LUKOIL OIL COMPANY

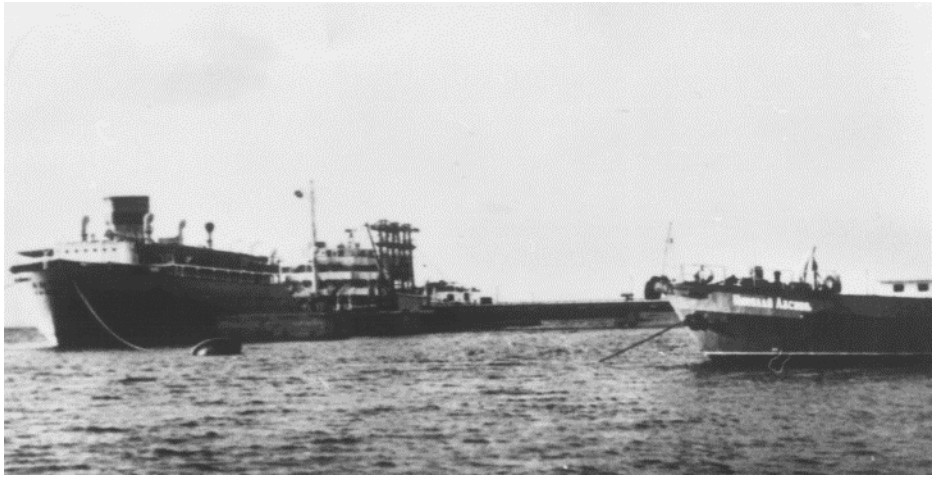
Always moving forward

Innovative approaches in new technologies implementation for enhancement of competitiveness

Atanas Ivanov,
Deputy Chief process engineer

Oil refining beginnings - September 1963

5 November1960 – Foundation stone laying, marking the construction of the oil refinery



4 August 1963 Anton Ivanov tanker ship delivered the first 12 308 **tons** of crude oil

At 17.30 on 02.09.1963 the FIRST BULGARIAN GASOLINE was produced.

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A new stage of Company's development within LUKOIL Group

12 October 1999: The contract of sale signed at an official ceremony in Burgas. Neftochim becomes a part of the big family of the international vertically-integrated company LUKOIL.

A new stage of Company's development starts.

Investment projects for providing EURO-5 quality fuels production

Motor gasolines – 344 mln. $

Revamp of existing facilities

- **Fluid-bed catalytic cracking unit– 2003**
- **Catalytic reforming unit – 2004**
- **APC updating on FCCU – 2016**
- **New process control on FCCU and CR-1 – 2016**
- **New instrumentation on MTBE – 2016**

Construction of new units

- **Sulphur Acid Alkylation and SAR – 2009**
- **Gasoline desulphurization – 2010**
- **N-Butane Izomerisation unit – 2012**

