# DEVELOPMENTS IN THE BIO ETHERS MARKET

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*LyondellBasell Industries*

**Bioenergy International Expo and Conference**
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*5th May 2010*

biofuels international

EFOA

# European Fuel Oxygenates Association

WWW EFOA ORG

- Non-profit Technical Organisation
- Founded in 1985
- ~ 2/3rd of Total EU Etherification Capacity

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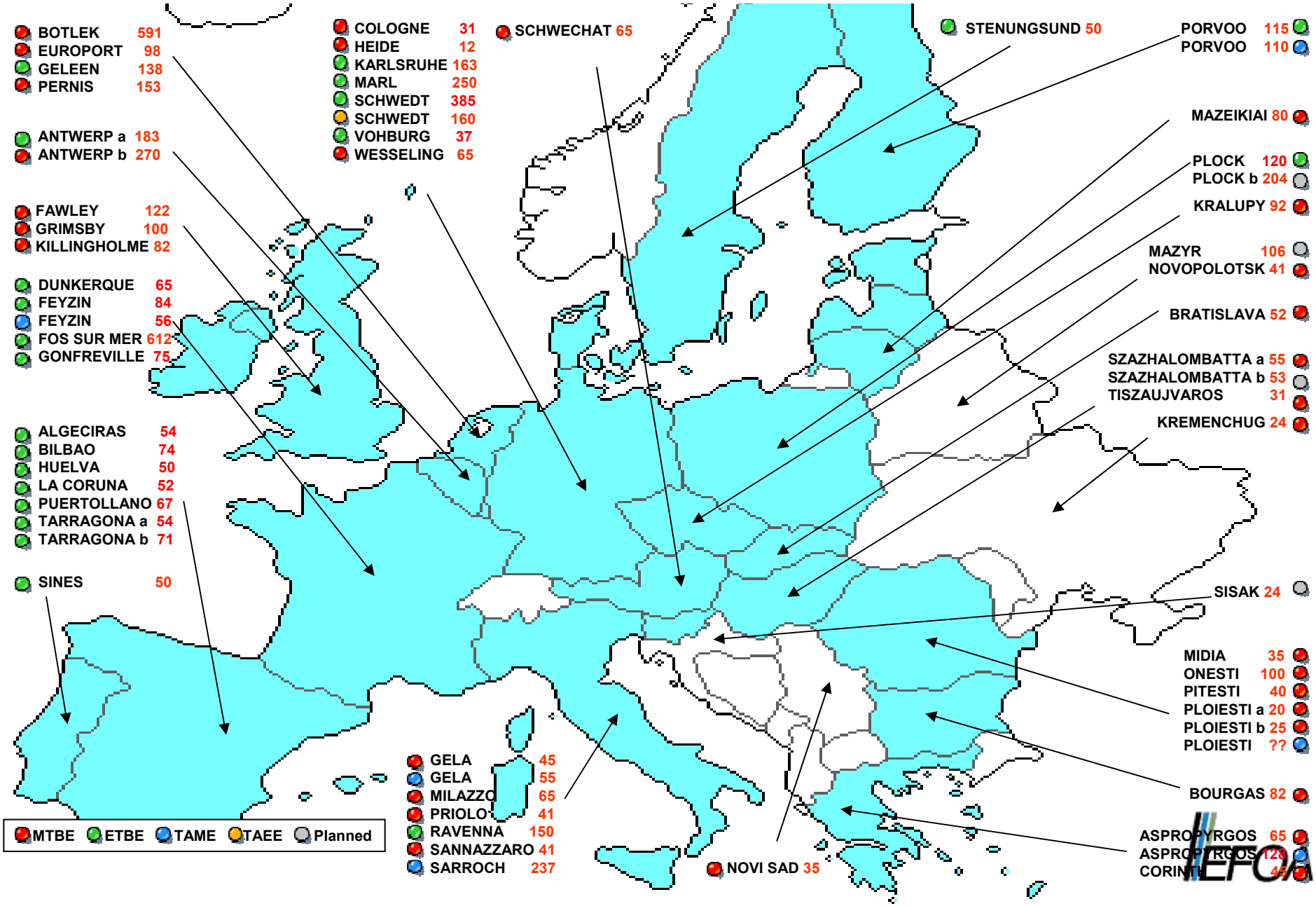
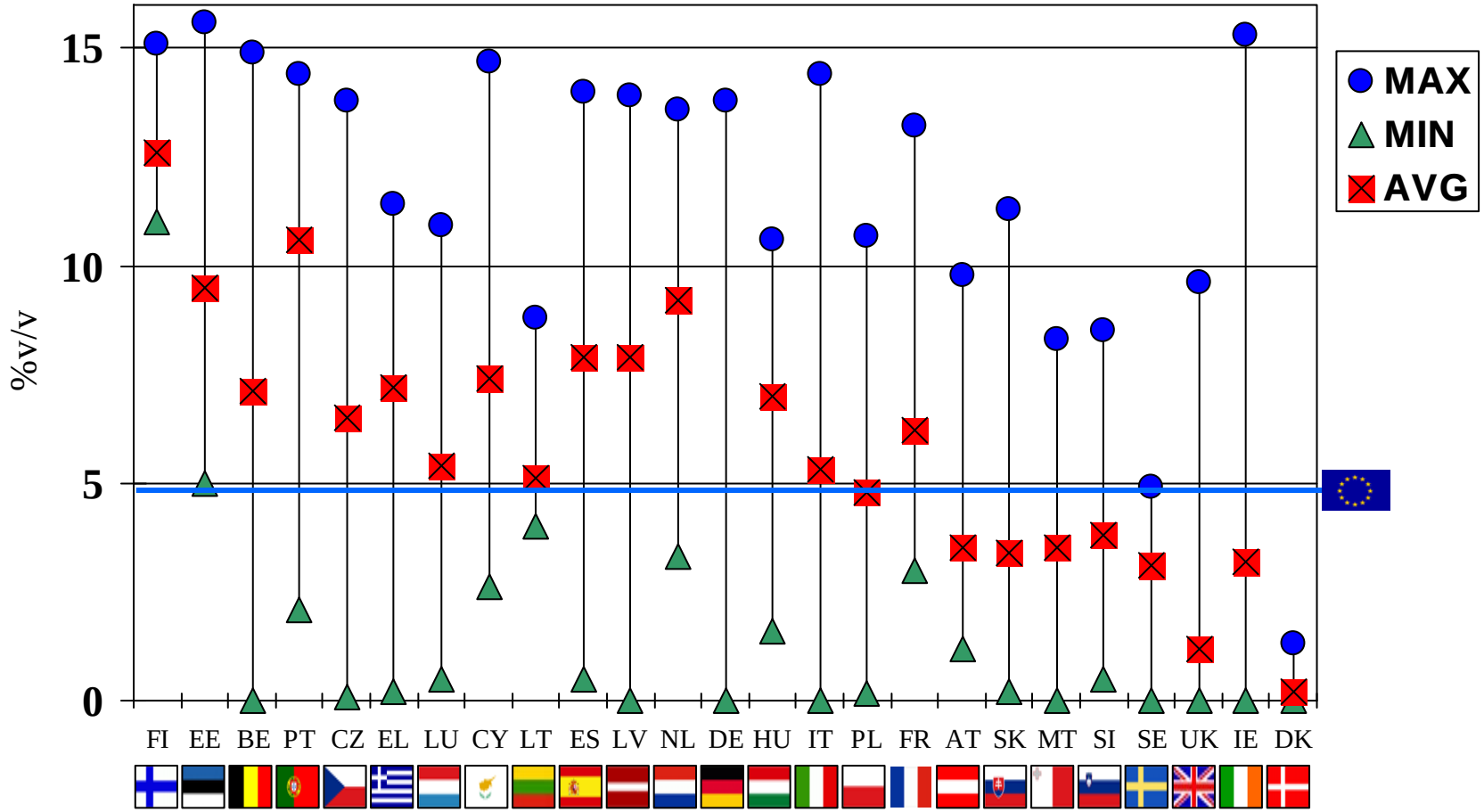
# European Fuel-Ethers Production Capacities 2010 *(KT/Y)*



