

# CONTRIBUTION OF EPE IN THE PROMOTION OF LOW SULFUR FUELS

# Topics

- Introduction
- A Brief Look at Environment
- Why Sulphur from fuels is a pollutant to the Environment?
- Contribution of Fossil Fuels ( Petroleum and Coke) to Sulphur Emissions as  $\text{SO}_2$
- The Overall Changing Pattern of  $\text{SO}_2$  Emissions from Petroleum
- Alternate Energy Developments Towards Avoidance of Sulphur Pollution
- Role of Ethiopian Petroleum Enterprise on Controlling the Sulphur Content of Imported Fuels

# What is Environment

Albert Einstein

*"everything except me"*



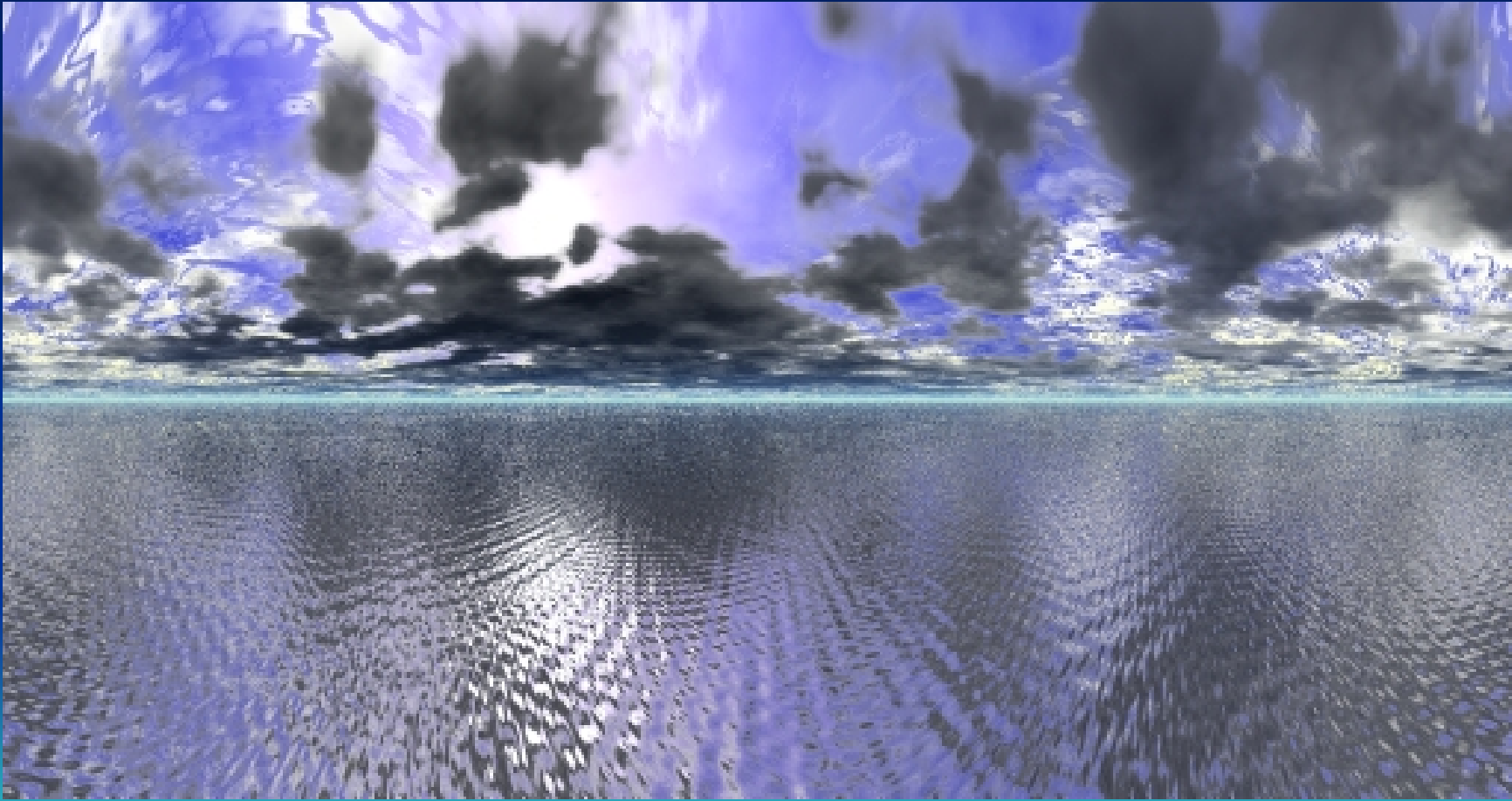
# What is Environment ?

according to ISO 14001

Air



# Water



# Land



# Natural Resources



# Flora



# Fauna



# Humans



# Environment

- Etymologically environment means surrounding
- It is the sum total of external factors, substances and conditions which influence organisms without becoming their intrinsic part.
- Environment is usually :-

## 1. Physical

- a) Forces of nature e.g. wind , gravity, etc
- b) Conditions e.g. temperature and light
- c) Time
- d) Non living materials e.g. soil, water, rock, buildings, railways, sulphurdioxide, etc

## 2. Biotic

Made up of all living beings including their reactions, interactions and inter related actions.

# Environmental pollution

- Any undesirable change in the physical, chemical, or biological characteristics of air, water, and soil, that may create a hazard or potential hazard to the health safety or welfare of any living species.



# Pollutants

- A Pollutant is a **chemical** (radionuclide, organo-phosphorus compound or trace gases) or **geochemical** substances (dust, sediment, grit etc.) **biotic** component (pollen or products of microbiological activity) or **physical agent** (heat, sound etc) that is released intentionally or inadvertently by man in to the environment in such concentration that may have adverse ,harmful and inconvenient effects.



