Highlights of the production flows
Site visit in PKN ORLEN Płock Refinery

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ORLEN

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- Refinery
- Petrochemicals
- Supplementary Slides

Production assets in ORLEN Group

Refinery

Poland:

- PKN ORLEN 17.8 mtpa
- Rafineria Trzebinia (0.5 mtpa)
  Rafineria Jedlicze 0.2 mtpa
- ORLEN Oil
  (lubes in Płock and Jedlicze)
- ORLEN Asfalt
  (bitumens in Trzebinia and Płock)

Czech Republic:

- UniRaf – 51% share of Ceska Rafinerska
  Litvinov 5.4 mtpa
  Kralupy 3.3 mtpa
  Paramo 1 mtpa

Petrochemical

Poland:

- PKN ORLEN
  (olefins, glycols, aromatics, solvents, ethylene oxide, others)
- Basell Orlen Polyolefins
  (LDPE, HDPE, PP)

Czech Republic:

- Chemopetrol
  (olefins, HDPE and PP)
- Kaucuk
  (polystyrene and synthetic rubber)

Chemical

Poland:

- Anwil
  (PWC, fertilizers, amonia)

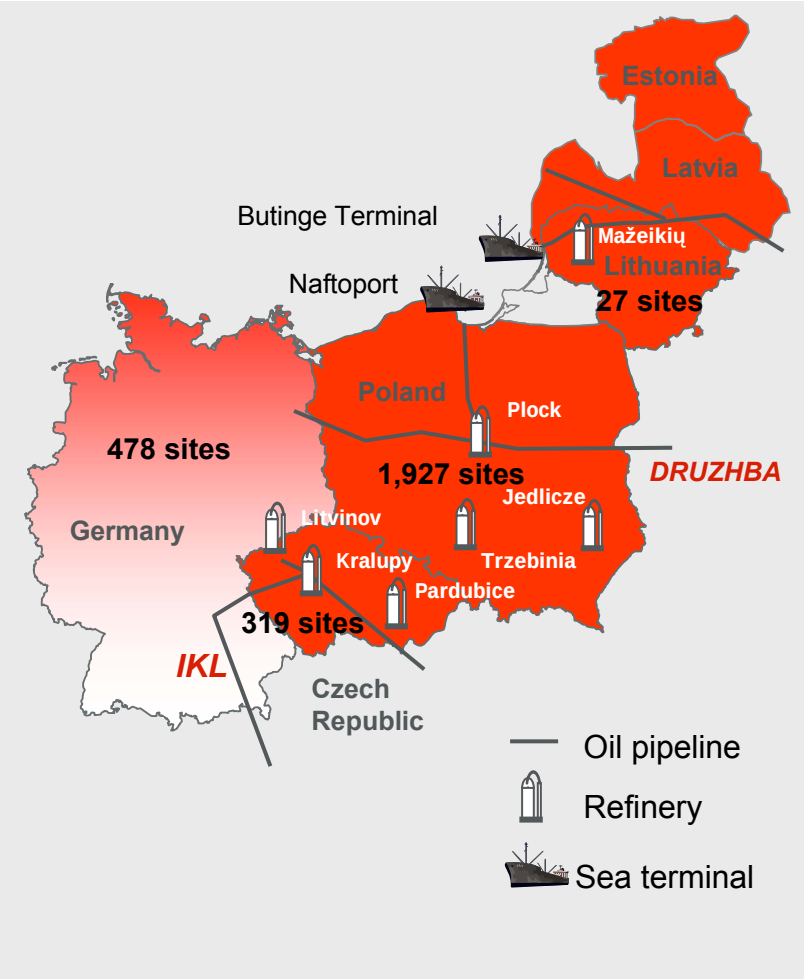
Czech Republic:

- Chemopetrol
  (amonia, urea)
- Spolana
  (PVC and caprolactam)
- Lovochemie
  (fertilizers)
- Aliachem
  (specialty chemicals and plastics)

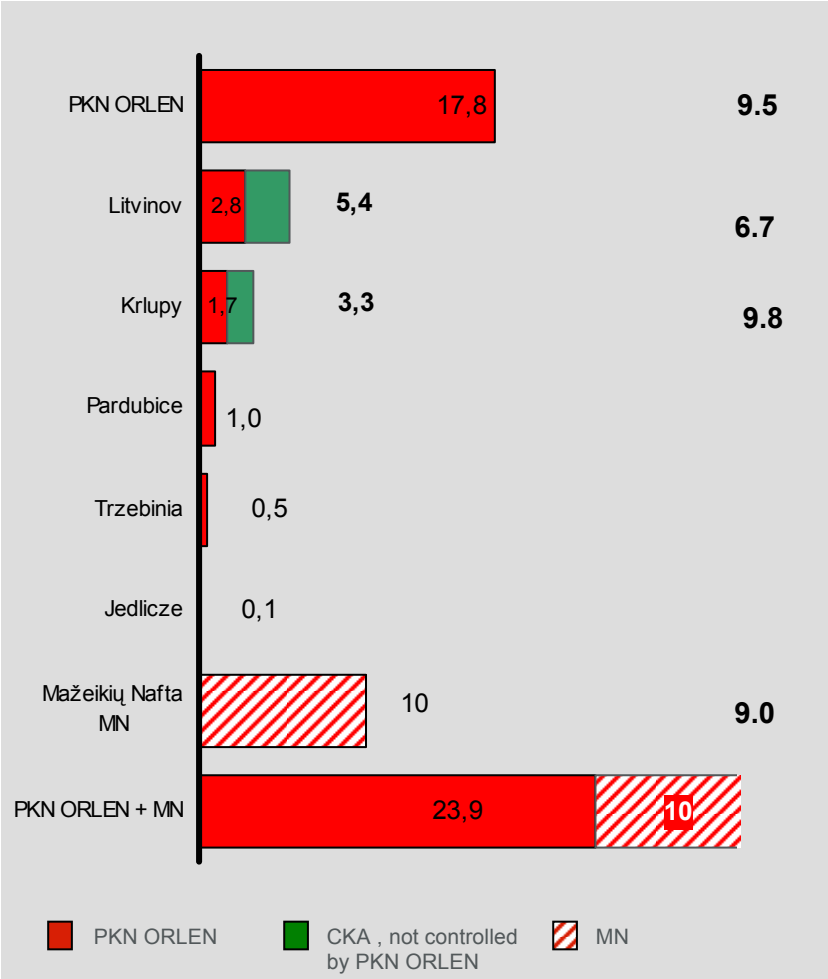
Delay between peeks of product price cycles and cooperation between segments brings long term stability of production business