Diesel fuels – 256 mln. $

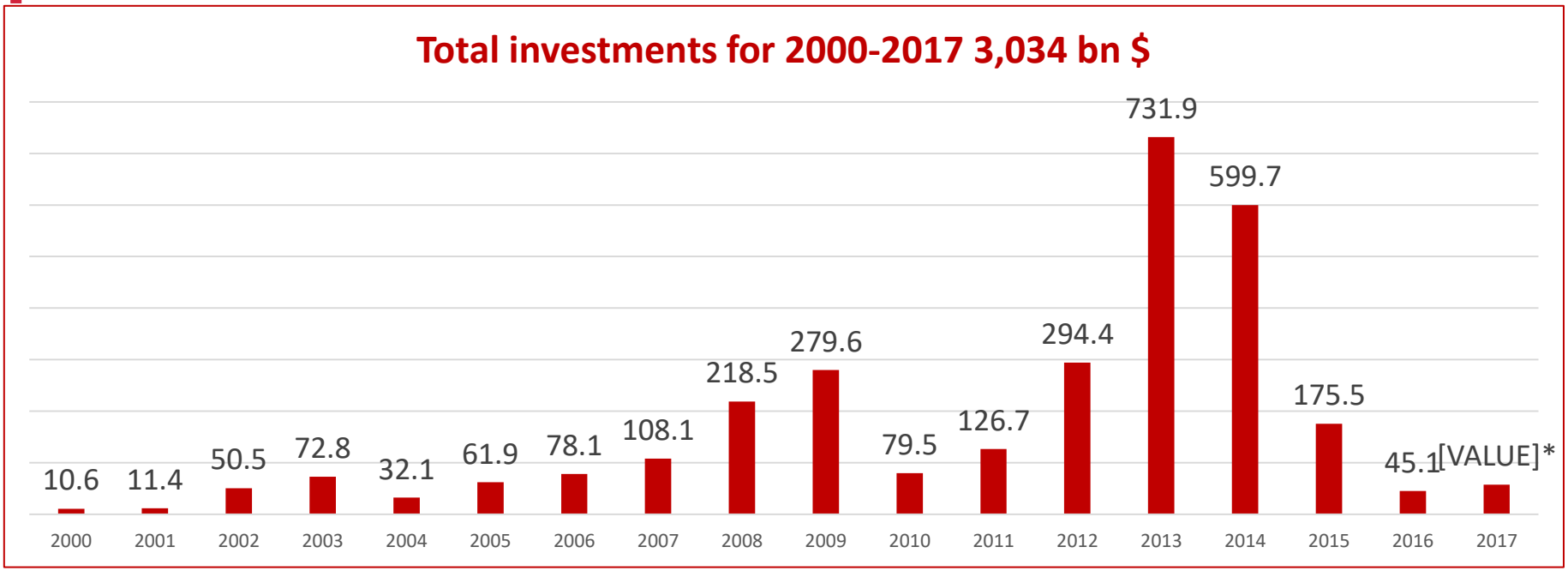
Revamp of existing facilities

- **HDS 2 – 2009**
- **HDS 3 – 2009r.**
- **New compressor room – 2010**
- **Optimisation of Hydrogen ring for efficient H_2 distribution to consumers – 2016**

Construction of new units

- **MDEA Regeneration-1 – 2009**
- **Diesel fractions desulphurization – 2010**

Total investments 2000 - 2017



- Revamp of key units
- Construction of **13** new facilities
- Environmental & safety projects

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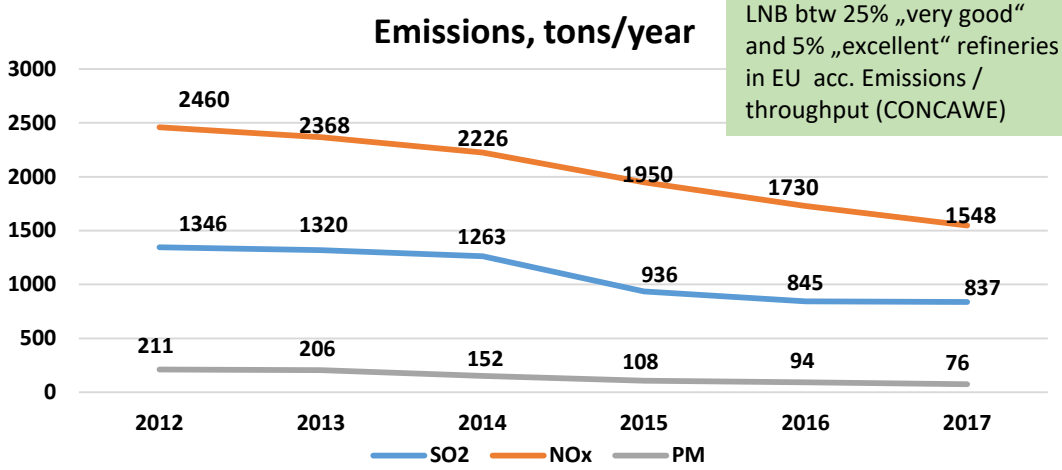
* Preliminary data