# Environmental issues ?

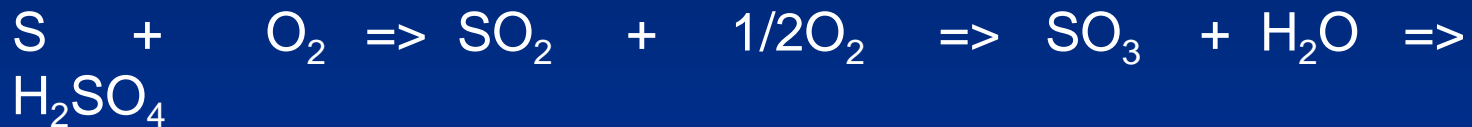
- ozone depletion
- global warming
- acid rain
- human health
- destruction of flora, fauna habitat
- extinction of species
- .....

# Environmental issues ?

- Most pollution have global implications, but there are many other anthropogenic atmospheric changes that are more regional in their impacts.
- acid rain
- fine-grained particulates

## Why Sulphur from Fuels is a Pollutant??

- Sulphur (S) as other elements is not bad by itself, it is nature that made it to be there
- And it is nature that made it to react with enough oxygen and breath out  $\text{SO}_2$  and absorb water and form  $\text{H}_2\text{SO}_4$  (sulphuric acid) with evolution of huge heat as  $\Delta G$  (Gibb's free energy)



- The  $\Delta H_f$  of  $\text{SO}_2$  from elemental sulphur & oxygen from the air is very high -11325KJ/Kg
- And may be that is why we read in the “Old Testament” of the “Bible” in the ruins of the Sodom and Gomorrah where God used sulphur (brim stone) as an armament together with fire (The Book of Genesis 19:23)
- Then one expects that the intensity and corrosiveness of the fire mixture increasing its explosiveness. And it may be this reason that lead the premedial developments to use S for making gun powder mixing with explosive initiators.

# Major sources of sulfur emissions

- Centralized power plants and district heating (coal, HFO, LFO ADO)
- Fuel conversion other than power plants
- Domestic, commercial and agricultural use
- Transportation
- Industrial

# Major sources of sulfur emissions

- Industrial
  - Oil refineries (UNDER EXPLORATION)
  - Coke plants (ON PROGRESS)
  - Pig iron - blast furnaces (Ore  $\text{FeS}_2$ )
  - Sulfuric acid plants (ALSSAF)
  - Sugar factories (SULPHITATION-2000t/year)
  - Cement and lime plants
  - Pulp mills

# Major sources of sulfur emissions( $\text{SO}_2$ )

- Most sulfur dioxide is produced by burning fuels containing sulfur or by roasting metal sulfide ores, although there are natural sources of sulfur dioxide (accounting for 35–65% of total sulfur dioxide emissions) such as volcanoes.

# Adverse Effects of S and Its Compounds

- Sulphur (S) combustion and emission to the environment is like a venom from the bite of a snake
- S inhibits industrial refining process of crude oils via inhibiting metal catalysts making refining process expensive
- S corrodes iron and steel parts of refinery equipments such as pipes, reactor vessels, tanks, etc
- Corrosion and obliteration of colors from stored petroleum products arises mainly due to sulphur oxidation , formation of an acid and reaction with metallic parts, mainly iron
- Combustion of S and hence evolution of its compounds to the environment results in acid rain and petrochemical smog in urban areas

# Adverse Effects of Sulphur Pollution

- Vehicular and Industrial emission of  $\text{SO}_2$  form acid rain in the air and result in:
  - Corrosion of building materials such as steel and iron materials
  - Acid rain highly corrodes building and other infra structure paints which results in huge sum of money for repainting and results in unnecessary labor costs
  - Acid rain adversely affects agricultural productivity reducing farm yields where it increases the soil Ph
  - This results in infertility of the soil creating the soil medium unfit & killing important soil enriching natural bacteria and organisms so that nitrogen fixation which is important for protein synthesis in plants (especially legumes) whose final result will be lessening crop yield.

# WHO IS EPE

**EPE is a government owned enterprise established according to council of ministry proclamation No. 210/1987E.C**

## VISION

- Engage in petroleum refining & position the enterprise as the leading supplier of products in Ethiopia and export surplus.