PKN ORLEN refinery assets

Strengthening PKN ORLEN'S Footprint



Processing capacity (mt pa ; NCI)



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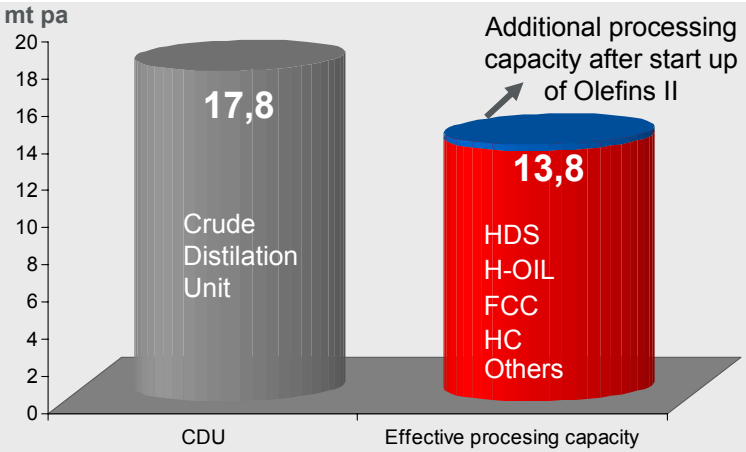
Throughput capacity in Płock refinery

Two methods of crude throughput calculation

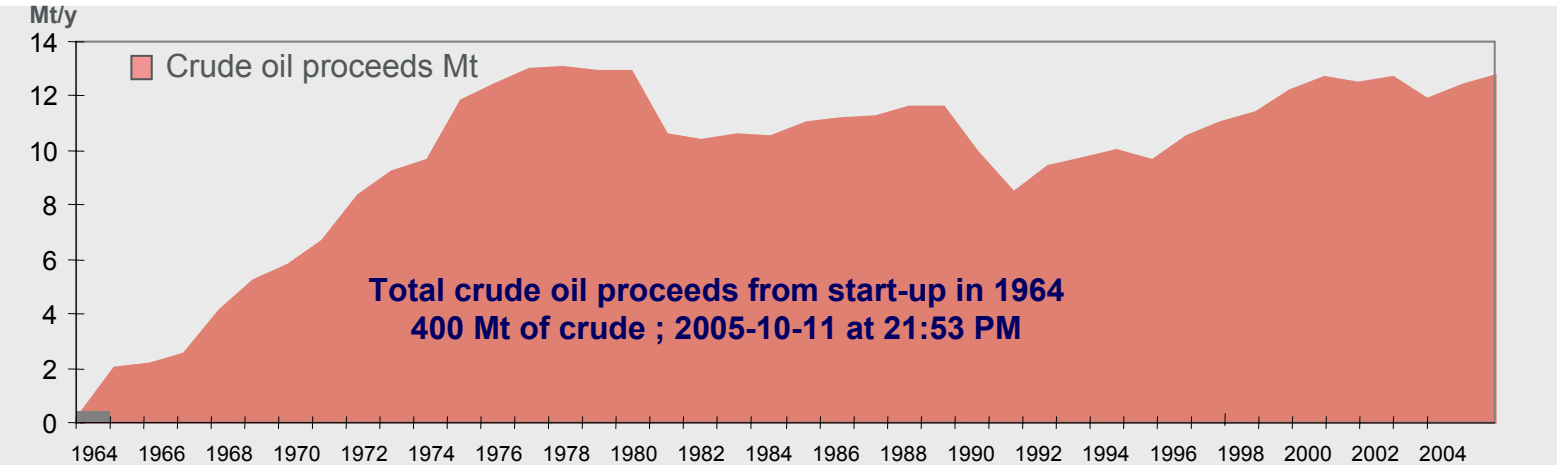
Throughput calculation in Plock Refinery as for 2006

MAXIMAL – maximal throughput
17.8 mt pa of Crude Distillation Units

EFECTIVE – production complex throughput which gives final products with optimum economical margin.
13.8 mt pa (after Steam Cracker revamp)