# % Ethers Content in $EU_{25}$ Petrol:

2006 $EU_{25}$[1] Average Ethers Blending Percentage = 4.7%

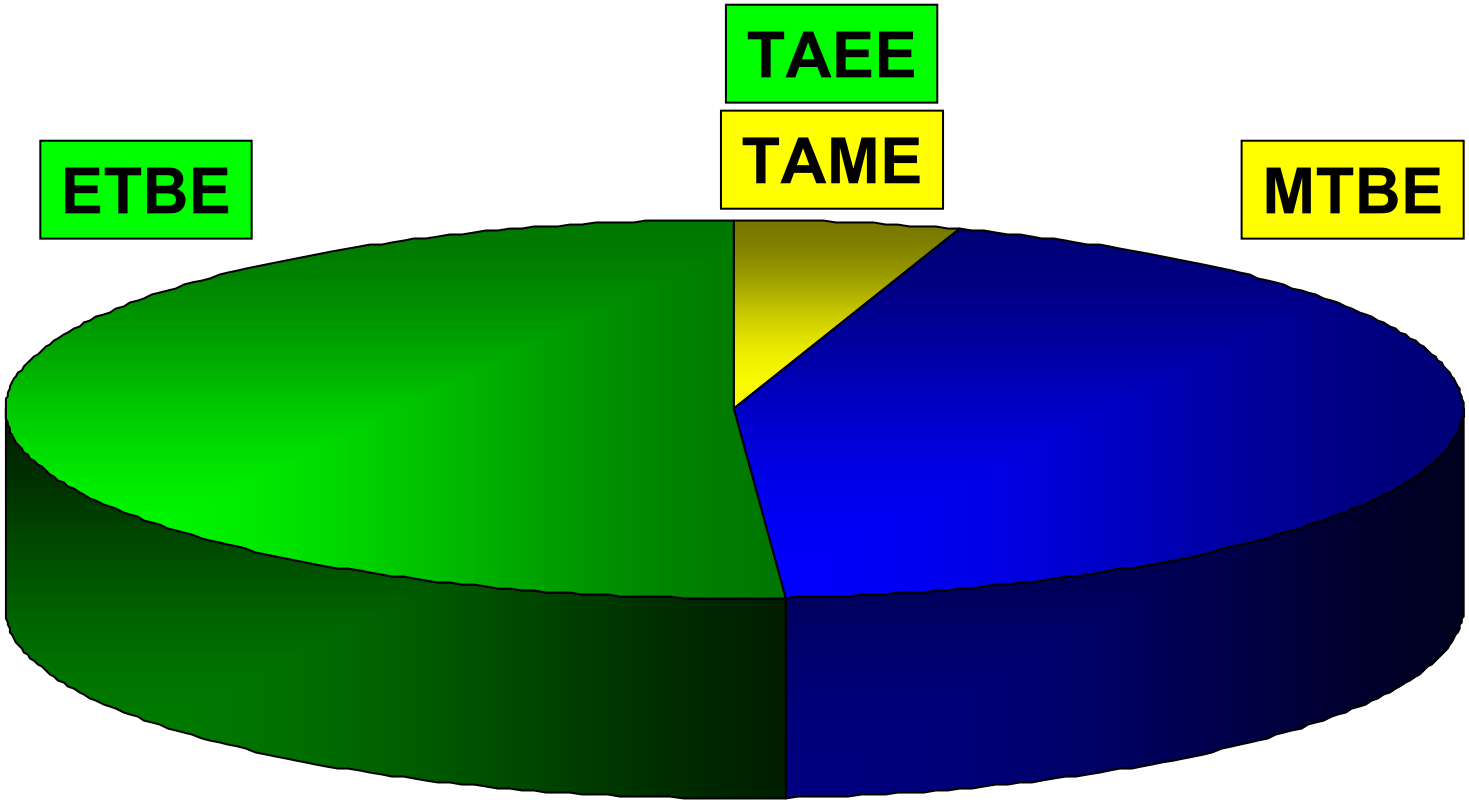



[1] For LU and MT used 2005 data since no figure provided to FQS-UE for 2006

** Bulgaria and Romania omitted since not participating to the survey*

*Source: DG ENV: "EU Fuel Quality Monitoring – Report 2006" – 2007 FQM excludes this information*

# EU Fuel-Ethers Consumption 2008
## ~ 6 *Million Tons*




Renewable Ethers replacing fossil ones

*Source: FERC: "Fuel Ether REACH Consortium"*

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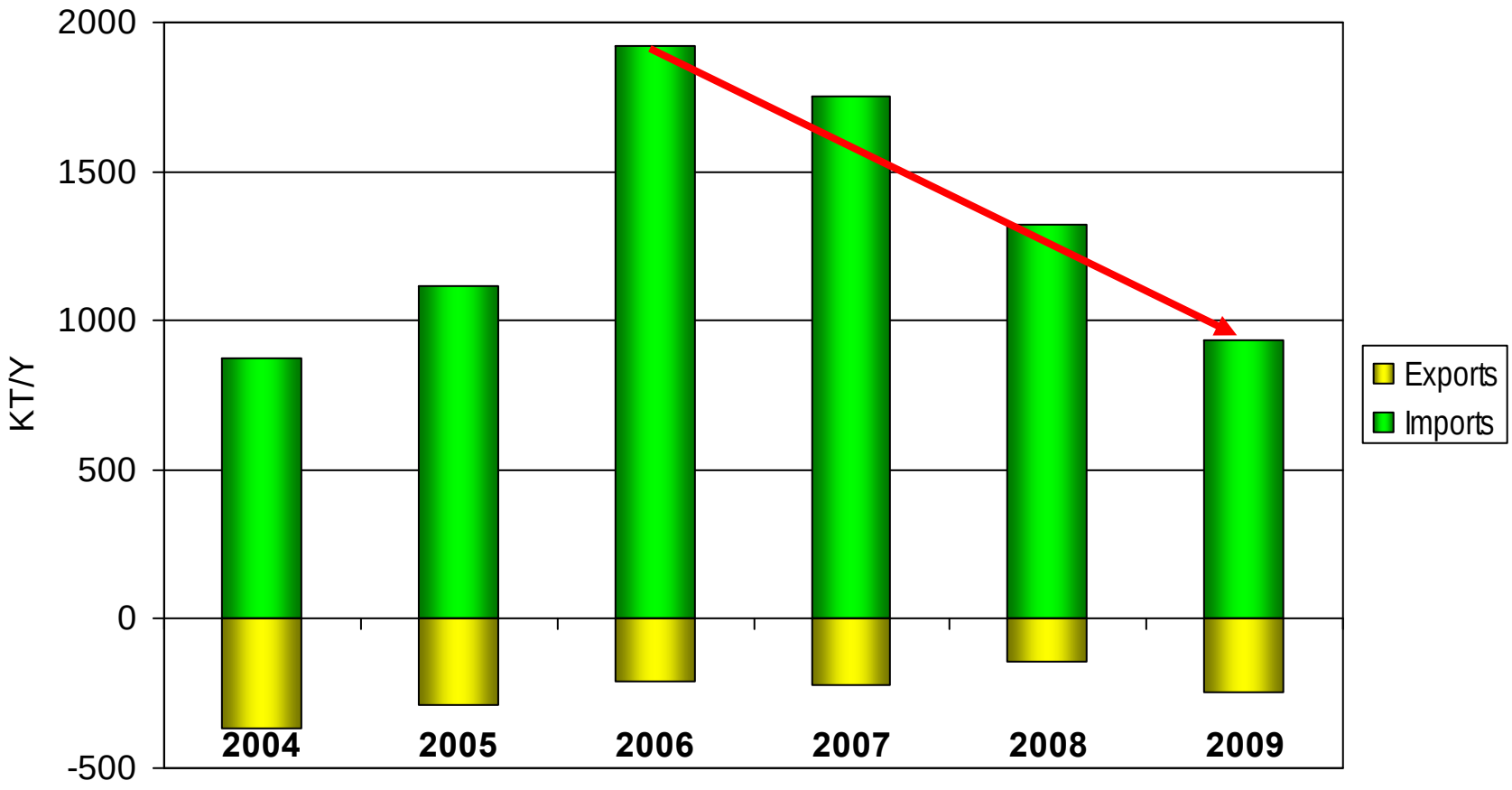
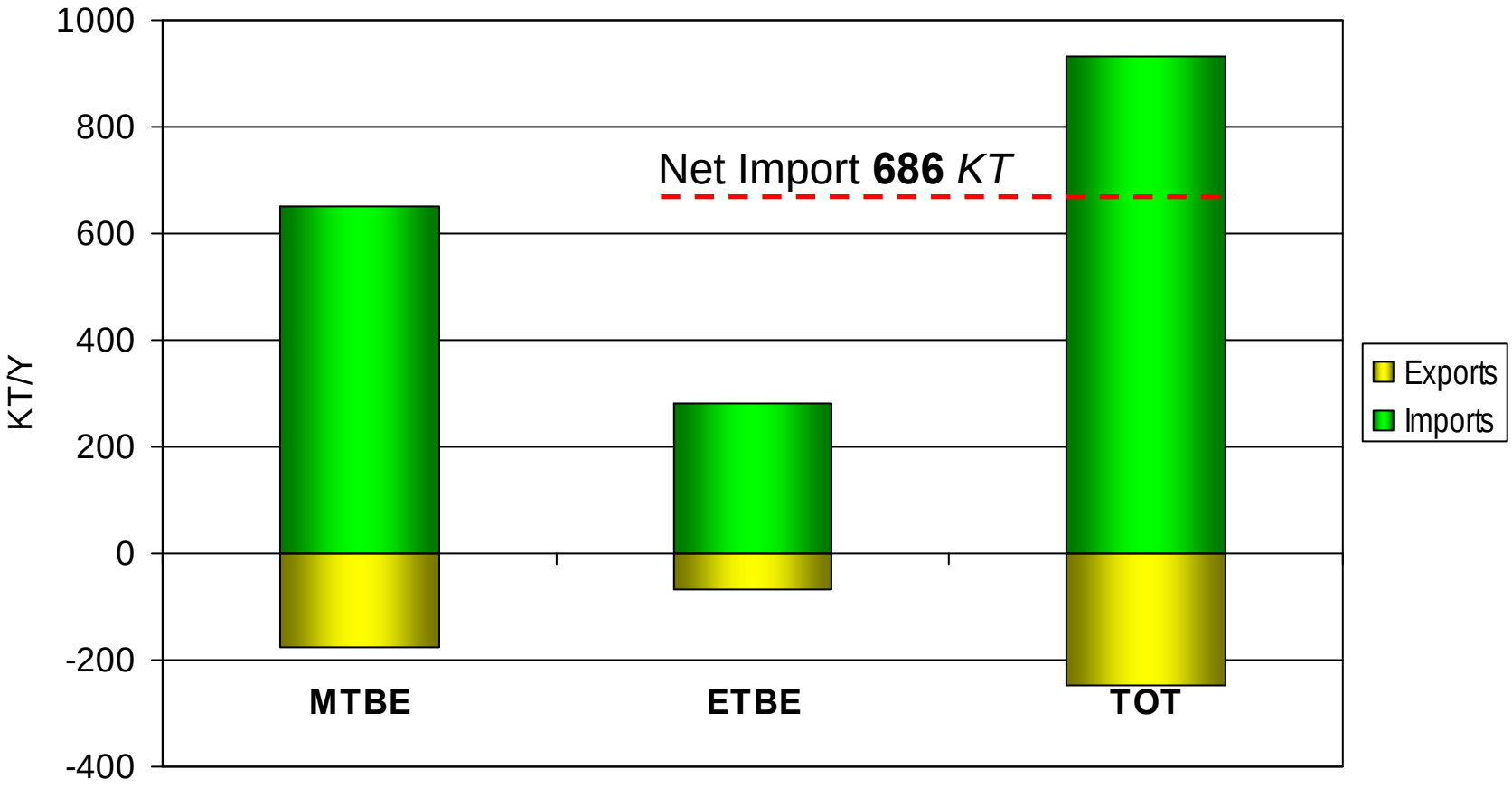
# Fuel-Ethers Trade EU 2004-2009