## MISSION

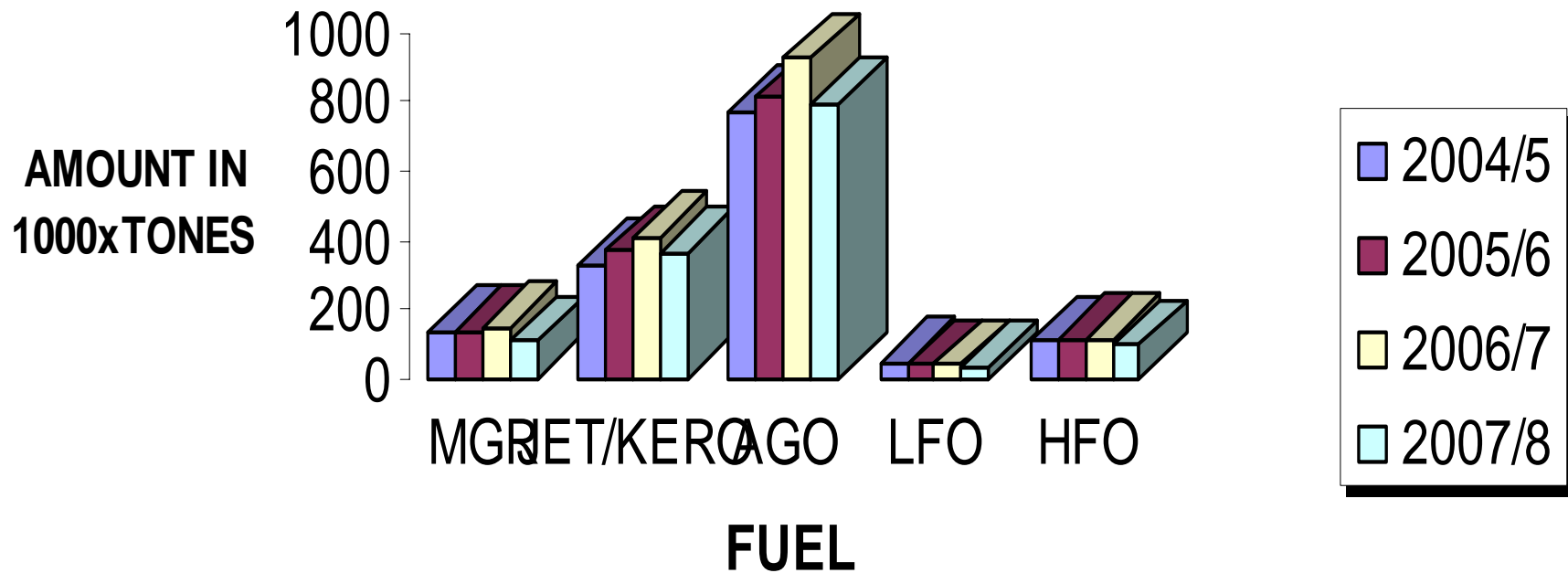
- Contribute towards growth and development of Ethiopia, by ensuring timely delivery of sufficient Quantities of petroleum products having the right Quality at reasonable price.

# Types of Imported Petroleum Products by EPE and Maximum Limit for Total Sulphur

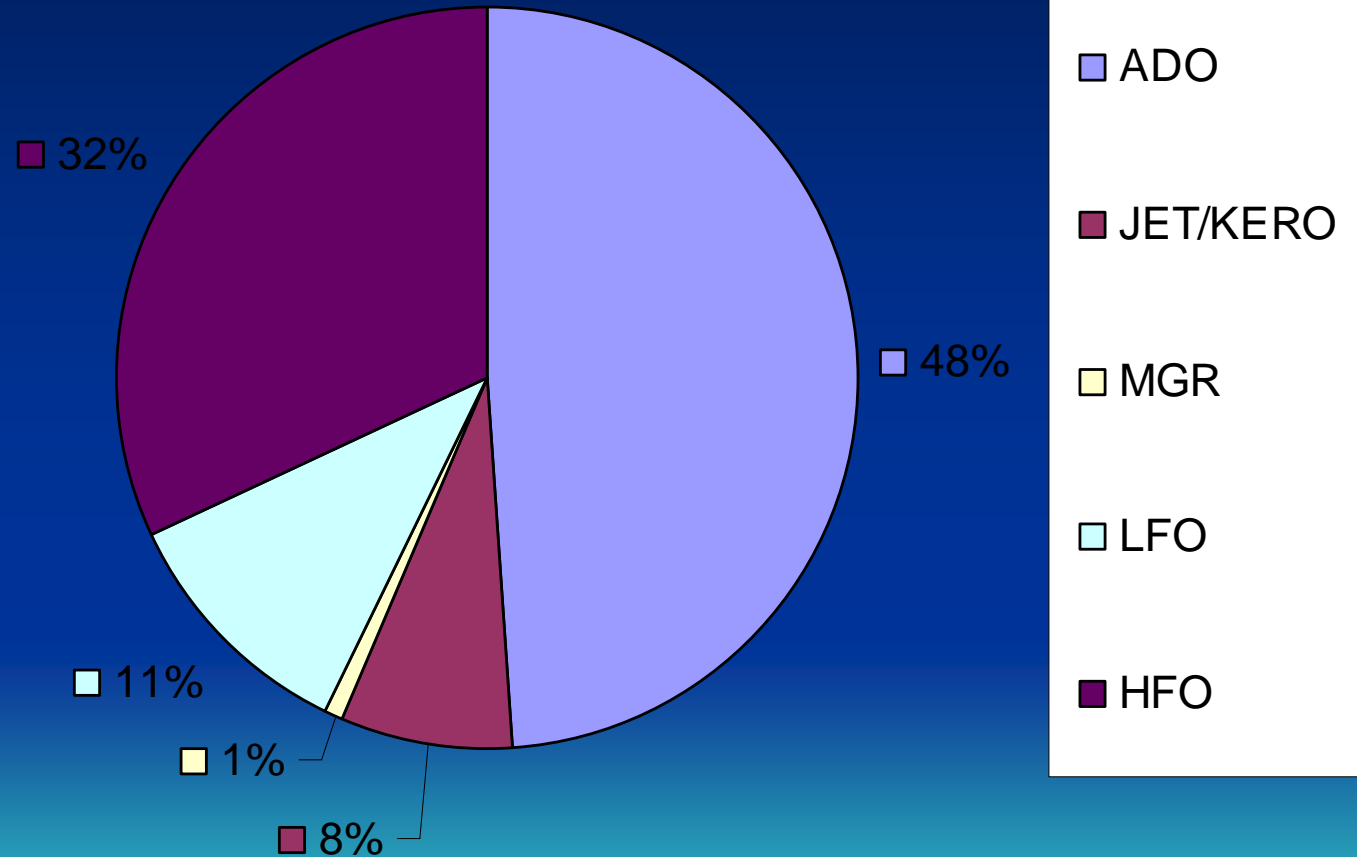
	<u>TYPE OF FUEL</u>	<u>%Wt Max.</u>	<u>Actual</u>	<u>ASTM METHOD</u>
1.	Automotive Gas Oil (AGO)	0.50	0.465	D1552
2.	Gasoline Regular (MGR)	0.10	0.07	D1266
3.	Kerosene or Jet Fuel (Jet A-1)	0.30	0.192	D1266
4.	Heavy Fuel Oil (LFO)	3.5	2.553	D1552
5.	Light Fuel oil (HFO)	3.5	2.803	D1552