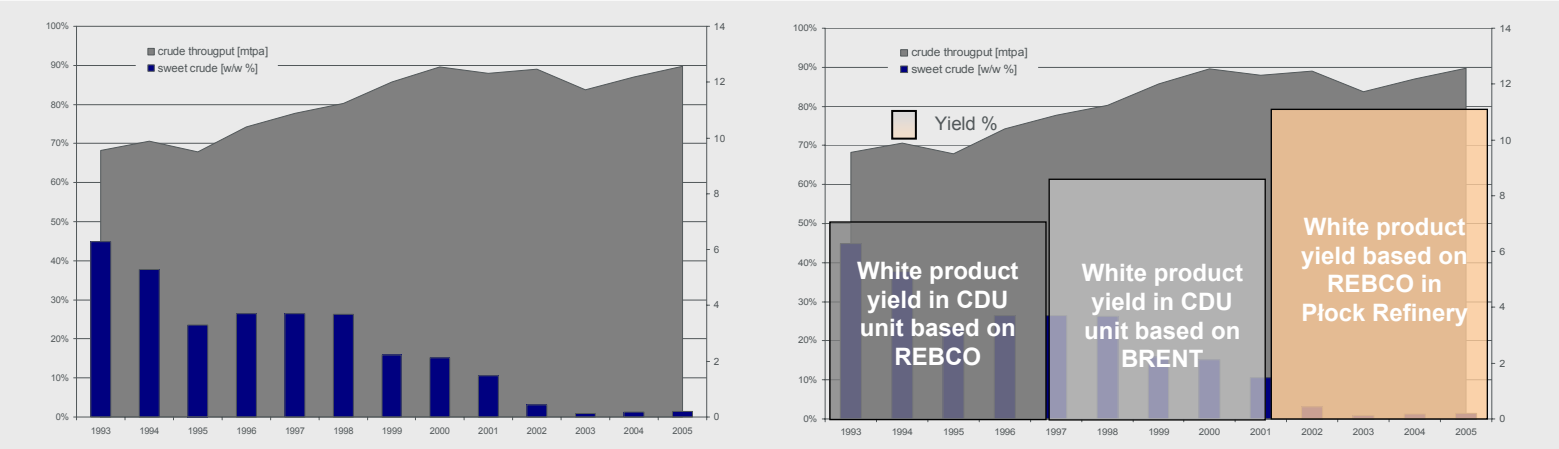
Crude oil throughput



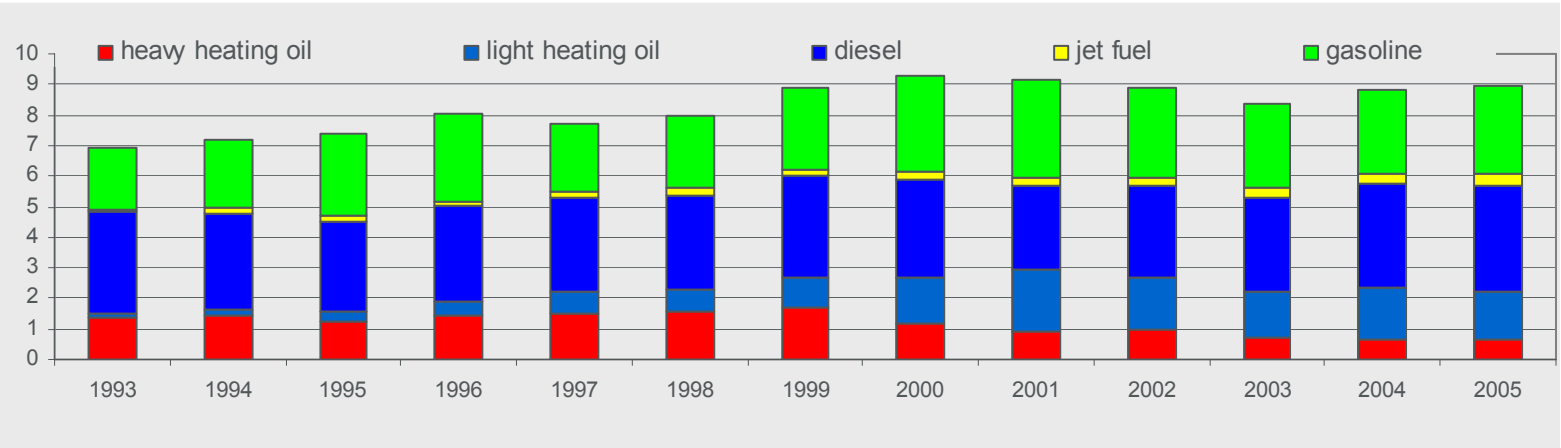
Crude oil throughput breakdown.

Fuels and heating oils production structure

Sweet and light crude utilisation.

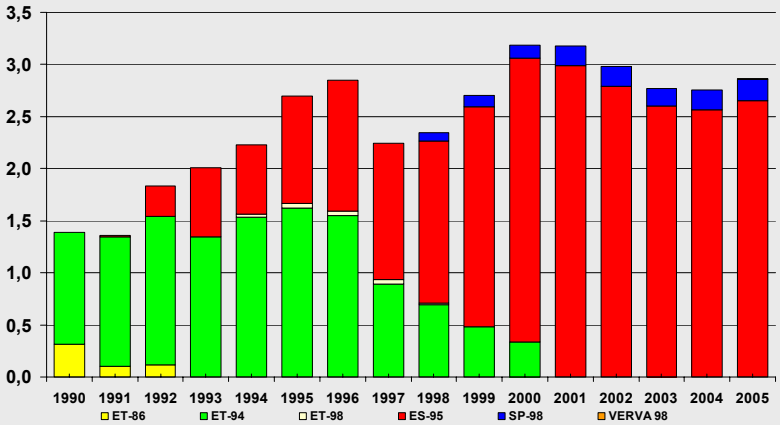


Heavy heating oil production decrease, atmospheric oils production increase.