Total Ethers import into EU on constant decrease since 2006

*Source: EUROSTAT*

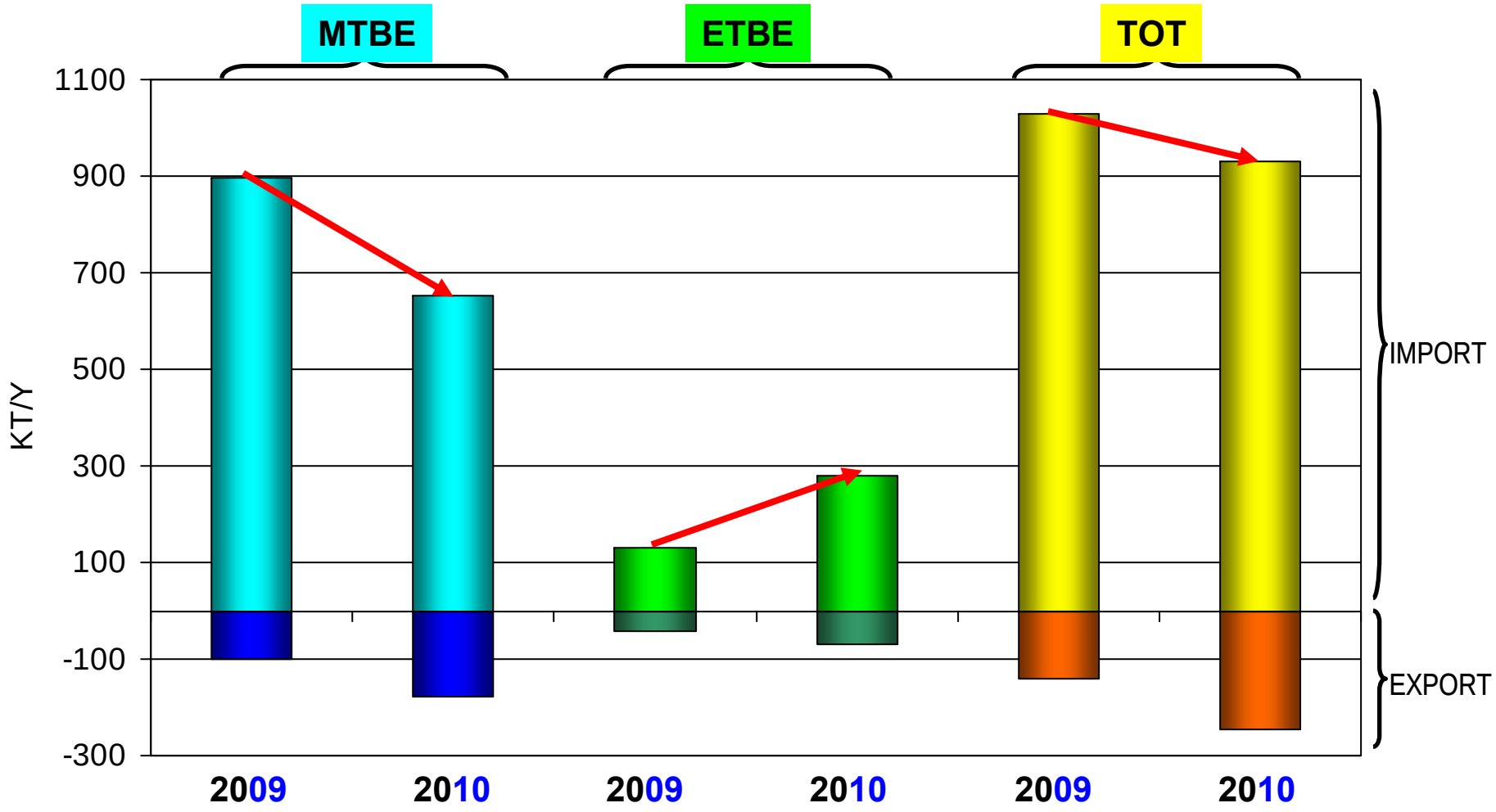
# MTBE & ETBE Trade EU 2009




EU still importing, but net ethers import only 10% of EU production

*Source: EUROSTAT*

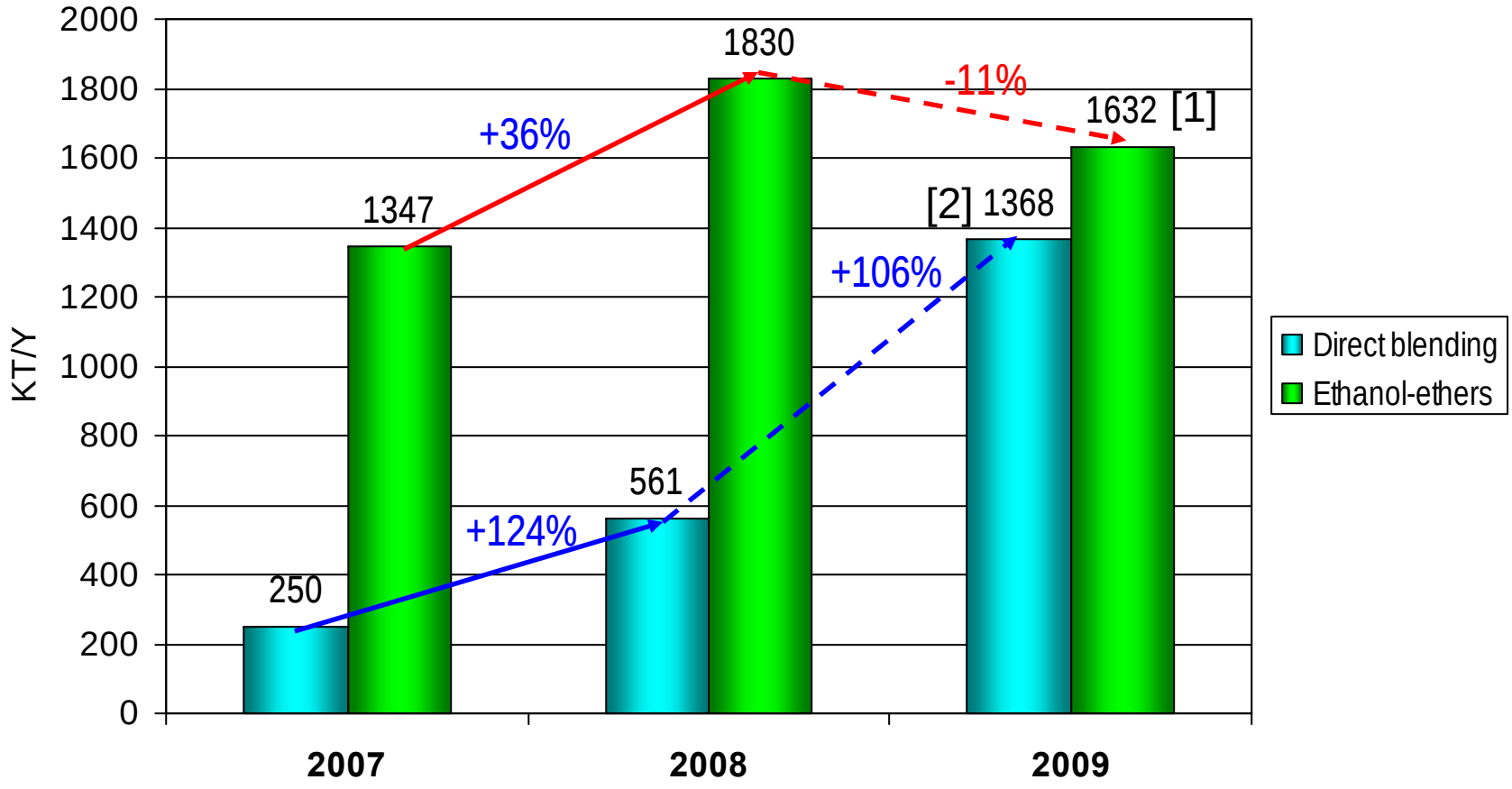
# MTBE & ETBE Trade EU 2009/2010




EU ETBE import grown, but MTBE one significantly dropped

*Source: EUROSTAT*

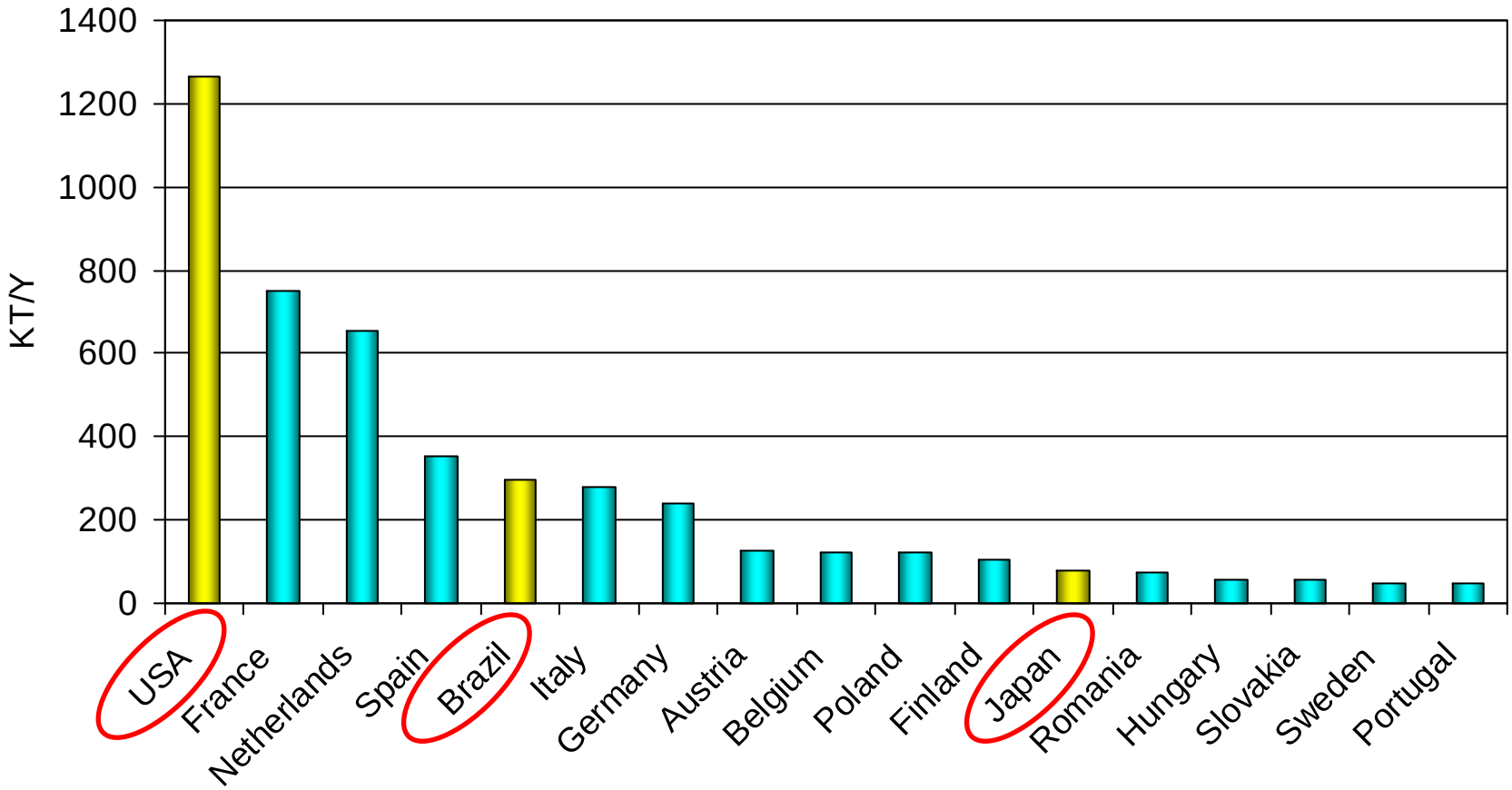
