Refinery modernization and efforts to meet high environmental requirements of EU Directives

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Conclusion
Film – NIS – Future at work
Pančevo oil refinery - RNP

Location: **20km from Belgrade and 3km from river Danube**
Area: **151 hectares**
Crude oil processing capacity: **4,85 Mt/year**
Nelson complexity index: **9,2**
Share of light products: **75%**
No. of employees: **cca 1000**

**IPPC Facility**
**Higher tier SEVESO operator**
History and development of RNP

1959. Refinery established as a business entity

1965. Start of construction of the first plant

1968. The first plants put into operation:
• Atmospheric Distillation Unit, S-100
• Thermal Cracking, S-200
• Naphtha Platforming, S-300
• Diesel and Jet Fuel HDS, S-400

1979. Start of the process units:
• Vacuum Distillation, S-2200
• Bitumen, S-0250
• FCC Complex and Alkylation

1985. Refining capacity 4.8 Mt/y

1987. S-200 reconstructed into Visbreaking Unit

1989. Refining capacity 1.3 Mt/y

2001. Start up of MHC-DHT Complex

2002. Reconstructed Vacuum Distillation

2003. Reconstructed FCC

2009. Ownership transformation

2011. Market liberalization

2012. Reconstructed FCC

2013. Reconstructed FCC

2011. Start of construction of Delayed Cooking unit - DCU

2017. Start of construction of Delayed Cooking unit - DCU

2020. Start of DCU
RNP efficiency indicators

- In order to monitor business performance and market position, NIS has opted for an independent methodology for monitoring refining efficiency indicators.

- For this purpose, the methodology of Solomon Associates was chosen, which as a world leader in this field covers over 85% of refining capacity in over 70 countries worldwide.

- RNP has been in the program since 2008, when a system of measuring key performance indicators, planning of target values and development of the Program for achieving the set goals were established.

- Since 2008, RNP has recorded a positive trend in all key business parameters:
  - Increase in operational availability
  - Improving energy efficiency
  - Improving staff efficiency
  - Reduction in operating costs
  - Reduction of hydrocarbon losses
<table>
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<tr>
<th>Investments implemented and ongoing in RNP</th>
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<table>
<thead>
<tr>
<th><strong>1 Fuel quality</strong></th>
<th><strong>2 Energy efficiency</strong></th>
<th><strong>3 Renewables</strong></th>
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<th><strong>5 VOC Directives</strong></th>
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<tr>
<td>• MHC / DHT – fuel EURO 5 standard</td>
<td>• Optimization of combustion on furnaces</td>
<td>• Bio components blending</td>
<td>• Reduction of PM in air (FCC reconstruction)</td>
<td>• Reconstruction of gasoline tanks</td>
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<tr>
<td>• DCU – Zero fuel oil production</td>
<td>• Thermal isolation of tanks</td>
<td></td>
<td>• Reduction of SO₂ in air (Washing of ejector gas at Vacuum dest.)</td>
<td>• Installation of VRU unit (Autofiling station, Railway station end Port)</td>
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<td></td>
<td>• Installation of heat exchanger on FCC</td>
<td></td>
<td>• Reduction of NOₓ in air (Low NOₓ burners installation)</td>
<td>• Instalation of loading arms for bottom loading</td>
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<td></td>
<td>• Application of ceramic coatings on furnaces</td>
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<td>• Reconstruction of petrol tanks</td>
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<td></td>
<td>• Replacement of electric motors and other</td>
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**CAPEX 2012-2020:** 696 million €

**CAPEX 2012-2016:** 17,3 million €

**CAPEX 2016-2021:** 6,8 €

**CAPEX 2012-2019:** 50,5 million €

**CAPEX 2012-2018:** 101,5 million €
Modernization of RNP was a major requirement for bringing the Company to a strategically important leadership position in the regional petroleum products market.

**Phase I – MHC/DHT**

**Description:**
- Start up of Mild hydrocracking in 2012
- Capacity 2,970,000 t/year
- Increase in oil refining depth up to 84%
- Output of white derivatives is increased up to 75%

**Goal:**
- Production of unleaded motor gasoline and euro diesel with a sulfur content not exceeding 10 ppm, according to the Euro 5 standard
- Increase in processing volume and export to the Balkan region

**Environmental effects:**
- Reduction of sulfur content in derivatives
- Reduction of SO₂ emissions in air

**Cost:**
- 396 milion EUR
Phase II – DCU

Description:
- 2017 beginning of the project
- Start-up of the plant - 2020

Goal:
- Increase in oil refining depth up to 99,2%
- Production of high-calorie fuel - petroleum coke
- Heavy residues will be used as feedstock for DCU
- Increasing the energy efficiency of RNP

Environmental effects:
- Reduction of SO₂, NOx and PM emissions from all RNP combustion plants
- With the start of operation of DCU, production of fuel oil ceases, thereby reducing the emission of pollutants into the air in the region (NIS markets)