LNB and environmental protection



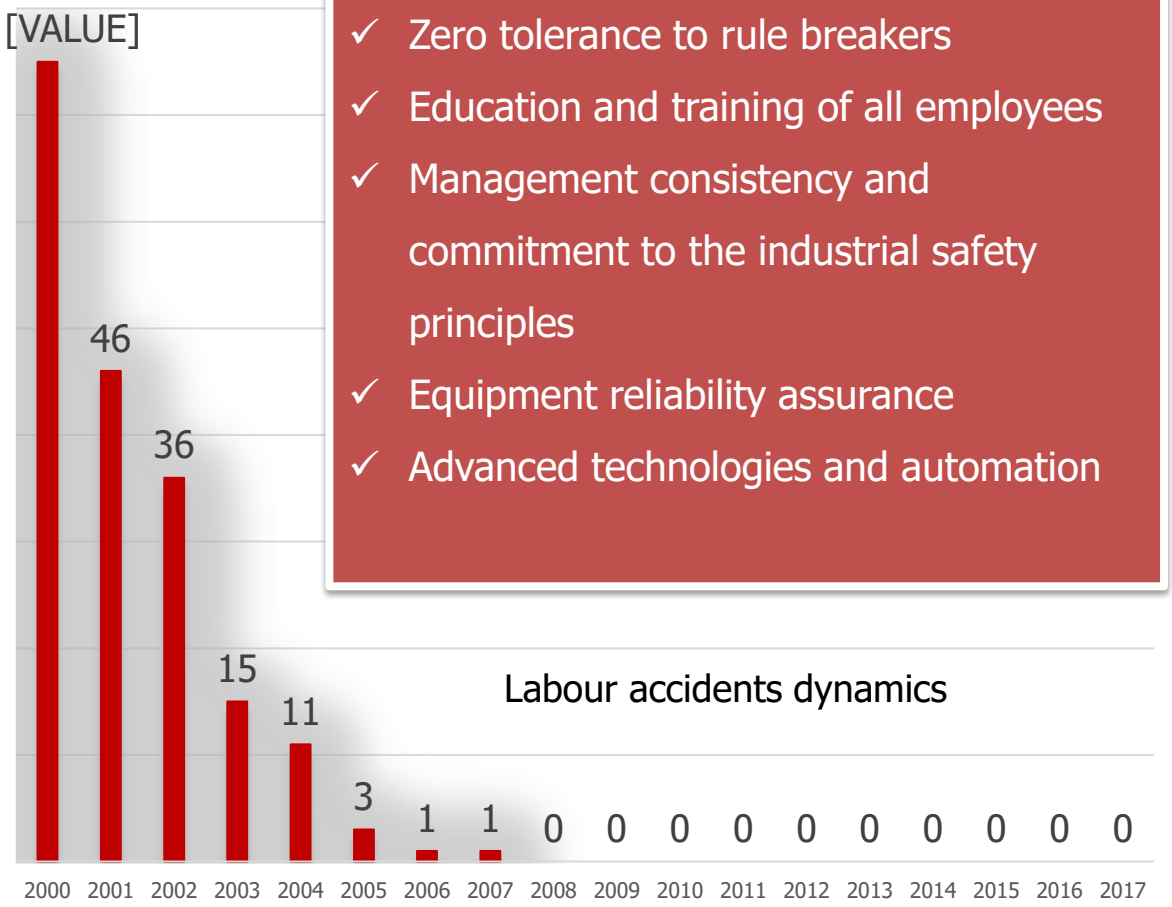
LNB btw 25% „very good“ and 5% „excellent“ refineries in EU acc. Emissions / throughput (CONCAWE)

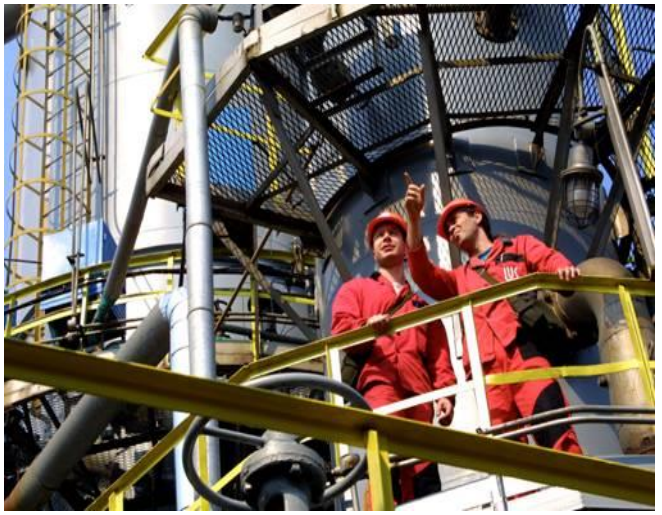
- New field instrumentation and controls HDS-1/2 (2016)
- Reduced Nox emissions from s.1000 down to60 mg/Nm^3 against regulatory standard 300mg/Nm^3 (2016)
- Process condensates treatment unit (2015)
- New Sulphur Recovery Unit (2014)
- Catalyst dust filter of FCCU (2014)
- Automated road truck and railway filling racks with VRU (2012)
- Local water treatment facilities at Rosenets Oil terminal
- Commissioning of HC flare (2011)
- New industrial waste disposal area (2009)