# OPPORTUNITIES

## AMOUNT OF FUEL IMPORTED

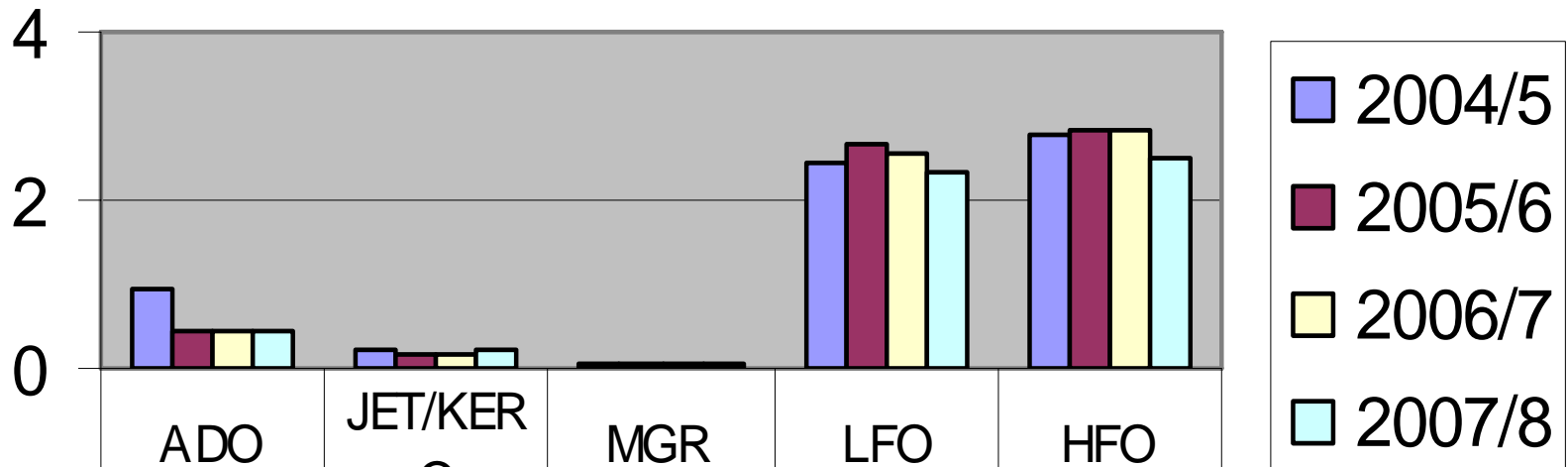


# DISTRIBUTION OF SULFUR BY FUEL TYPE SINCE 2004/5-2007/8



# ANNUAL SULFUR CONTENT BY FUEL TYPE

SULFUR CONTENT%MAS



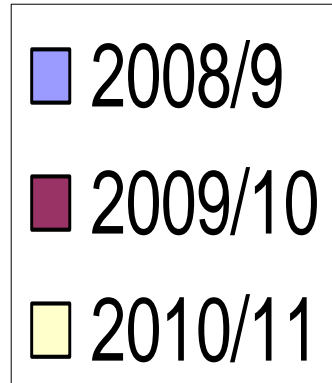
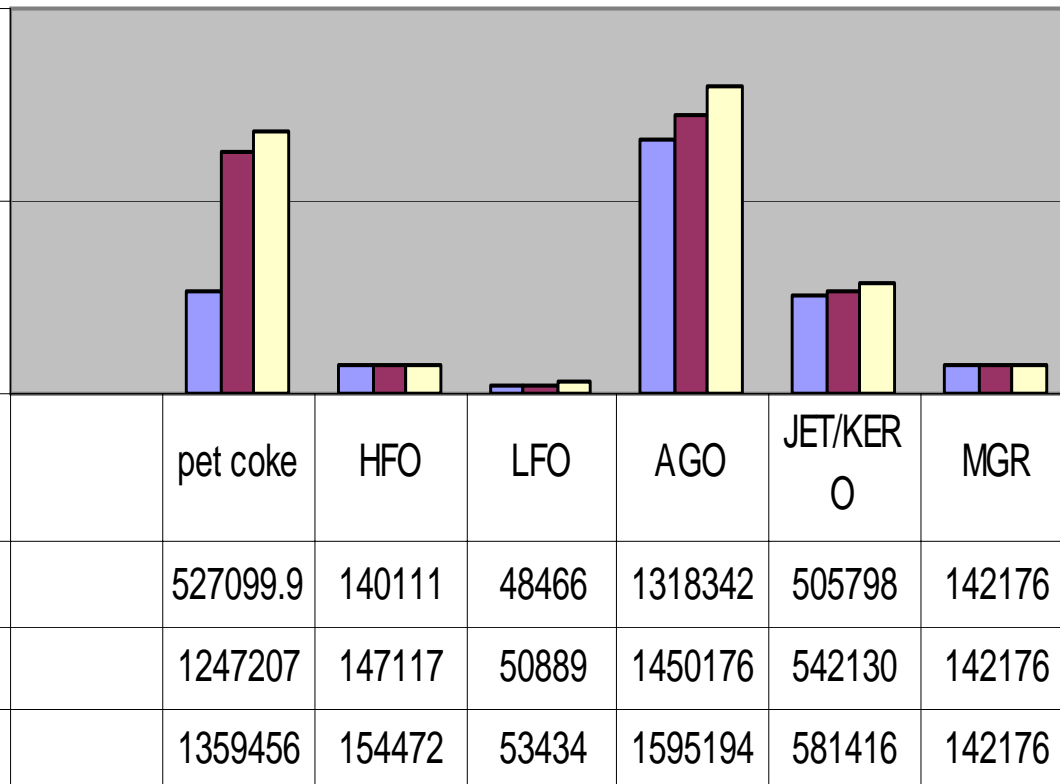
	ADO	JET/KERO	MGR	LFO	HFO
2004/5	0.92	0.2	0.073	2.43	2.77
2005/6	0.44	0.19	0.077	2.67	2.86
2006/7	0.45	0.19	0.054	2.54	2.81
2007/8	0.46	0.2	0.067	2.36	2.51