Cost:
- > 300 million EUR
# Energy efficiency projects in RNP 2013-2019

<table>
<thead>
<tr>
<th>Project</th>
<th>Realization year</th>
<th>Total mil. EUR</th>
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<tbody>
<tr>
<td>1. The insulation of the tank in RNP</td>
<td>2013</td>
<td>1,9</td>
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<tr>
<td>2. Installation of energy efficient lighting in RNP</td>
<td>2013</td>
<td>0,2</td>
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<tr>
<td>3. Measurement of electricity consumption</td>
<td>2014</td>
<td>0,2</td>
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<tr>
<td>4. Installation of system for the optimization of combustion in furnaces S-300, S-2100, S-2200, S-400 and S-2300</td>
<td>2014</td>
<td>5,3</td>
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<tr>
<td>5. Installation of energy efficient electric motors</td>
<td>2014</td>
<td>1,2</td>
</tr>
<tr>
<td>6. Water-fuel oil emulsion system</td>
<td>2014</td>
<td>0,8</td>
</tr>
<tr>
<td>7. Installation of frequency regulation of the electric motors of the air coolers S-400/2100/2200/3600</td>
<td>2016</td>
<td>0,7</td>
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<tr>
<td>8. Reduction of NOx emission in flue gases in RNP – Energy plant</td>
<td>2016</td>
<td>1,5</td>
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<tr>
<td>9. Application of ceramic coatings in BA-2101 and BA-2201 furnaces</td>
<td>2016</td>
<td>0,8</td>
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<tr>
<td>10. Installation of &quot;Packinox&quot; heat exchanger at Plaftofming S-300</td>
<td>2016</td>
<td>4,2</td>
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<tr>
<td>11. Implementation of continuous dry cleaning of the BA-2201A / B furnace</td>
<td>2018</td>
<td>0,14</td>
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<tr>
<td>12. Application of ceramic coatings in furnaces BA-301/2/3/4, BA-305 and BA-306</td>
<td>2018</td>
<td>0,39</td>
</tr>
<tr>
<td>13. Application of ceramic coatings in furnaces</td>
<td>2019</td>
<td>0,5</td>
</tr>
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**Total:** 17,3
### Environmental projects

#### IED Directives
1. FCC - reduction of solid particle emissions in air  
   - Realization year: 2012  
   - Total mil. EUR: 15,6
2. Regeneration of spent sulfuric acid  
   - Realization year: 2012  
   - Total mil. EUR: 14,5
3. Construction of a closed drainage and closed sampling system  
   - Realization year: 2015  
   - Total mil. EUR: 6,2
4. Replacement of Low NOx burners on furnaces on: Vacuum dest., HDS, Atm. distilition and FCC  
   - Realization year: 2018/2019  
   - Total mil. EUR: 2,8
5. Washing of ejector gas on Vacuum distilition  
   - Realization year: 2019  
   - Total mil. EUR: 1,6
6. Other projects  
   - Realization year: -  
   - Total mil. EUR: 9,8

#### VOC Directives
7. Reconstruction and modernization of installations for loading and unloading of LPG  
   - Realization year: 2012  
   - Total mil. EUR: 3,0
8. Reconstruction and modernization of the port  
   - Realization year: 2013  
   - Total mil. EUR: 29,9
9. Reconstruction of auto loading stations  
   - Realization year: 2015  
   - Total mil. EUR: 8,8
   - Biocomponents blending with diesel fuel  
   - Realization year: 2016  
   - Total mil. EUR: 6,8
   - Total: 99,0

#### Projects with environmental effect
1. Reconstruction of petrol tanks  
   - Total mil. EUR: 59,8
   - Total: 158,8

### Projects are realized in order to comply with the obligations of IED Directive 2010/75/EU and VOC Petroleum Directive
From 2009 – 2015 significant investments in environmental projects
From 2015 - 2018 we were burning **fuel oil** as dominant fuel, which reflected on the emissions
From 2019 dominant usage of natural gas

* Projected emissions for 6M 2019. (based on the I series of measurements and operating hours of facilities)
Compliance with environmental legal requirements

For full compliance with Industrial emissions Directive (IED), projects in progress:

- BA-0252 – Fuel gas desulfurization
- BF-2301+DC-2302 – Installation of EC filter
Future obligation – GHG (EU – ETS)

1. Legal framework in RS
   - Law on Climate changes still not adopted in RS (expected end of 2019)
   - Then in 2 years adoption of by-laws, will introduce concrete obligations (monitoring and reporting on CO₂)

2. Preparation for new obligation
   - RNP identified as C category plant, CO₂ emissions > 500 000t*
   - Identified new obligations (monitoring plan, emission report)
   - Training of personnel for monitoring CO₂
   - 2 Studies done

3. Calculation of CO₂ emissions
   - Year | CO₂ emissions [t]
   - 2016  | 982.735
   - 2017  | 973.222
   - 2018  | 1.058.820

4. Estimation of costs
   - Estimated cost of purchasing emission units for 1 mil. t of CO₂ with:
     - 60% share of free units**,
     - Current emission units price 26 EUR/t CO₂ is 10,4 mil. EUR/year
   - cca 1 mil tons CO₂/year
   - 10,4 mil. EUR/year

*In accordance with Regulation 601/2012 EC on monitoring of emissions reporting and GHG emissions
**Source: Institute for Energy and Environmental Protection EKONERG from Croatia, 2018
Conclusion

• Good level of compliance with environmental legal requirements, still in progress to achieve full compliance;

• To achieve full compliance it is necessary to:
  • Substitute heavy fuel oil with natural gas;
  • Continue environmental investments Program implementation;
  • Continue Energy efficiency Program implementation;
  • Timely prepare for new obligation (EU-ETS)

• Plan for additional financial costs for EU-ETS:
  • Emission units purchase,
  • OPEX costs (laboratory analysis, measurement devices, reports, stock market, etc.)
  • To keep active role in development of new legislation
Thank you