Industrial safety

Labour safety as well as safe and efficient production assurance is the priority task of LUKOIL Neftohim Burgas

- ✓ Zero tolerance to rule breakers
- ✓ Education and training of all employees
- ✓ Management consistency and commitment to the industrial safety principles
- ✓ Equipment reliability assurance
- ✓ Advanced technologies and automation





Rosenets Port Terminal

- Rosenets PT – crude oil delivery and oil products logistics
- Capacity: 9-12 mln tons per annum
- in 2011 a concession contract signed with the government for a period of 35 years

- The products are delivered to Bulgarian market by pipeline, tank-trucks and railway tank-cars
- Oil products export through Rosenets PT to Mediterranean, East-European and North American markets

Getting started

2003	2006	2007	2008	2012
EC directives (2003/30/EC) regarding the fuels quality requirements	Complexity program for development of LNB 2006 – 2015 including strategic plan for heavy residuals utilisation	Choice of the most effective technology for implementation	Contract with Axens for the licensed technology "H-oil®"	EPC contract signed with Technip Italy S.p.A.

- The policy of EU becomes a driver for the refiners to invest and develop new technologies;
- Technology choice as function of:
  - CAPEX, OPEX;
  - products price & markets availability;
  - overall refinery process configuration (integration);
  - NPV, IRR, PI.
- EPC contract choice with all advantages and disadvantages;

Construction of the Heavy Residue Processing Complex (HRPC)

Laying the first stone (31.07.12)

Opening ceremony (20.05.15)

Intensive construction works

The implementation of this project was of crucial importance for LNHB and will further increase its competitiveness and oil refining performance.

H-oil mega-project engineering achievements

Transportation of two mega-reactors through the territory of Burgas city

Changes were made in the city transport scheme and infrastructure to transport the large-sized equipment.

Erection of the two reactors of 1500 tons each

Transportation and installation of reactors was done by Sarens.

Reactors assembly

The complexity of assembly works is comparable to assembly of a Swiss watch.

H-oil mega-project statistics

Construction workers up to 4 100 p.

Companies	**83**
Process sites	**17**

Site area	**207 400 м^2**
Concrete	**39,8 km^3**
Metal structures	**17,8 kt**
Pipelines	**12,7 kt**
Cables	**1 195 km**
Equipment	**16,9 kt**

H-oil mega-project and people

200 Project team

147 personnel

1500 hrs. training

Dedicated project team:
-LNB - **23** people
-Axens – 15 people
-KT – 12 people
-Technip – 150 people

The overall personnel in the H-oil complex, including the engineers, operators, etc.

Specialised training:
-Axens - **30** people
-FLOWSERVE - **7** people
-Kinetics Technology - **24** people
-Technip - **15** people

On-site training:
- Plock, Poland - **45** people
- LUKOIL PNOS refinery- **14** people

H-oil complex

▪**Flare and tank-farm**
- Start-up 02.2015

▪**Hydrogen plant**
- Start-up 03.2015

▪**Amine cleaning and sour waters**
- Start-up 04.2015 г.

▪**Sulphur recovery unit**
- Start-up 12.2014 г.

▪**Cooling water**
- Start-up 11.2014 г.