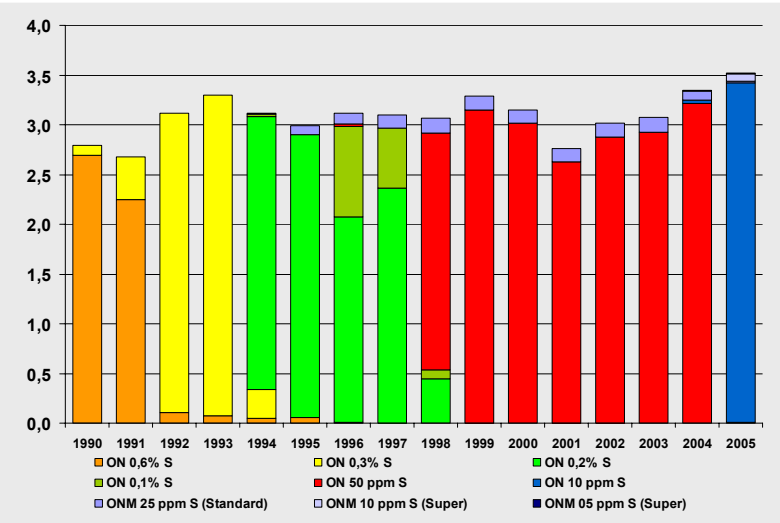


Fuels quality improvement

Gasoline production ; mt pa



Diesel production ; mt pa

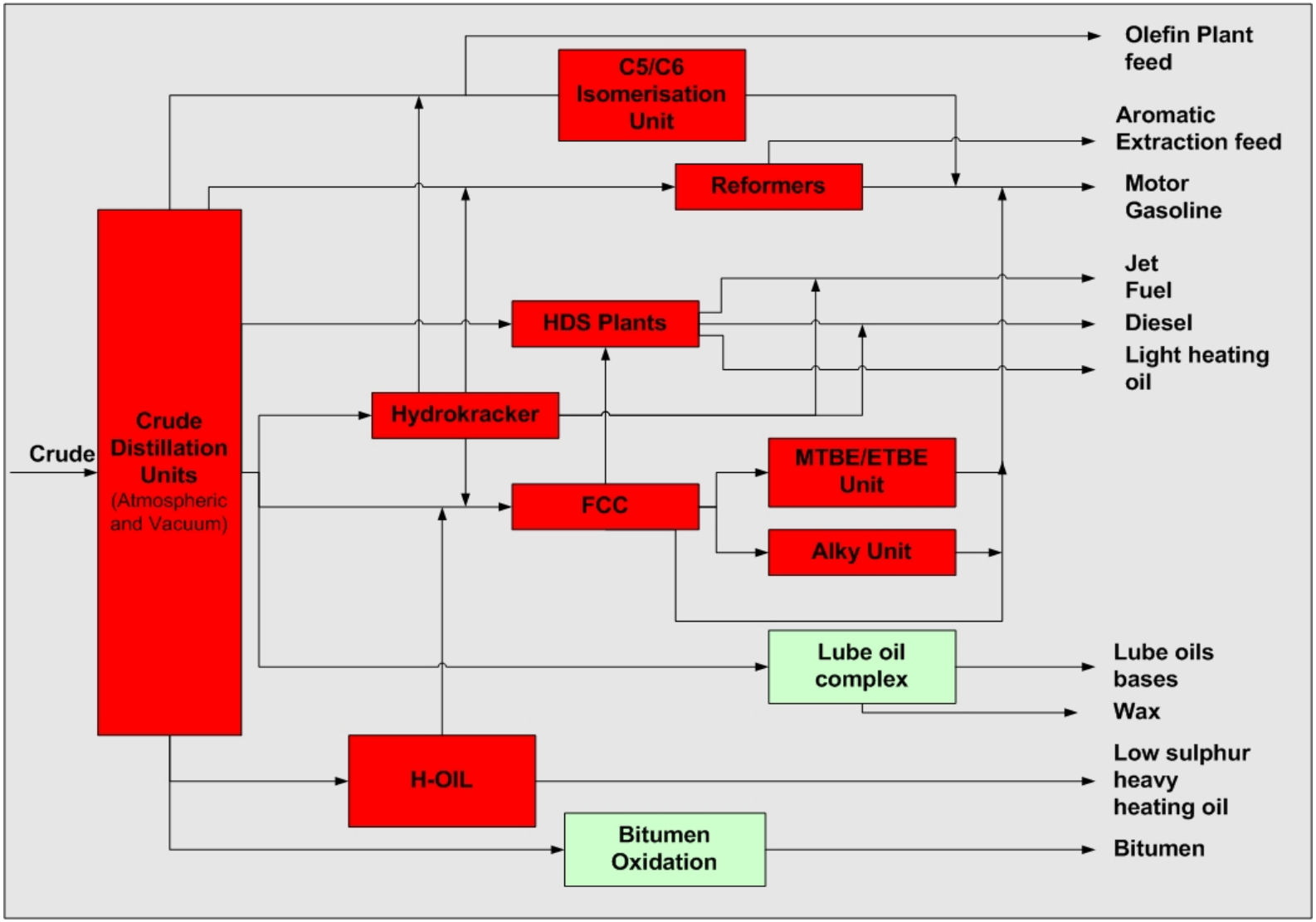


Properties of gasoline	2005 standard	2009
Aromatics content, v/v % max.	35	35
Olefin content, v/v % max.	18	18
Benzene content, v/v % max.	1	1
Oxygen content, wt/wt.%, max.	2.7	2.7
Sulphur , ppm, max.	50 (10)	10
RVP (summer time), kPa, max.	60 / 70	60 / 70
Lead, g/l max.	null	null

Properties of diesel	2005 standard	2009 (PKN today)
Sulphur , ppm, max.	50 (10)	10
Cetan number, min.	51	51
Polyaromatics, wt/wt.%, max.	11	7
Density, kg/m^3, max.	845	845
Distillation 95%, deg C, max.	360	360

Refinery in Plock

Product flow diagram



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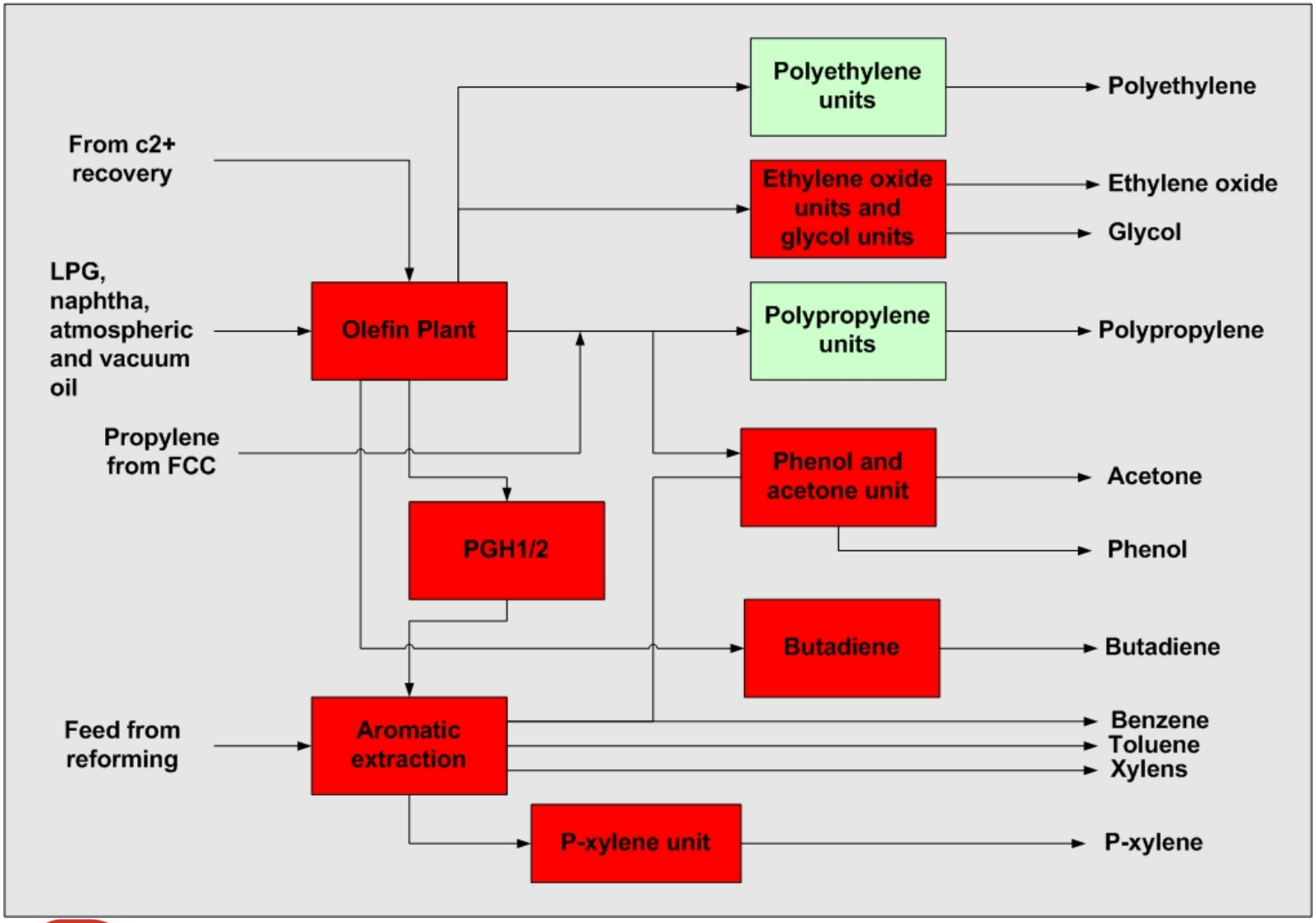
Petrochemical complex in Płock

