KHERSON OIL REFINERY

Reconstruction. Modernization. Development
**KOR: Historical data for modernization**

Enterprise relates to plants that run on alternative fuel.

The plant includes:

- Tank farms in volume of 120 thousand m³ for raw materials and 140 thousand m³ for petroleum products
- Installation of primary oil processing ABT-1,2; Power ABT-1 2,5 million tons / year. ABT-2 4,7 million tons / year.
- Gasoline reforming plant Л-35-11/600;
- Delayed coking installation 21-10/3М;
- Bitumen installations БУ-1,2;
- Supporting installations and off-plot facilities.

Maximum volume of processing was 8.4 mln tons of oil annually.

Existing technical equipment provided the depth of processing crude oil 48%, the yield light petroleum products product was 45%.
## Why is it necessary to modernize the KOR

### Energy Safety of Ukraine:
- Implementation of the state program "Energy Strategy of Ukraine till 2030"
- Providing 22% of Ukraine's requirements in the highest quality light petroleum products

### Economic Development:
- Substantial refill of state and local budgets - over 4 billion USD / year excise duties and other taxes
- 75% materials and works of the project will be managed by Ukraine companies
- Growth of business activity in Ukraine and in the region

### Social Benefits:
- Creating new workplaces:
  - The plant will employ about 1500 workers
  - Contracts for the project implementation will create employment in Ukrainian companies - implementing orders

### Ecology:
- Production of high-quality environmentally friendly petroleum products will reduce influence on human health and the environment
- Biofuel production
Energy Strategy of Ukraine

To ensure the needs of the state in high-quality oil requires reorganization of Ukraine petroleum industry. It aims to enhance oil refining, reducing energy costs while increasing competitiveness of domestic enterprises.

Oil refining industry modernization should be divided into two phases. During the first stage (up to 2017) should be completed a cycle of deep processing of oil. The depth of refining will be increased to 88%.

In the second phase (2017 - 2020 years.) Depth of refining will be brought to 92% by constructing catalytic cracking, hydrocracking, deasphaltizing, demetallization.
KOR: basic facts

Ready for creating a modern refinery complex:
- designed an investment plan for the modernization of the plant at the existing facilities and construction of new based on progressive global experience
- prepared and received all necessary project solutions, feasibility studies and other important technical papers and permits

Partners and Licensees of Reconstruction project:
- Leading international and Ukrainian companies: Axens, Purvin & Gertz Inc, JSCo «Ukrnaftokhimproject», JSCo “Naftokhimproject” CB&I Lummus Global, UOP Limeted Honeywell, BNP Paribas, Rothschild,

Quality:
- after the first stage of modernization products of the plant will conform to EURO 5
KOR: benefits and potential

- Developed infrastructure
- Advantageous accommodation
- Production of biofuel
KOR: benefits and potential

- Ability to be the first plant in Ukraine that produces high fuel standard EURO-5.

Black Sea neighbourhood:
- Diversification of supply channels of raw materials and using the different oil fields.
- Transportation of petroleum products by tanker fleet to ports of the Mediterranean, the Black Sea and Sea of Azov navigable part of the Dnipro and Danube.
- Closeness to the explored reserves of oil in the Black Sea.

Location in the South of Ukraine:
- High volume of consumption of petroleum products, especially diesel engine.
- High volumes cultivation of agricultural plants with further recycling for biofuel production.
- Equidistance from the western and eastern regions of Ukraine - the efficiency of logistics supply finished products.
**KOR: modernization, reconstruction**

**A purpose:**
- improving the overall efficiency of the OR;
- manufacturing of high-quality petroleum products Euro-5;
- reducing fuel oil production;
- improving environmental characteristics of production

Modernization Project involves the two stages:

<table>
<thead>
<tr>
<th></th>
<th>I stage</th>
<th>II stage</th>
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</thead>
<tbody>
<tr>
<td>Renovation</td>
<td>New technological units: isomerization</td>
<td>New technological units: hydrocracking</td>
</tr>
<tr>
<td></td>
<td>Hydrotreatment middle distillates</td>
<td>Production of hydrogen</td>
</tr>
<tr>
<td></td>
<td>First stage production of sulfur production</td>
<td>The second stage of sulfur production</td>
</tr>
<tr>
<td></td>
<td>Module production unit of hydrogen</td>
<td></td>
</tr>
<tr>
<td>Depth of processing</td>
<td>88%</td>
<td>92%</td>
</tr>
<tr>
<td>Output light petroleum</td>
<td>60%</td>
<td>85%</td>
</tr>
<tr>
<td>products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>EURO 5</td>
<td>EURO 5</td>
</tr>
<tr>
<td>Power</td>
<td>4,5 mln tonn/year</td>
<td>4,5 mln tonn/year</td>
</tr>
<tr>
<td>Terms</td>
<td>3 years</td>
<td>+1 year</td>
</tr>
<tr>
<td>Investments</td>
<td>877 260 USD</td>
<td>440 910 USD (including funding with operating profits derived from the plant after the start of stage I of modernization)</td>
</tr>
<tr>
<td>Payback</td>
<td>7.8 years including period of reconstruction</td>
<td></td>
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</tbody>
</table>
KOR: modernization

Parts of the modernization program
- Development of feasibility study
- Development of the basic project
- Detailed design
- Delivery of equipment
- Construction works

Yield after the I stage
- Sulphur 0.5%
- Total gases 2%
- Total gasolines 18%
- Vacuum gas oil 25%
- Jet fuel 15%
- ДП 10 ppm 27%
- Bitumen 2%
- oil fuel 6%
- Кокс 5%

