Oxygen Enrichment at Sulphur Recovery Unit

Murat KOLBAŞI
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KOÇ GROUP
Overview
KOÇ GROUP

- Koç Group is Turkey’s largest industrial and services group in terms of revenues, exports, employees, taxes paid and market capitalization at Borsa İstanbul.
- Koç Holding has leading positions with strong competitive advantages in various sectors, such as energy, automotive, consumer durables and finance.
- Following an average annual growth rate of 11% in consolidated profit in US$ terms between 2005-2015, Koç Holding ranks among the world’s top 500 companies.

Largest Industrial Group in Turkey
4 of the top 5 industrial enterprises in Turkey are Koç Group companies*

#1 Tüpraş
#2 Ford Otosan
#3 Arçelik
#5 Tofaş

Largest Exporters in Turkey
4 of the top 10 exporters in the Turkish Exporters’ Assembly ranking are Koç Group companies**

#1 Ford Otosan
#2 Tüpraş
#6 Tofaş
#7 Arçelik

Largest R&D Investments in Turkey
Turkey’s Largest Intellectual Property Rights Portfolio with more than:

- 7,500 trademarks
- 4,100 patent families
- 9,600 patents
- 800 industrial design registrations
- 5,400 Internet domain names

3 Koç Group companies ranked in the top 10 on the Turkish Patent Institute’s list of “the Highest # of Patent Applications” in 2015

#1 Arçelik
#3 Ford Otosan
#4 Tofaş

*İstanbul Chamber of Commerce ranking (2016 report), ** Turkish Exporters’ Assembly ranking (2016 report)
**Leadership Positions in Strategic & Lucrative Business Lines**

### Energy
- **Main Companies**: Tüpraş* / Opet / Aygaz* / Entek
- **Domestic Market Position – Market Share**
  - Sole petroleum refiner in Turkey – 29%
  - #2 in LPG distribution – 18%

### Automotive
- **Main Companies**: Ford Otosan* / Tofaş* / TürkTraktör* / Otokar* / Otokoç
- **International Alliances**: Ford Motor Co. / Fiat Chrysler Automobiles / Case New Holland
- **Domestic Market Position – Market Share**
  - #1 in total automotive – 22%
  - #3 in passenger cars – 13%
  - #1 in commercial vehicles – 52%
  - #1 in farm tractors – 47%
  - #1 in automotive retailing
  - #1 in car rental
  - #2 in operational car leasing

### Consumer Durables
- **Main Companies**: Arçelik*
- **International Alliances**: LG Electronics (Air conditioner manufacturing)
- **Domestic Market Position – Market Share**
  - #1 in white goods – c. 50%
  - #1 in air conditioners – 51%

### Finance
- **Main Companies**: Yapı Kredi Bankası*
- **International Alliances**: UniCredit
- **Domestic Market Position – Market Share**
  - #4 in total banking assets among private banks
  - #1 in credit cards – 22%
  - #1 in leasing – 20%
  - #1 in factoring – 18%

### Other Lines of Business
- **Main Companies**: Tat Gıda* (Food) / Koçtaş (DIY Retailing) / Setur (Duty Free) / Marmaris Altınyumus* (Tourism)

* Listed companies
TÜPRAŞ
Company Overview
Tüpraş Shareholder Structure

Publicly Traded 49%

Distribution of Domestic / Foreign Ownership of Tüpraş shares

- Foreign Ownership: 16%
- Domestic Ownership: 84%

Distribution of Ownership of Tüpraş shares:

- DİTAŞ: 79.98%
- Koç Holding: 77%
- Opet: 3%
- Aygaz: 20%

51%
**Tüpraş Refining Assets & Distribution Network**

**İzmit**
- 11.0 MT Capacity
- NC: 14.5
- Storage Capacity: 3.0 mn m³
- Base oil 400 k tons

**İzmir**
- 11.0 MT Capacity
- NC: 7.66
- Storage Capacity: 2.5 mn m³

**Kırıkkale**
- 5.0 MT Capacity
- NC: 6.32
- Storage Capacity: 1.4 mn m³

**Batman**
- 1.1 MT Capacity
- NC: 1.83
- Storage Capacity: 0.25 mn m³

Total Capacity: 28.1 mn. ton
Nelson Complexity: 9.5
Tüpraş Storage Cap.: 7.2 mn. m³
OPET Storage Cap.: 1.1 mn. m³