Product flow diagram



Synergies between refinery and petrochemical
complex in Plock site

Feed exchange without logistic costs

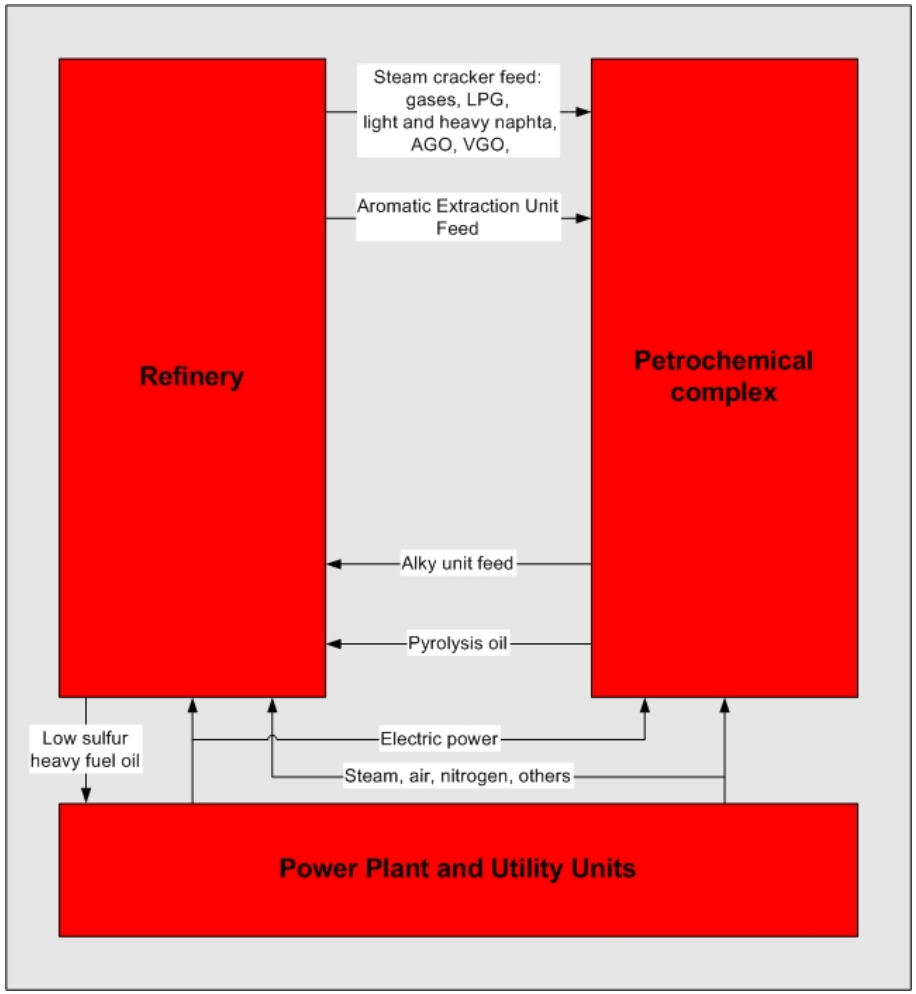
Lower cost of utilities (steam, electric power, air, water)

Utilization of surplus gasoline from refinery

Lower cost of slops and waste utilization

Bigger consumption of fuel oil on Power Station = lower sells of low profitable heating oil

Benzene is final product and is not compound to motor gasoline



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Units specification in Płock site

Unipetrol production sites – simplifies product diagram flow

Crude distillation Units

Includes atmospheric and vacuum distillation

Crude Distillation Units	kt pa
CDU II	3 700
CDU IV	3 700
CDU VI	3 700
CDU III	6 700
CDU - TOTAL	17 800

Crude Distillation Units designed for processing REBCO (URAL) crude oil. PKN ORLEN process as well other types of crude oil, in most cases BRENT

REBCO crude oil is delivered to Plock refinery by Friendship pipeline and BRENT by Pomerania pipeline or by rail

Gasoline production unit in Płock refinery

Reformers	kt pa (1)
Semiregen Reformer	300
CCR-Reformers (2 units)	1 600

Transforming Units	kt pa (1)
HF Alkylation Plant	150
C5/C6 Isomerisation Plant	600
MTBE/ETBE Plant	140

Blending unit	kt pa (1)
Unit with online active analyzer NIR	Flexible (2)

New investment during start-up	kt pa
FCC gasoline Hydrodesulphurization	1 150

(1) Potential processing capacity or currently in use
(2) Depending on the production needs

Middle distillate production unit in Płock refinery

Hydrodesulphurisation Units	kt pa (1)
Diesel Desulphurisation units	4 420
Diesel Desulphurisation low temperature properties improvement	
Jet Desulphurisation	

Blending units	kt pa
Low sulphur diesel	Flexible (2)
JET A-1	
Low sulphur light heating oil	

(1) Potential processing capacity or currently in use
(2) Depending on the production needs

Conversion Units in Plock refinery

Fluid Catalitical Craking	kt pa (1)
Vacuum oil utilization	1 600
Naphta and olefins fraction	

Hydrocracker	kt pa (1)
Vacuum oil utilization	3 400
Deep desulphurization	
Diesel production	

H-OIL (Vacuum residue hydrocracker)	kt pa (1)
Vacuum residue utilization	1 800
Power Station feed desulphurization	
Naphtha, diesel, vacuum oils production	

(1) Potential processing capacity or currently in use

Non-fuel production units in Plock site

Lube Oil Complex (ORLEN Oil)	**kt pa** (1)
Furfural unit	**150**
Dewaxing MEK-Tol unit	
Lubes Hydrodesulfurization Unit	

Bitumen Plant (ORLEN Asfalt)	**kt pa** (1)
Bitumen	**600**

(1) Potential processing capacity or currently in use

Petrochemical units specification in Płock

Main assets

Steam cracker (main output products)	kt pa (1)
Ethylene	700
Propylene	385

Other main units	kt pa (1)
Aromatic Extraction	550
Py-Gas Hydrogenation	520
Butadiene Extraction	55
LPG Separation	flexible[2]

(1) Potential processing capacity or currently in use
(2) Depending on the production needs