FUEL TYPE

# FUTURE DEMAND TREND

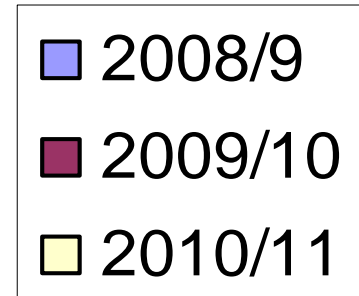
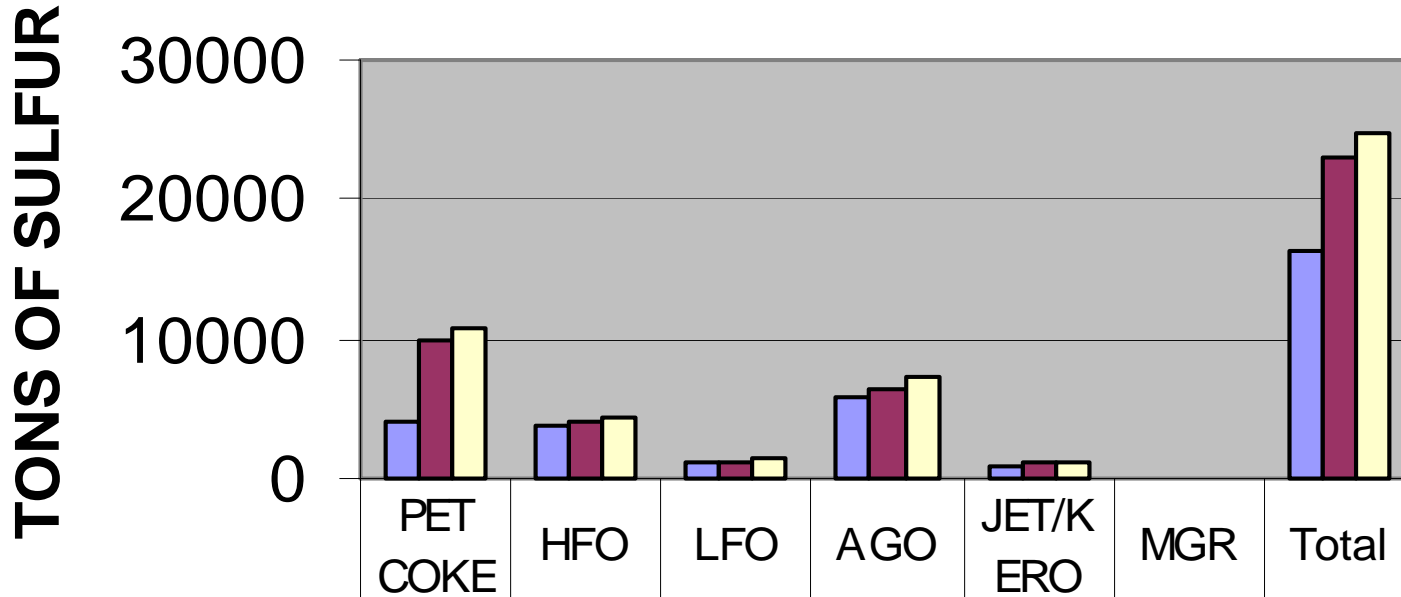
QTY IN TONS