# Fuel-Ethanol "Forms" Evolution EU 2007-2009




[1] Assuming ETBE production units @ only 85% utilization rate

[2] Assuming 3 *Million Tons* of Ethanol actually blended into EU petrol in 2009: data not available (1.6 in 2007, 2.4 in 2008)

# Global ETBE Nameplate Capacity 2010




Few new "non-EU" ETBE producers entered the market scene

*Source: Kingsman*

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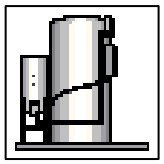
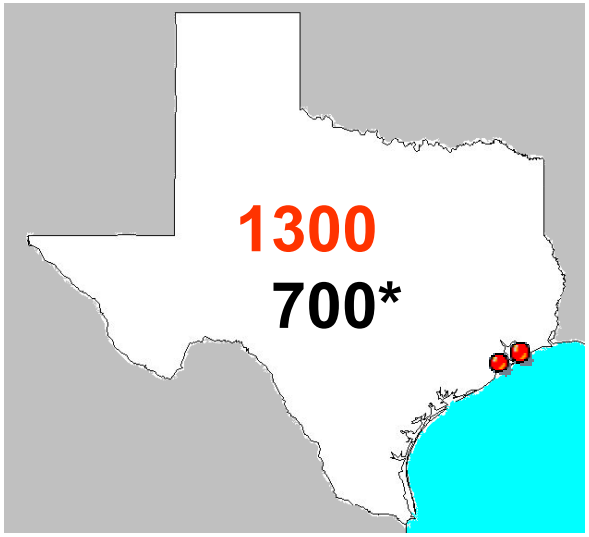
# LyondellBasell ETBE Production Capacity *(KT/Y)*