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**İzmit**
- MARMARA Terminal
- 721,000 m³

**İzmit**
- Antalya Terminal
- 19,392 m³
- 240,000 m³

**İzmir**
- Mersin Terminal
- 43,130 m³

**Kırıkkale**
- Giresun Terminal
- 721,000 m³

**Batman**
- Terminal
- Refinery

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**Total Capacity:** 28.1 mn. ton
**Nelson Complexity:** 9.5
**Tüpraş Storage Cap.:** 7.2 mn. m³
**OPET Storage Cap.:** 1.1 mn. m³
Project Summaries
Total Capacity: 28.1 mn. ton
Nelson Complexity: 9.5
Tüpraş Storage Cap.: 7.2 mn. m³

**İzmir**
- 3 SRU Units
- 70 ton/day Claus
- 190 ton/day SuperClaus
- 420 ton/day EuroClaus

**İzmit**
- 2 SRU Units
- 65 ton/day Claus
- 182 ton/day SuperClaus

**Kırıkkale**
- 2 SRU Units
- 60 ton/day Claus
- 75 ton/day SuperClaus

**Tüpraş Sulphur Recovery Units**
# Tüpraş Sulphur Recovery Units

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Project Summary

- **Definition of Project**
  Installation of low level Oxygen Enrichment Unit in SRU units.

- **Scope of Project**
  The main objective of SRU is install oxygen enrichment unit to increase sulphur product capacity in SuperClaus ® and EuroClaus ® process with minimum investment and operational cost, maximum operation flexibility and reliability in Izmit, Izmir and Kirikkale Refineries.

- **Project Schedule**
  Process Study : 6 months
  Implementation & start-up 6 months for each unit.

- **Project Cost**
  2-5 MUSD. Investment cost includes commissioning, procurements, civil works, assembly, roads, automation, E&I works.
Advantages O2 Enrichment Process

The Aim of Oxygen Enrichment in SRU units.

- Debottlenecking of existing SRU (capacity increase)
- Reduction of process gas volume
- Reduction of pressure drop
- Reduction of energy consumption
- Increase of combustion temperature
- No damaging or change of burner, combustion chamber and boiler
The Effect of Oxygen Enrichment in SRU units on,

- Sulfur Conversion
- COS CO, COS, CS2 Emissions
- Energy consumption
- Emission
- RF temperature
- Mechanical Integrity.
Safety limit for $\text{O}_2$-Enrichment: 28%
Design Evaluation of Enrichment in SRU’s

![Reaction Furnace Temperature (°C) vs. O2 Concentration %](image)

- **RF Temperature**: 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800
- **O2 Concentration %**: 21, 22, 23, 24, 25, 26, 27, 28
- **Design**: Red line
- **Design +10%**: Orange line
- **Design +15%**: Yellow line
- **Design +20%**: Blue line
- **Design +22%**: Dark blue line
- **Design +33%**: Dark orange line
- **Design +49%**: Gray line
- **Temp. Limit**: Black line

This graph illustrates the reaction furnace temperature in °C against O2 concentration in %. The various lines represent different designs and their temperature limits.
Design Evaluation of Enrichment in SRU’s

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Management Standards X Operational Discipline

Operational Excellence

- Management Standards
  - Process Hazard Analysis, HAZOP,
  - MOC-Tech & Process Technology package of project
  - Procedures, work permits
  
  with
  
  trained FLM's (first line managers) and Leaders
  
dedicated team work
Site Execution Enrichment Location in SRU’s
Enrichment Location in SRU´s
Equipment Overview
Performance Evaluation of Enrichment in SRU´s

- Capacity Increase % 15
- No need additional equipment
- PSRM and HAZOP requirements overviewed.
- Quickwin project
- Min investment and quick return on Investment
SRU O2 Enrichment Economic Results

- Project Economic Results
- 15-20 % SRU capacity increase
- Project time 6-9 months
- Project Cost 2-5 mUSD
- Project Income: 20-25 mUSD (incl Crude oil margin)
Thanks