pyrolysis unit - 600 kTA
  - Polyethylene plant - 600 kTA
  - Polypropylene plant - 300 kTA

OAO VNIPIneft’s scope of work:
- Detail Engineering for EP-350 Unit recondition has been developed jointly with OOO LUKOIL-NizhegorodNIInefteproyekt
- Feasibility Study for the Complex has been developed.

Project status: Selection of Licensors for the new petrochemical complex is underway.

Planned to be put into operation in 2020
Client: Kazakhstan Petrochemical Industries Inc.

Location: Atyrau

Configuration:
- 500-kTA polypropylene plant
- 500-kTA propane dehydratation unit

OAO VNIPIneft’s scope of work:
- Updating of TEOC documentation and PD
- Participation in the Complex detailed design development is anticipated.

Project status:
- Complex TEOC documentation has been updated.
- Complex PD updating is in progress.
- A tender for detailed design development and equipment procurement is underway.
OAO VNIPINEFT AS A LEADING RUSSIAN ENGINEERING COMPANY FOR OIL REFINING, GAS PROCESSING AND PETROCHEMICAL INDUSTRY

Over 85 years in the engineering service market

- Established: February 9, 1929
- Number of employees: 947
- Major roles: Engineering and design contractor in oil and gas, oil refining, gas processing, petrochemicals / chemicals

OAO VNIPIneft’s scope of services

- Pre-project work
- Design
- Procurement
- Construction management

- Crude Oil Distillation Plant, Catalytic Cracking Unit, Isomerization Unit, Hydrotreating Unit (OJSC TANECO, OAO TAIF-NK, OOO PO Kirishinefteorgsintez, OAO Gazpromneft-Moscow Refinery)
- VGO Hydrotreating Complex (ZAO Ryazan Oil Refining Company)
- VGO Hydrocracking Complexes (OJSC TANECO, OOO Slavneft-Yaroslavnefteorgsintez, OOO LUKOIL-Permnefteorgsintez, OOO PO Kirishinefteorgsintez)
Major challenges impeding revamp of the refining and petrochemical sectors are as follows:

- Ambiguity of the governmental tax policy in the field of refining and petrochemical sectors
- Financial sanctions imposed by the USA and EC
- High import dependence in the industry
- Increase in equipment cost due to the weakening rouble
- Project cost increase
- Disruption in equipment delivery schedules

As of today, out of the six clusters the West-Siberian refining and petrochemical cluster has the best perspectives. It is planned to construct within this cluster Russia’s largest petrochemical complex in Tobolsk which will include ethylene and polyethylene plants, with a capacity of 1500 kTA each.

Under the current economic situation the government’s top priority should be import substitution, improving competitiveness of Russian manufacturers and quality of their products.

Enhancement of technological specialization and promotion of investments into science-intensive industries are crucial aspects in development of domestic technologies.

Technology Platform “Deep Conversion of Hydrocarbon Resources” has been created to expedite development and implementation of domestic technologies.

VNIPIneft as Russia’s leading engineering company is ready to provide the entire package of engineering services required in the market to revamp operating and construct new refining and petrochemical facilities.
В России начаты работы по созданию новых нефтегазохимических кластеров: Приволжского, Каспийского, Западно-Сибирского, Восточно-Сибирского, Балтийского, Дальневосточного.

Планируется построить в г. Тобольске самый крупный в России нефтехимический комплекс, включающий в себя установки производства этилена и полиэтилена мощностью по 1500 TPA.

Для ускорения разработки и внедрения отечественных технологий создана технологическая платформа «Глубокая переработка углеводородных ресурсов».

Разрабатываются следующие отечественные нефтехимические технологии:

- мембранные-катализические процессы получения олефинового сырья для нефтехимии (ИПХФ РАН)
- технология алкилирования бензола этиленом на гетерогенных катализаторах (ИНХС РАН)
- усовершенствованный процесс получения полиэтилена низкой плотности (ИПХФ РАН)

ОАО «ФНИПИнефть», являясь ведущей в России инжиниринговой компанией, готово оказывать весь комплекс необходимых на рынке инжиниринговых услуг для модернизации действующих и строительства новых объектов газо-и нефтехимии.

Thank you!