**USA**

**TEXAS**

**CHANNELVIEW**




**EU**

**FRANCE**

**FOS SUR MER**


**NETHERLANDS**

**BOTLEK**


Total **ETBE** Production Capacity = **3310** *KT/Y*

Total **Ethanol**-Equivalent = **1492** *KT/Y*

*** This plant currently still producing MTBE**

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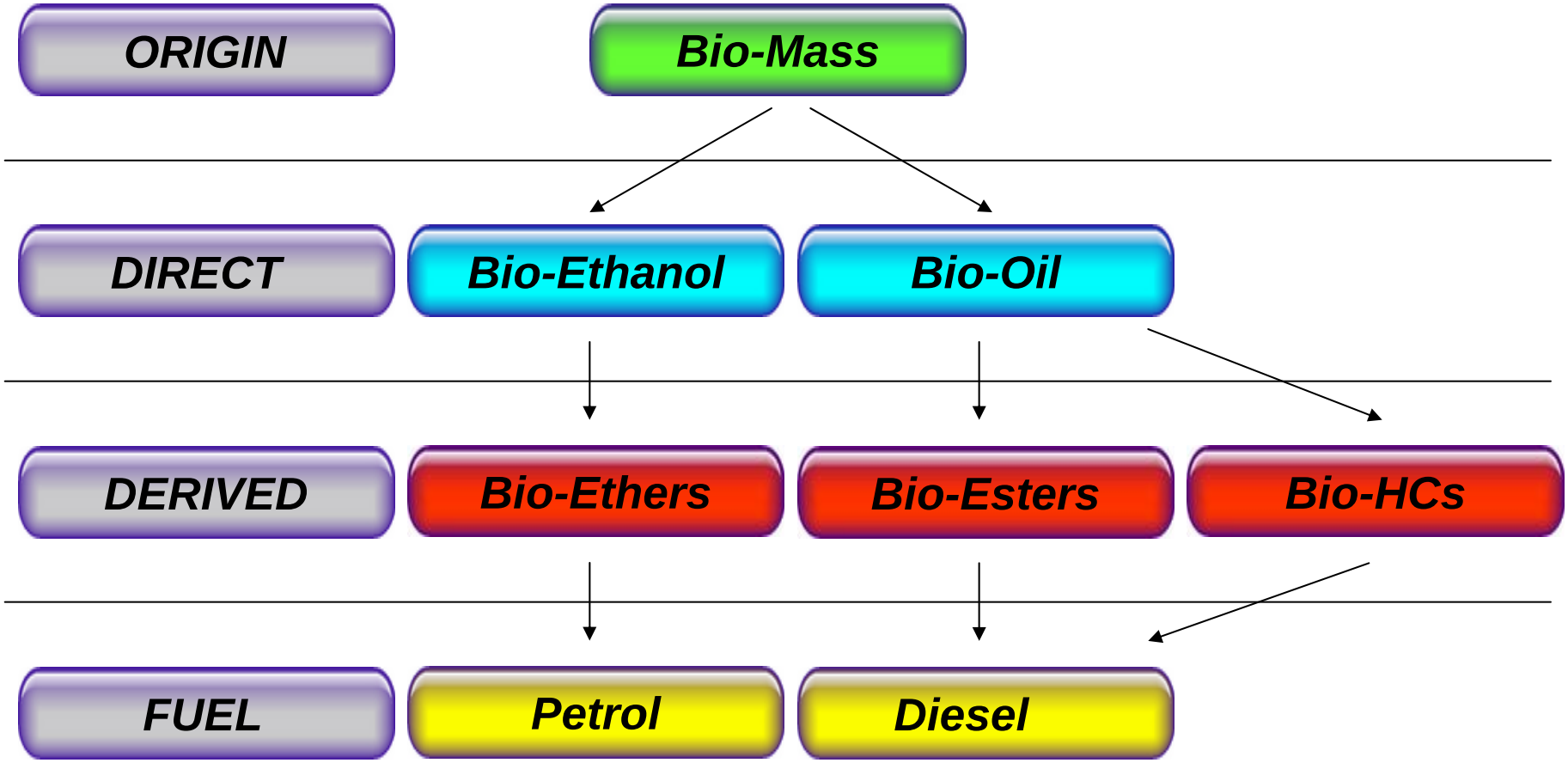
# Bio-Fuels "Supply Chains"




Bio-Ethers are for petrol what Bio-Diesel is for diesel

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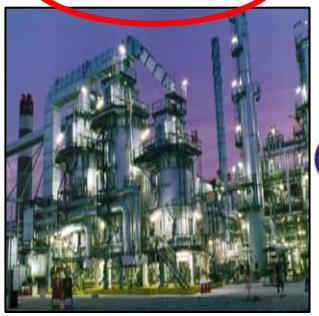
# Bio-Petrol Supply Chain & Ethers

The "down-stream" value

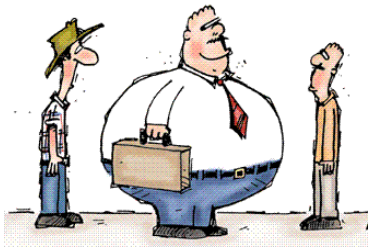
WHAT ?

| BIOMASS | PRIMARY BIOCOMPONENT | DERIVATIVE BIOCOMPONENT | FUEL | VEHICLE |
|---|---|---|---|---|
|  |  |  |  |  |
| Feedstock Growing | Ethanol Fermentation | Ether Synthesis | Petrol Formulation | Engine Powering |

WHY ?

The "middle-man" misconception

# The “middle-man” misconception




Why don’t we save money
by running vehicles on crude?

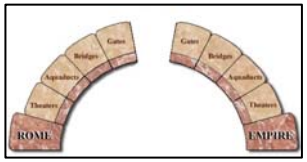
Why don’t we save time
by not cooking food?

Why do we transform
Ethanol into Ethers?

… upgrading is there to add value, not to waste money, time and energy

# The “down-stream” Value


+

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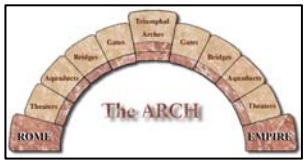



?

Are ashlars
equal to any arch component
or to finished arch?

+

=

?

Are soup cubes
equal to water
or to finished soup?

+


=

?

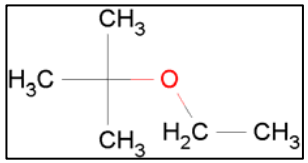
Are pigments
equal to solvents
or to finished paints?

+

=

?

Are essential oils
equal to carriers
or to finished perfumes?




+

=

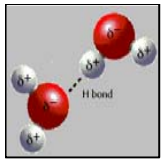
?

Are Ethers
equal to BOB*
or to finished petrol?

High performing components deliver “down-stream” performance

* **BOB** = **B**lendstock before **O**xygenate **B**lending

# ETBE: Further Enhancing ETOH Performances




← < Blending Volatility

< VOCs Emissions →

← > Octane Barrel Delivery

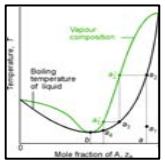
> $CO_2$ Emissions Reduction →

← > Crude-oil Replacement

No Commingling →

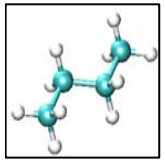
← > Water Tolerance

No Azeotrope →




← < Logistic Complexity

> Blend-stocks Value →



← Butane Uptake/Upgrade

> Refining Flexibility →

← > Material Compatibility

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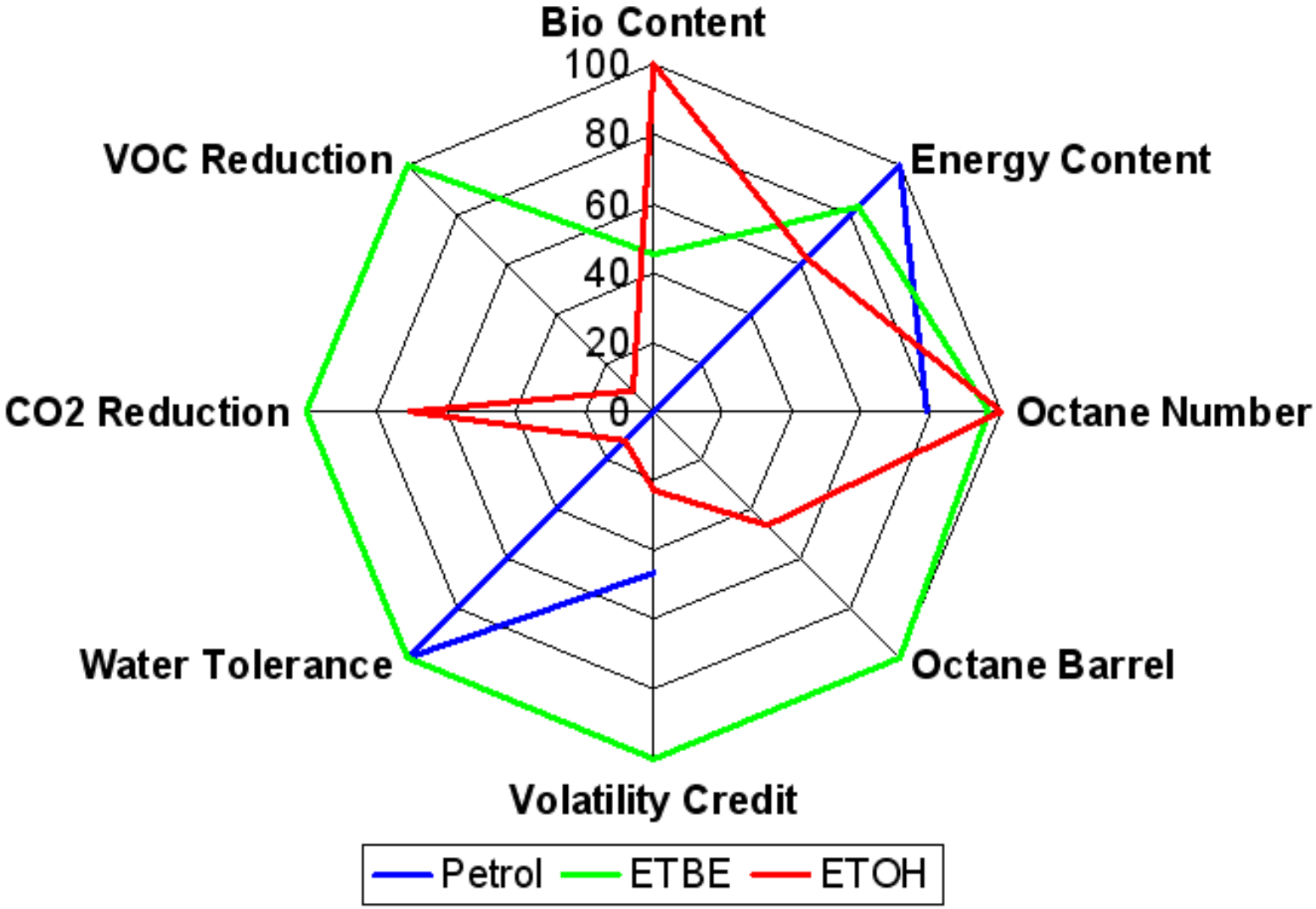
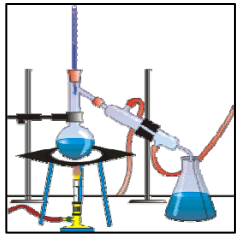
# Ethanol/ETBE/Petrol Blending Performances