Project parameters

▪CAPEX:
1, 540 bn $

▪Capacity:
2.5 mln. tons/year

▪**Conversion:**
70%

▪Refinery conversion rate:
90%

▪Staffing:
147 people

▪**H-oil units**
- Start-up 05.2015

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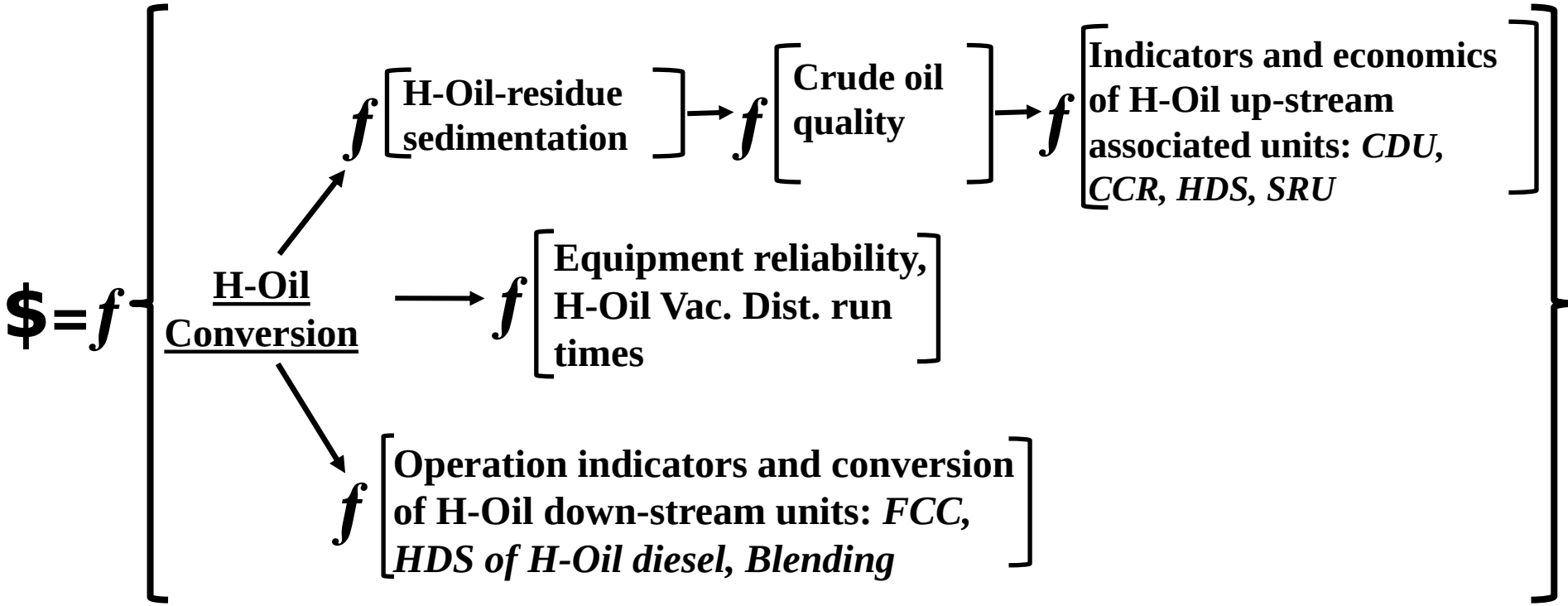
Mastering the new H-Oil process.
Optimisation of the Refinery Process Flow Diagram



Profit maximisation is the solution of the most challenging task with a great number of variables and limits, which requires:

- Collection, classification and analysis of new data;
- Formulation of new limits;
- New technological approaches;
- Innovative thinking;
- Refinery LP-model update.

H-oil and innovative solutions for efficiency improvement

Optimization of crude oil types & product quality constraints leading to H-Oil Hydrocracking conversion (up to **10%** conversion increase);

Improve H-Oil residue quality (stability) using semi-products available in the refinery (another **8%** conversion increase);

Ensuring operation reliability of:

- Dynamic equipment (pumps and compressors);
- Instrumentation;
- Fixed equipment: heat exchangers, vacuum tower.

Implementing a technology model to identify the relationships and development of adequate measures for optimization of operation modes and feedstock pools together with the Licensor Axens and the catalyst supplier.

75,3 %
Mid 2017

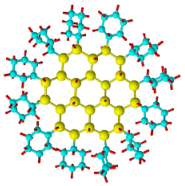
57,5 %
Start up 2015

Further steps for improvement

Evaluation of H-cat technology for further conversion increase and process (products) stability;

Ensuring equipment reliability and safety through dedicated investment programs;

Working on extension of the cycle length and overall economic efficiency!



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