2000000  
1000000  
0



FUEL

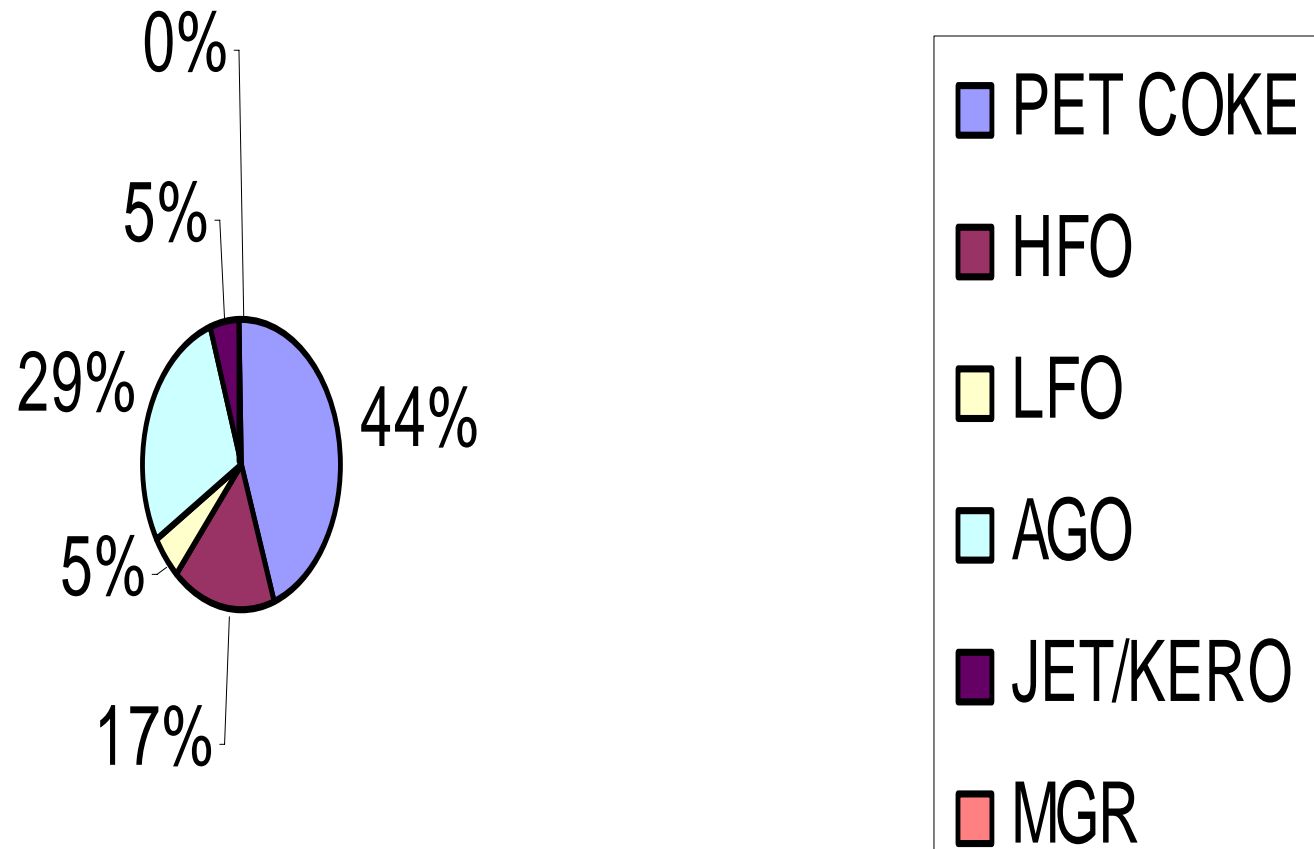
# FUTURE TREND



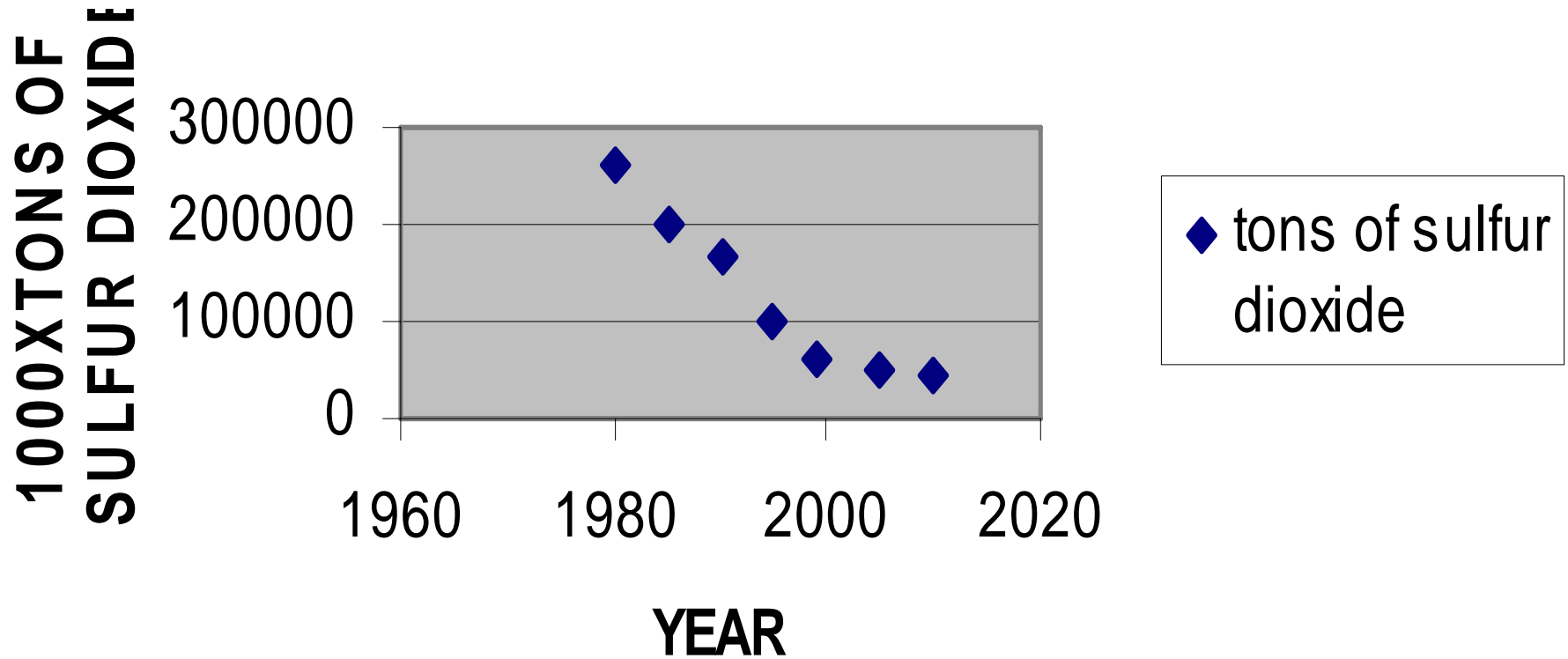
	PET COKE	HFO	LFO	AGO	JET/KERO	MGR	Total
2008/9	4216.8	3835.5	1211.7	5932.5	986.31	96.324	16279
2009/10	9977.7	4027.3	1272.2	6525.8	1057.2	96.324	22956
2010/11	10876	4228.7	1335.9	7178.4	1133.8	96.324	24849