*"Normalized" Comparison*



# Key Blending Properties Affecting Fuel Formulation

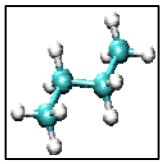
Vapour pressure

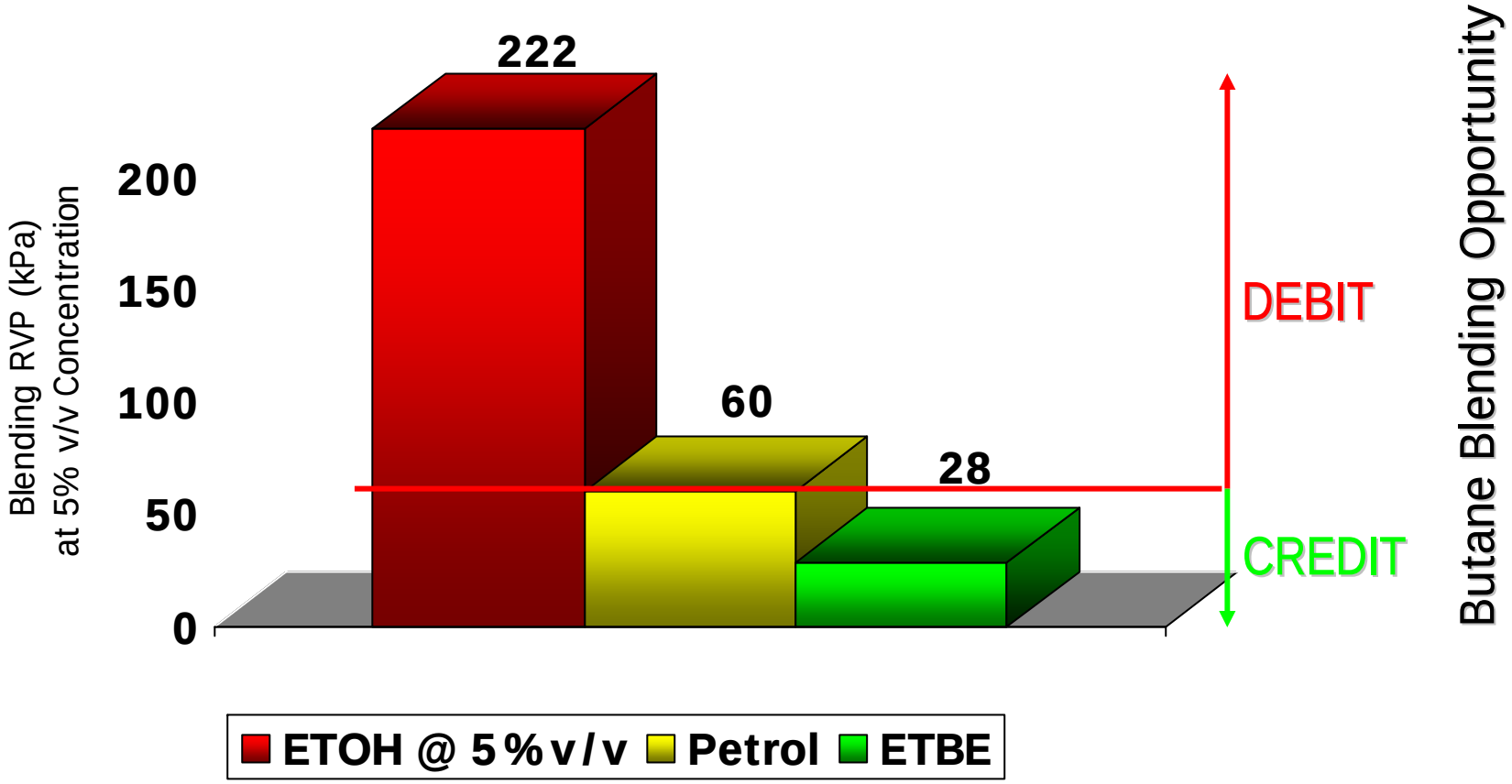


Distillation characteristics

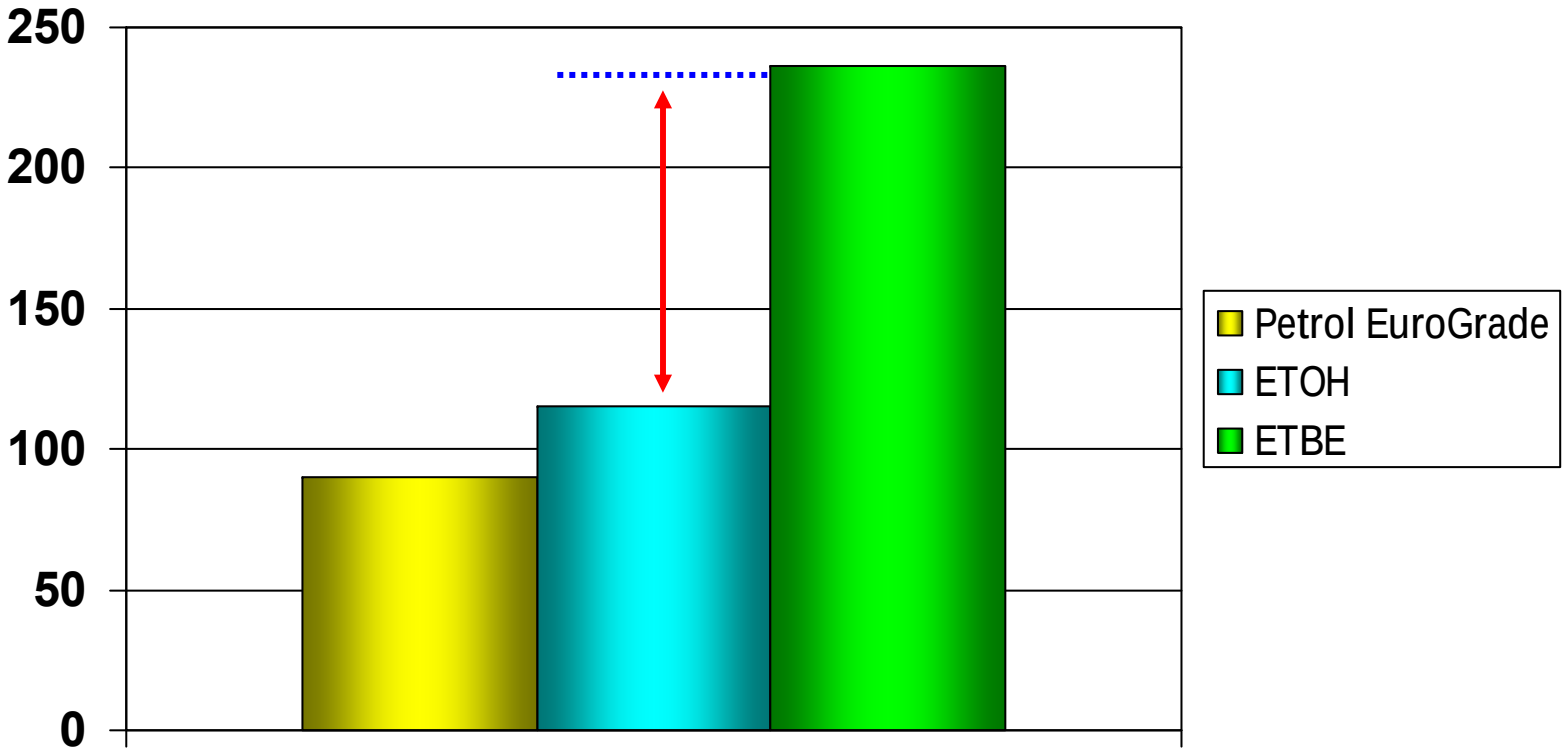
Octane number

# Butane Uptake/Upgrade Value





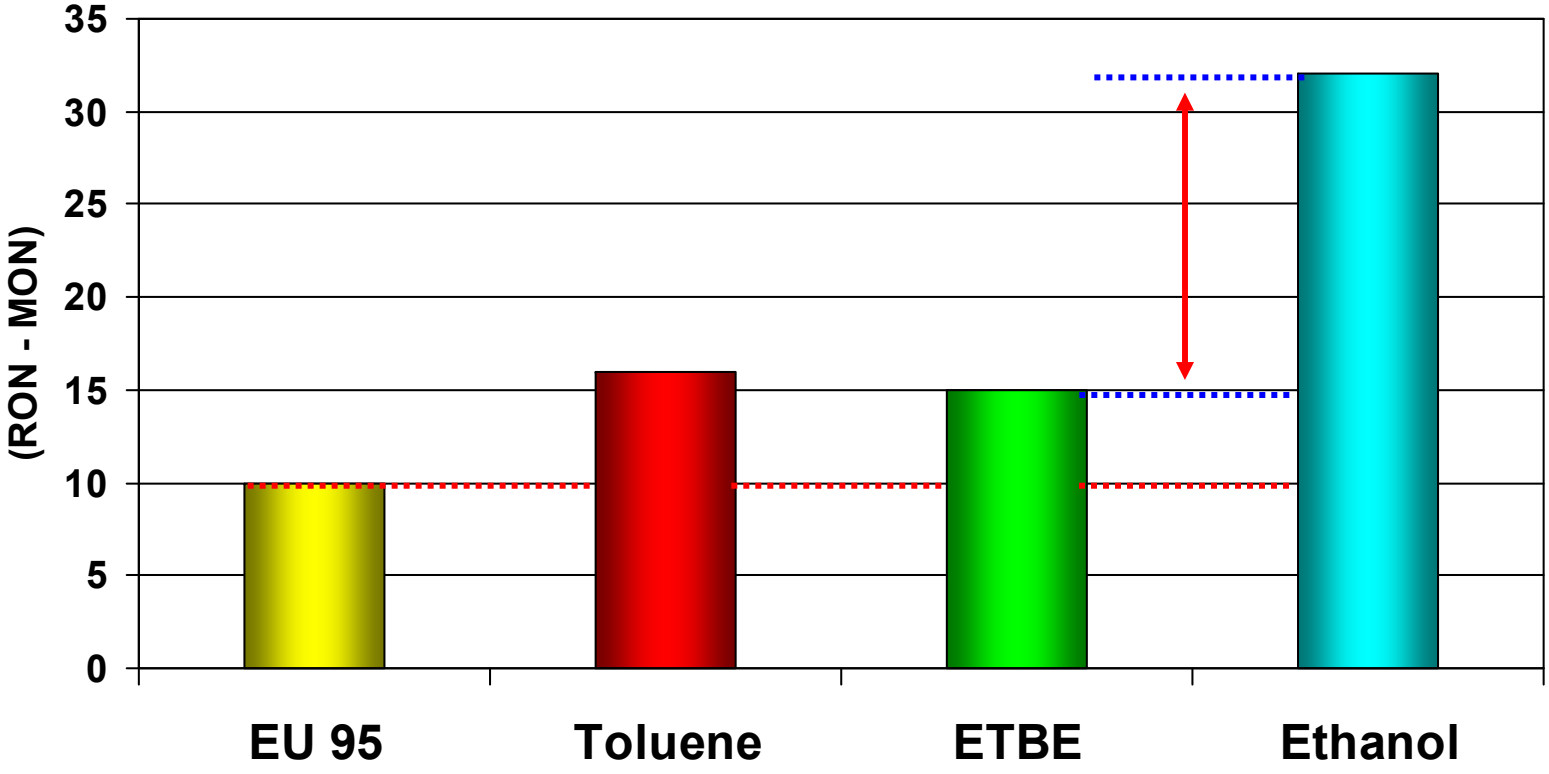
# Octane "Barrel"




ETBE delivers more than twice "*Octane Barrel*" @ same Ethanol-equivalent