Petrochemical units specification in Płock

Supplementary assets

LPG	kt pa (1)
LPG desulphurisation	640

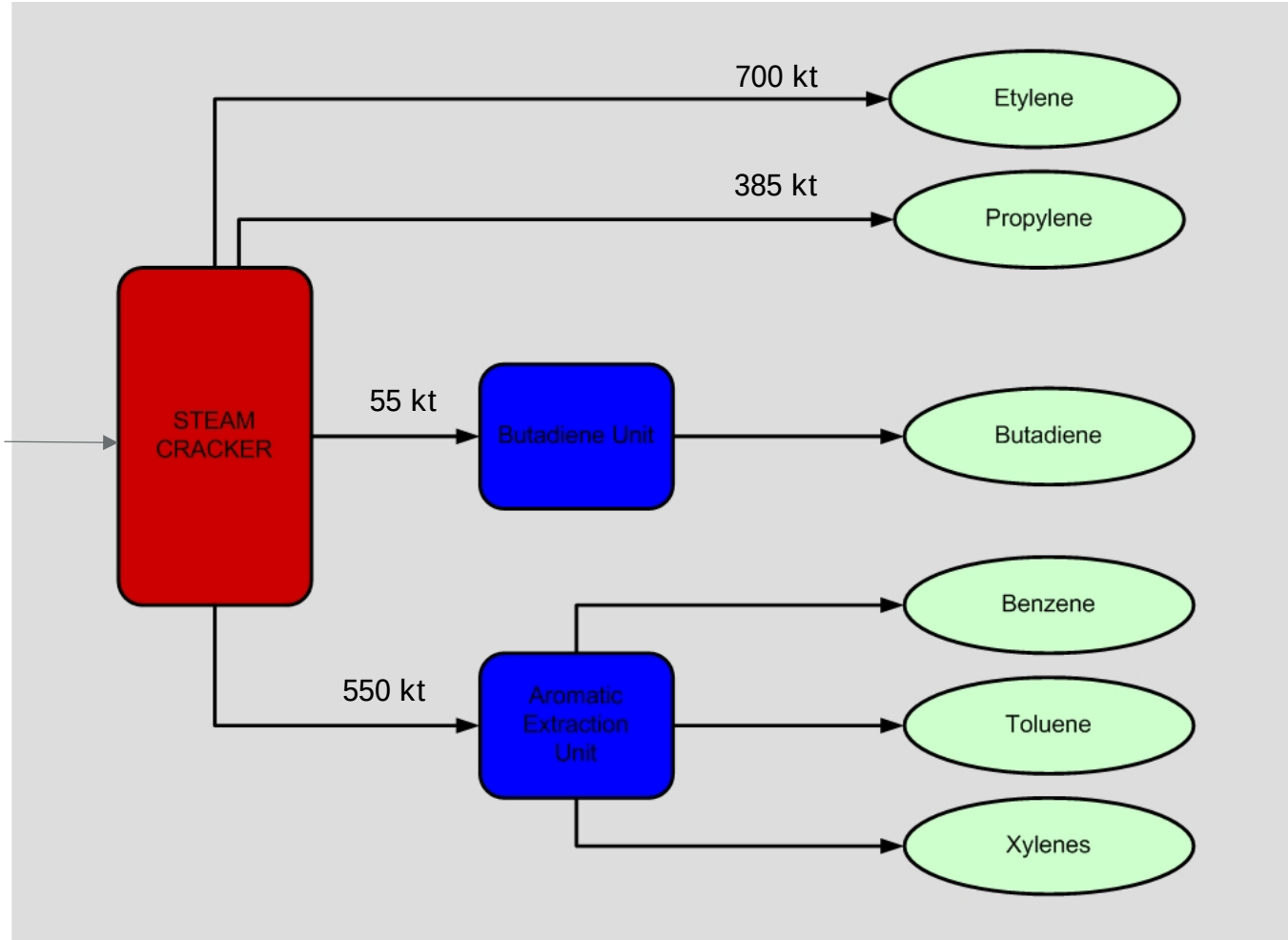
Phenol and acetone (cumene method)	kt pa (1)
Phenol	51
Acetone	32

Ethylene oxide + glycols	kt pa (1)
ETOX	105
MEG	100

(1) Potential processing capacity or currently in use

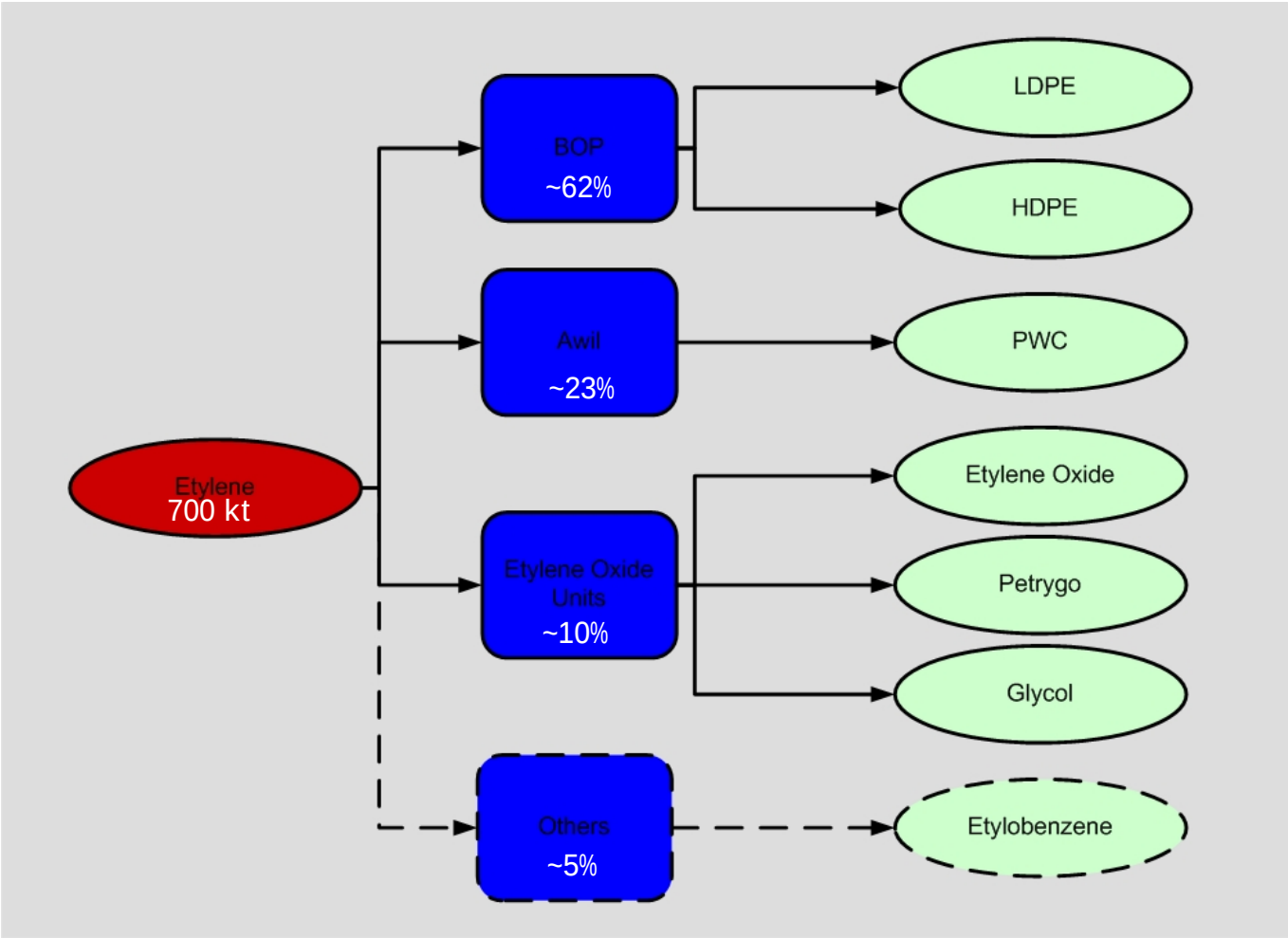
Olefins as a feed base of chemical synthesis