Yield after the II stage
- Bitumen 2%
- Sulphur 1%
- Total gases 2%
- ДП 10 ppm 48%
- Total gasolines 24%
- Jet fuel 18%
- Кокс 5%
- Sulphur 1%
- Кокс 5%
- oil fuel 6%
- Vacuum gas oil 25%
- Jet fuel 15%
- ДП 10 ppm 27%

Project Team: 75% of the materials and works will be manufactured and completed by Ukrainian companies

Finished goods: gasoline and diesel engine of standard EURO-5 jet fuel, biofuel
KOR: I stage of modernization

Reconstruction of facilities for processing oil ABT-2;

- Reconstruction of the reformer - the licensor company "UOP Limited";
- Reconstruction of the delayed coking unit - the licensor company "CB&I Lummus Global";
- Reconstruction of bitumen plant;
- New gasoline isomerisation unit - the licensor "UOP Limited";
- New hydrotreating installation of kerosene and diesel fractions - the licensor company "UOP Limited";
- New installation of regeneration amine solution and sulfur production;
- New installations the steam stilling of acid treatment;
- Reconstruction of tank parks;
- Reconstruction of plantwide household.

### Power plants

<table>
<thead>
<tr>
<th>A plant</th>
<th>ths. tons / year</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABT-2</td>
<td>4500</td>
</tr>
<tr>
<td>И-35-11/600</td>
<td>750</td>
</tr>
<tr>
<td>УСК</td>
<td>987</td>
</tr>
<tr>
<td>Isomerization</td>
<td>250</td>
</tr>
<tr>
<td>Hydrotreating д/п</td>
<td>2156</td>
</tr>
<tr>
<td>Hydrocracking</td>
<td>1500</td>
</tr>
<tr>
<td>Bitumen plant</td>
<td>100</td>
</tr>
</tbody>
</table>

After I stage of modernization:
- Capacity of enterprise 4.5 million tons / year
- Depth of oil processing 88%
- The output of light petroleum products 60%
- Euro-5 quality
KOR: 1 stage of modernization

- **Hydrotreating unit (reconstruction)**
  - ABT-2 (reconstruction)
    - С5-180
    - Gasoline fr.
    - Gas fr.
    - Diesel fr.
    - Vacuum gas oil

- **Catalytic reforming Λ-35-11/600 (reconstruction)**
  - BBG reformate
  - BBG
  - Φр. C5+С7

- **Isomerization**
  - Hydrogen
  - Φр. C5-C6

- **Hydrotreating of medium distillates**
  - Hydrogen
  - Izomeryat
  - Hydrogen sulphide

- **Stabilization unit (reconstruction)**
  - BBG reformate

- **Liquefied petroleum gas**

- **Gasoline A-92, A-95**

- **Sulfur**

- **Jet fuel**

- **Euro 5 diesel fuel**

- **Vacuum gas oil**
  - Oil fuel
  - Coke
  - Bitumen

- **Bitumen (reconstruction)**

- **Module hydrogen plant**
  - Hydrogen

- **Slow coking (reconstruction)**

- **Vacuum gas oil**

- **Hydrogen sulphide**

- **Hydrotreating unit**
  - Hydrogen

- **Stabilization unit**
  - Hydrogen

- **Hydrogen sulphide**

- **Coke**

- **Bitumen**
After the second stage of modernization:
- capacity of enterprise 4.5 million tons/year
- depth of oil processing 92%
- output of light petroleum products 85%
- Euro-5 quality

Project realization of modernization KOR meets the State Program "Energy Strategy of Ukraine" and "Development internal production of petroleum products"
KOR: II stage of modernization
KOR : market outlets

Location of the Dnipro estuary, approximately 30 km from the Black Sea
- Transporting oil products by pipelines to the local terminal servicing vessels with deadweight of 15 000 tonnes.
- Yield on Odessa terminal servicing vessels with deadweight of 100 000 tonnes.
- Shipment of petroleum products by railway transport.

Domestic market

Sales of KOR goods in Ukraine via WOG

<table>
<thead>
<tr>
<th>Type of fuel</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (mln. ton)</td>
<td>1,6</td>
<td>2,0</td>
</tr>
<tr>
<td>Including Kherson region (mln. ton)</td>
<td>0,5</td>
<td>0,6</td>
</tr>
<tr>
<td>Share across a country, %</td>
<td>22,2</td>
<td>22,2</td>
</tr>
<tr>
<td>Diesel fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (mln. ton)</td>
<td>1,5</td>
<td>1,8</td>
</tr>
<tr>
<td>Including Kherson region (mln. ton)</td>
<td>0,5</td>
<td>0,6</td>
</tr>
<tr>
<td>Share across a country, %</td>
<td>21,3</td>
<td>21,4</td>
</tr>
</tbody>
</table>
KOR : Project realization of reconstruction

- Feasibility the study
- Started the detailed design
- Selected the licensing processes
- Designed the investment project
### KOR : realization steps

<table>
<thead>
<tr>
<th>№ п/п</th>
<th>Найважливіші показники</th>
<th>Оп. номери</th>
<th>Кількість</th>
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<tr>
<td>1</td>
<td>Найважливіші показники</td>
<td>ПРАТ «Херсонський нафтопереробний завод» Херсонська обл., м. Херсон, пр. Найффельт, 52</td>
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<td>2</td>
<td>Характер будівництва</td>
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<tr>
<td>3</td>
<td>Поліпшення при переробці сировини</td>
<td>кол/лін</td>
<td></td>
</tr>
</tbody>
</table>
Thank you for attention!