# Octane Sensitivity:

*(Both MON and RON are Spec in EU)*




… replacing aromatics with ETBE in the petrol mix will have little impact on the refiner's octane sensitivity balance

# $CO_2$-Related Factors for Refinery Petrol Production


## Process Fuels Consumption

Octane-Production/Energy-Consumption Correlation

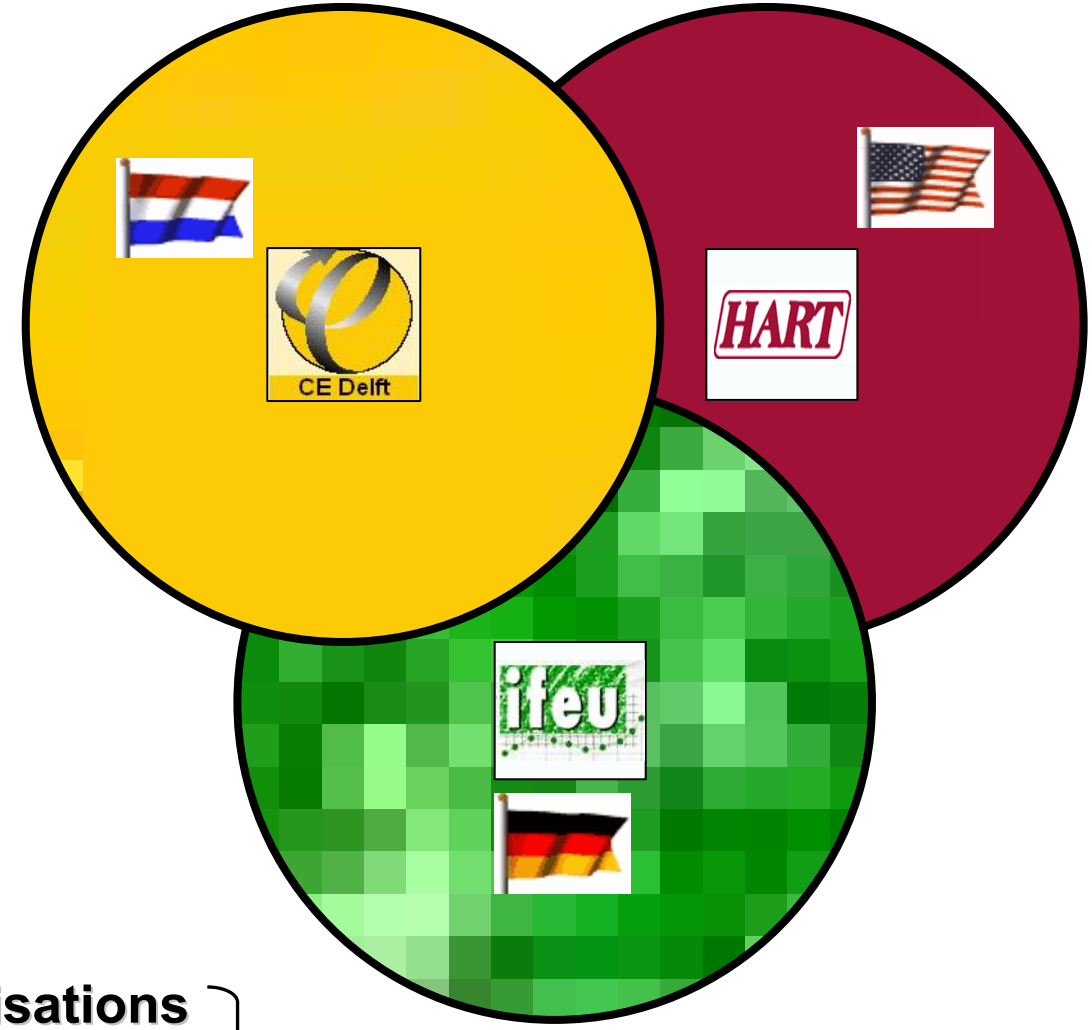
## Indirect Effects

Product Mix Modification due to other Optimization

## Petrol Composition

H/C Ratio (Aromatics, Olefins, Lights)