Benchmark main product split



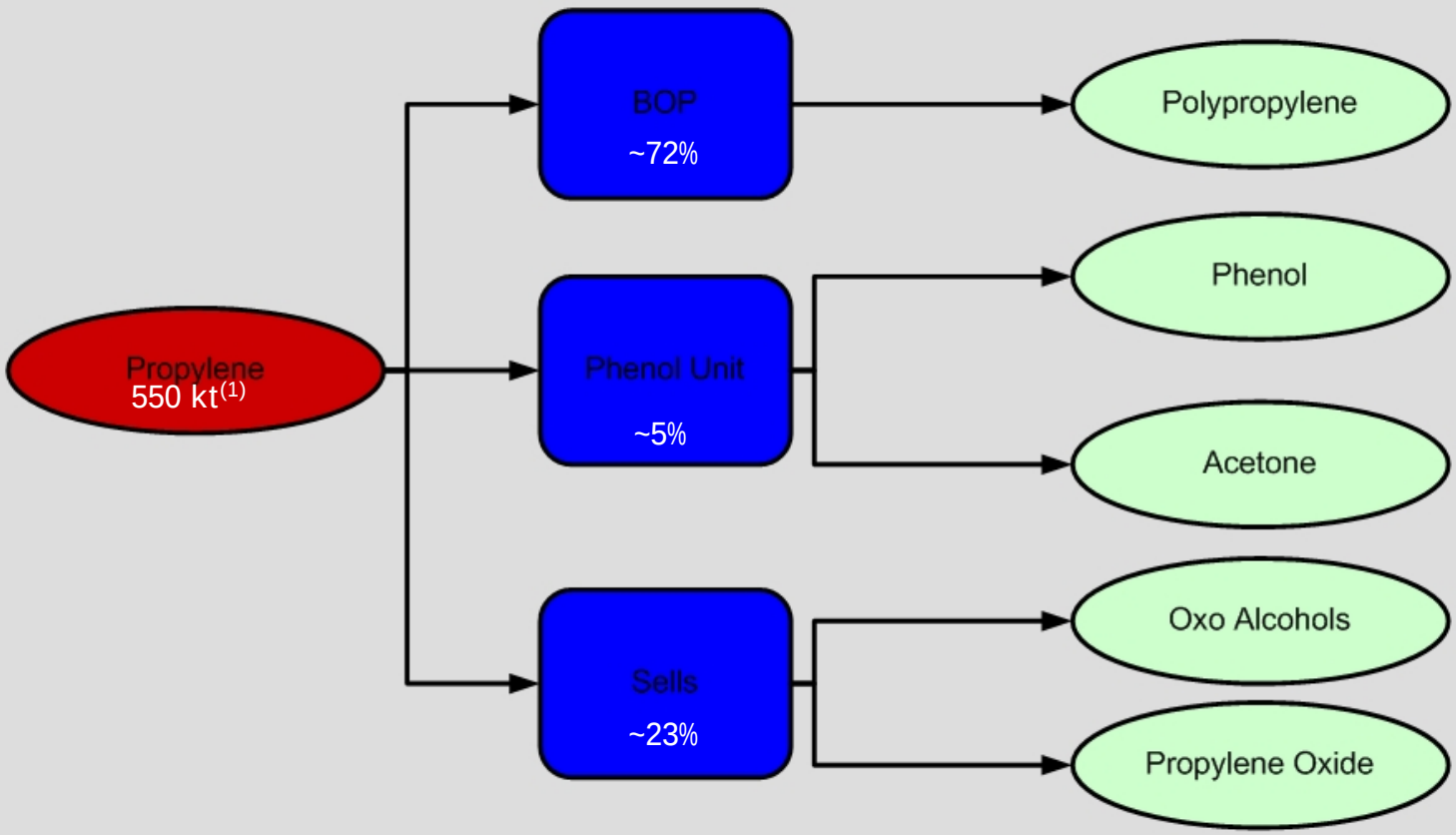
Ethylene utilization in Plock

Example



Propylene utilization in Plock

Example



1) 385 kt output from Olefins II and 165 kt from FCC

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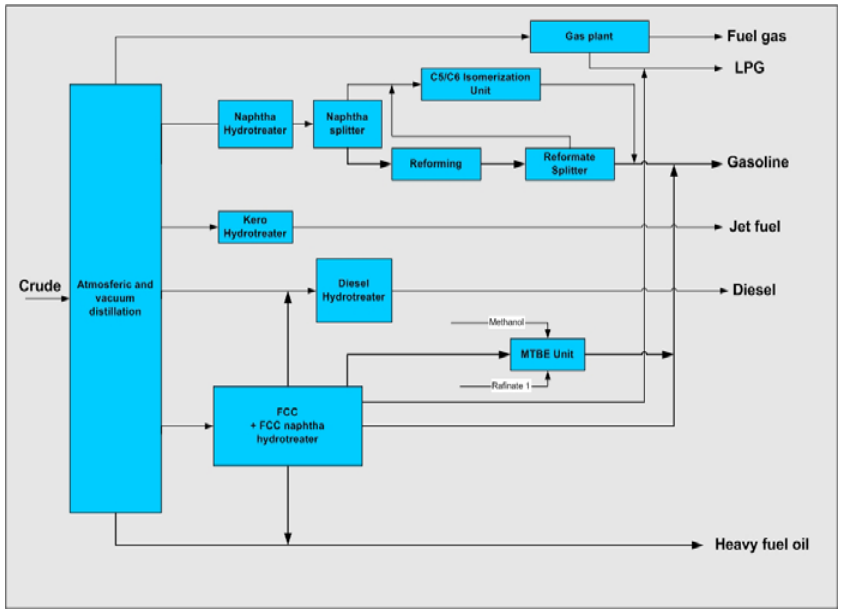