## FUEL

# FUTURE SULFUR DISTRIBUTION PROJECTION 2010/11



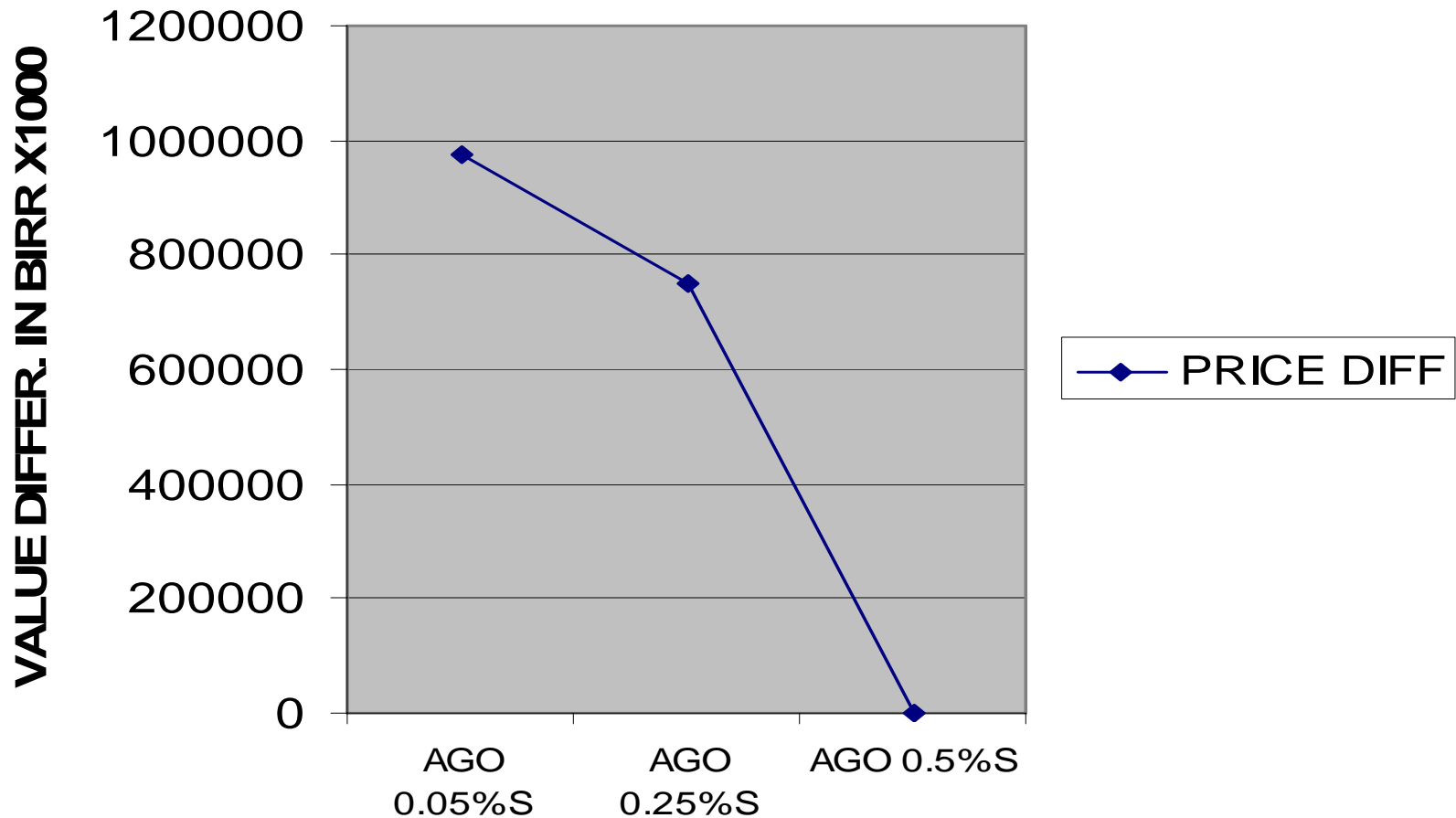
# EUROPEAN EMISSION TREND



According to the NEC Directive,  
Source: EMEP

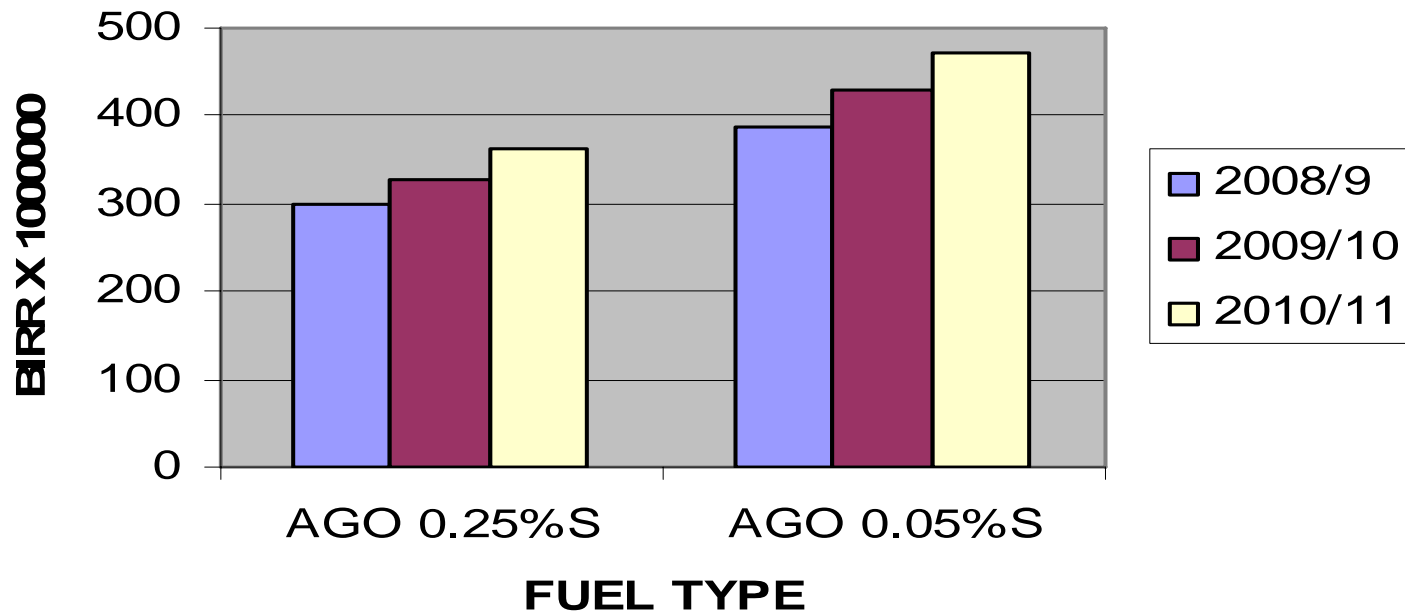
# Economic issues ?

*PRICE DIFFERENCE OF LOW SULFUR ADO w.r.t. THE  
CURRENT ADO IMPORTED*



# Economic issues ?

## PRICE DIFFERENCE OF LOW SULFUR FUEL COMPARED TO CURRENTLY IMPORTED



# Why?

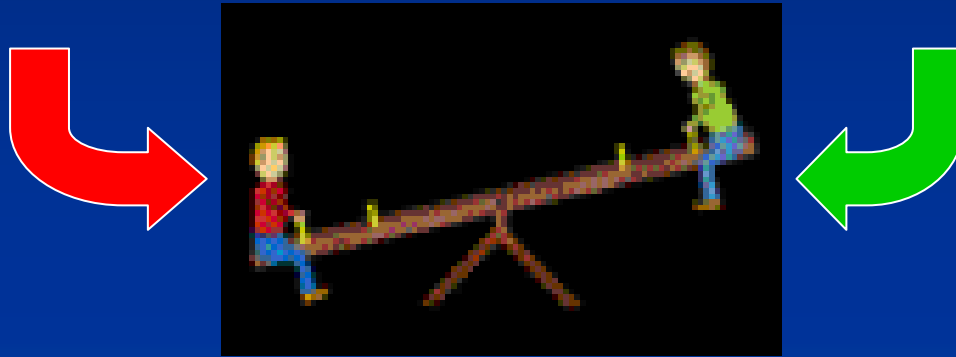
- The presence of sulfur in hydrocarbons has long been a significant problem from :-
  - The exploration,
  - Production,
  - Transportation, and
  - Refining all the way to the consumption of hydrocarbons as a fuel.

# Why?

- Sulfur can be found in almost any stream within a refinery complex. The process technology for removing sulfur that is in almost universal use today is hydro treating( hydrodesulphurization).
- Hydro treating, as used herein, is a process whose primary purpose is to reduce the sulfur and/or nitrogen content (and not to change the boiling range) of the feed.

# so what?

A idealistic balance point between  
Environmental and Economic Goals



# RECOMMENDATIONS

- The following broad groups of technical emission control options are distinguished:
  - **The use of low-sulfur fuels, including importing low sulfur fuel ; fuel desulphurization**
  - **In-furnace control of SO<sub>2</sub> emissions (e.g., through limestone injection or with several types of fluidized bed combustion);**
  - Conventional wet flue gas desulphurization processes;
  - Advanced, high efficiency methods for capturing sulfur from the flue gas;
  - Improving the energy Efficiency( industrial/transport).

# RECOMMENDATIONS

- Alternative energy sources (less sulfur content < 10mg/Kg)
  - Hydroelectric power
  - Bioethanol & Co-generation (sugar factories) from byproducts
  - Biodiesel (Sun biofuels (national biodiesel corporation) 2000 Ha)
    - Jatropha satisfies Max. CO<sub>2</sub> emission, 10ton/Ha/year, uses unfertile land, harvest 30-50yrs.
    - rapeseed
- Measures to control process emissions (CP).
- Legislation on sulfur content
- Commitment by all stake holders

# Sources

- STENUM Association
- Pollution Prevention and Abatement Handbook  
WORLD BANK GROUP  
Effective July 1998
- Project "the development of jatropha curcus as a source for production of biodieselfor the government of Ethiopia" Domestic Biofuels LLC
- UfOP status report Biodiesel,2005 Germany.
- EPE MIS &COMMERCIAL DEPARTMENT
- EPE QUALITY CONTROL

# Questions? Discussion