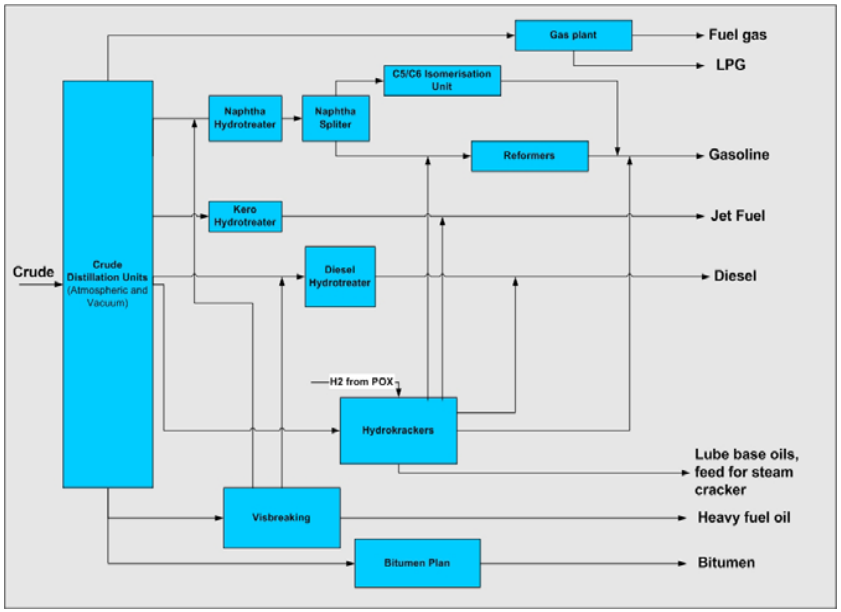
ČESKÁ RAFINÉRSKÁ refineries

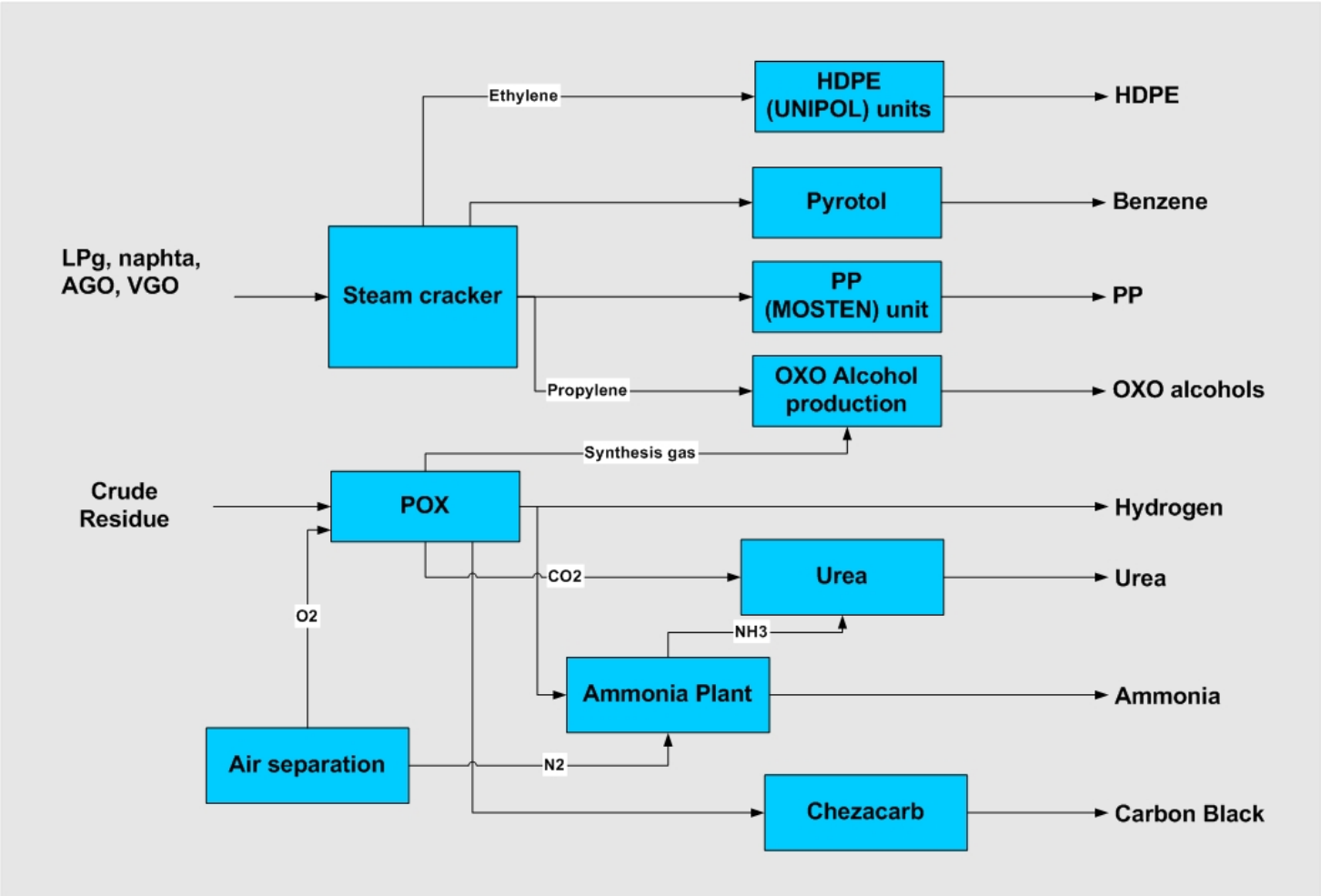
Kralupy Refinery



Litvinov Refinery



Petrochemical complex in Chemopetrol



THANK YOU FOR YOUR ATTENTION

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