# ETBE $CO_2$ Performance: 3 ≠ Studies

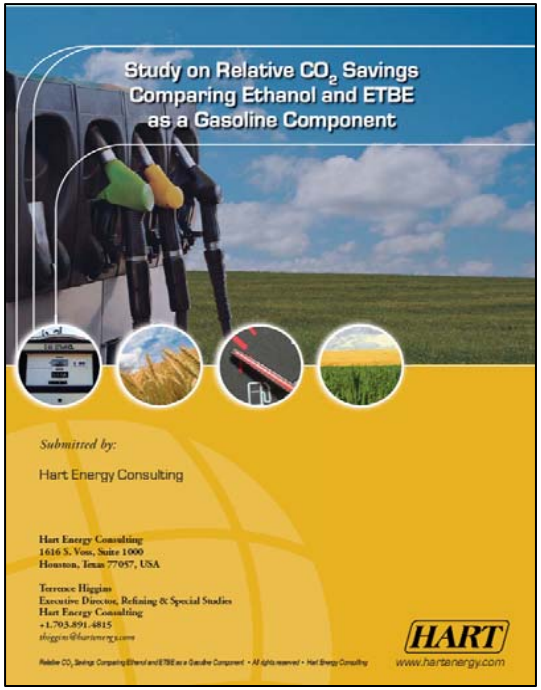



3 ≠ Organisations
3 ≠ Nationalities
3 ≠ Approaches

→ **Consistent Result**

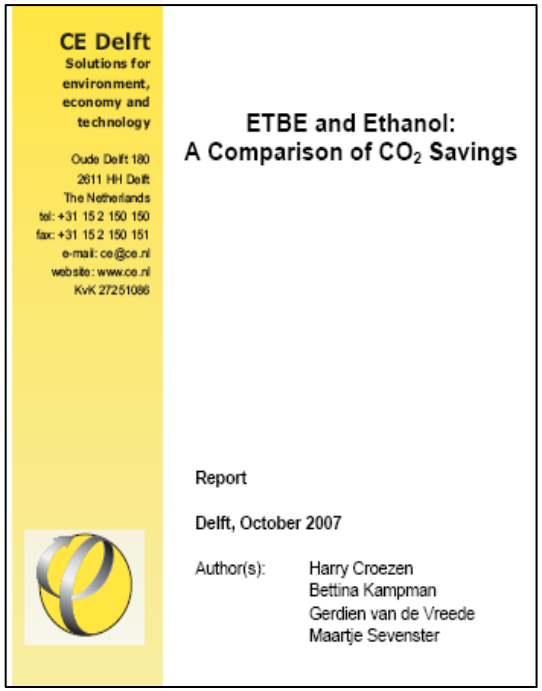
# ETBE Reduces $CO_2$ Emissions

## HART July 2007



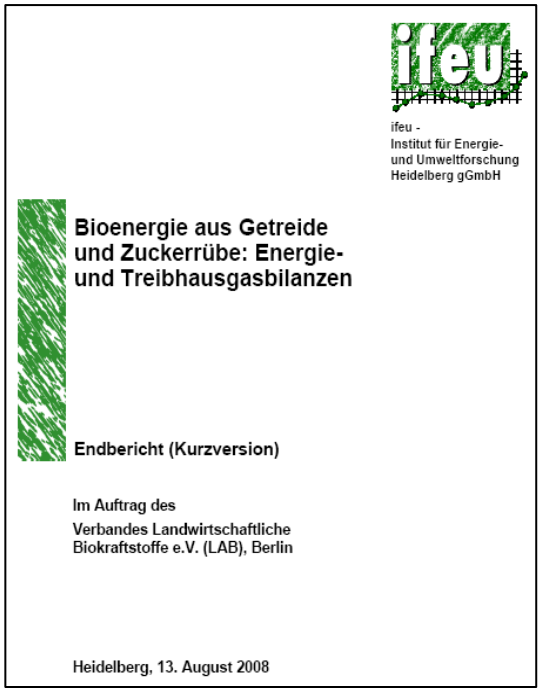

*"The use of bio-ETBE reduces refining crude-oil need and processing intensity, requires less fuel and, implying relevant petrol composition changes, allows the reduction of carbon factor and lesser $CO_2$ emissions"*

## CE-Delft October 2007




*"This study indicated that, when bio-ETBE is used, the resulting modification of refinery operations determine a significant reduction of greenhouse gases emissions"*

## IFEU August 2008




*"Best results by far are obtained when ethanol is converted to bio-ETBE.*
*The use of ETBE can allow the saving of 4 times the primary energy required to produce its fossil alternative.*
*IFEU recommends to exploit the whole potential of bio-ETBE"*

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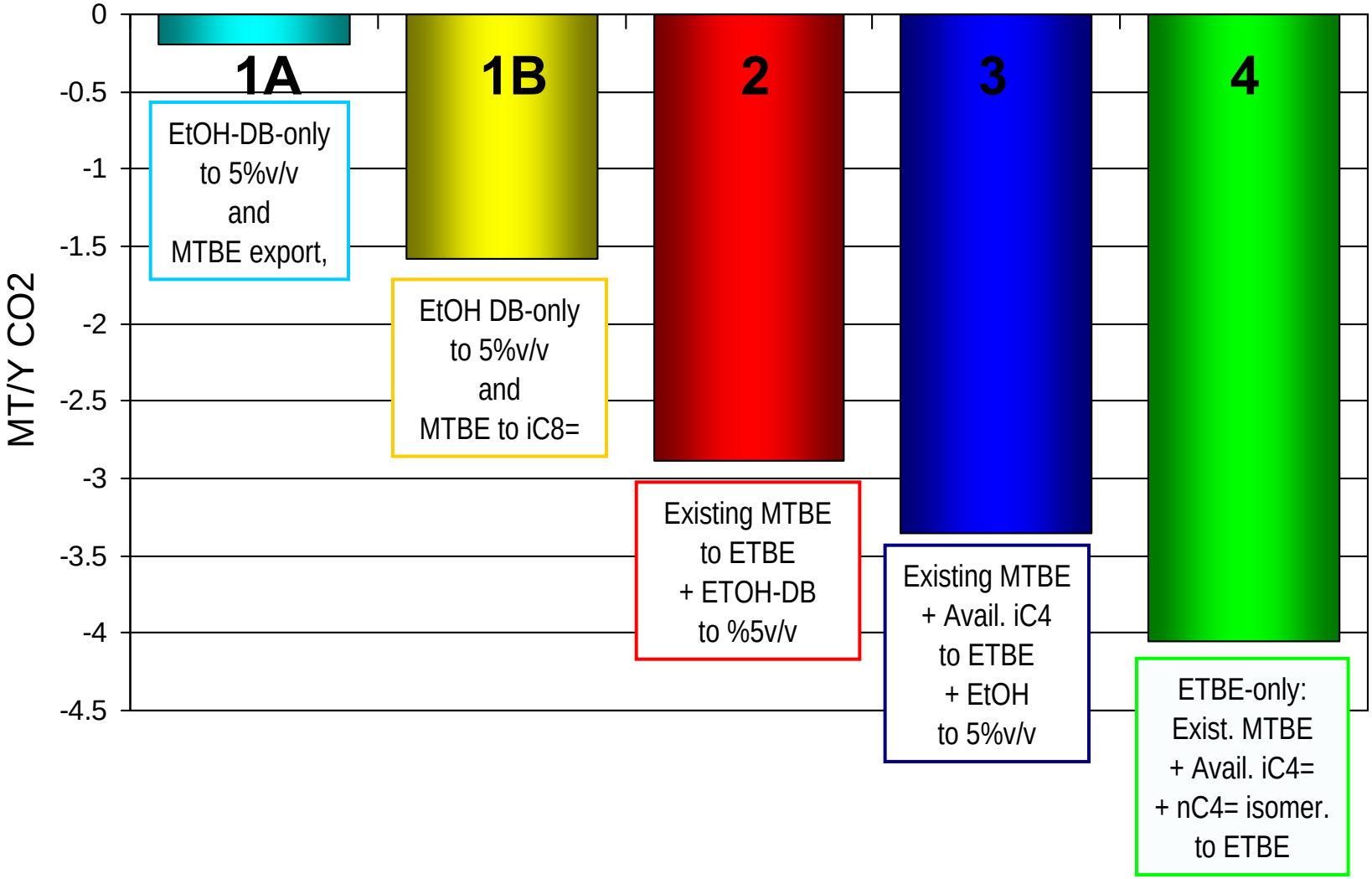
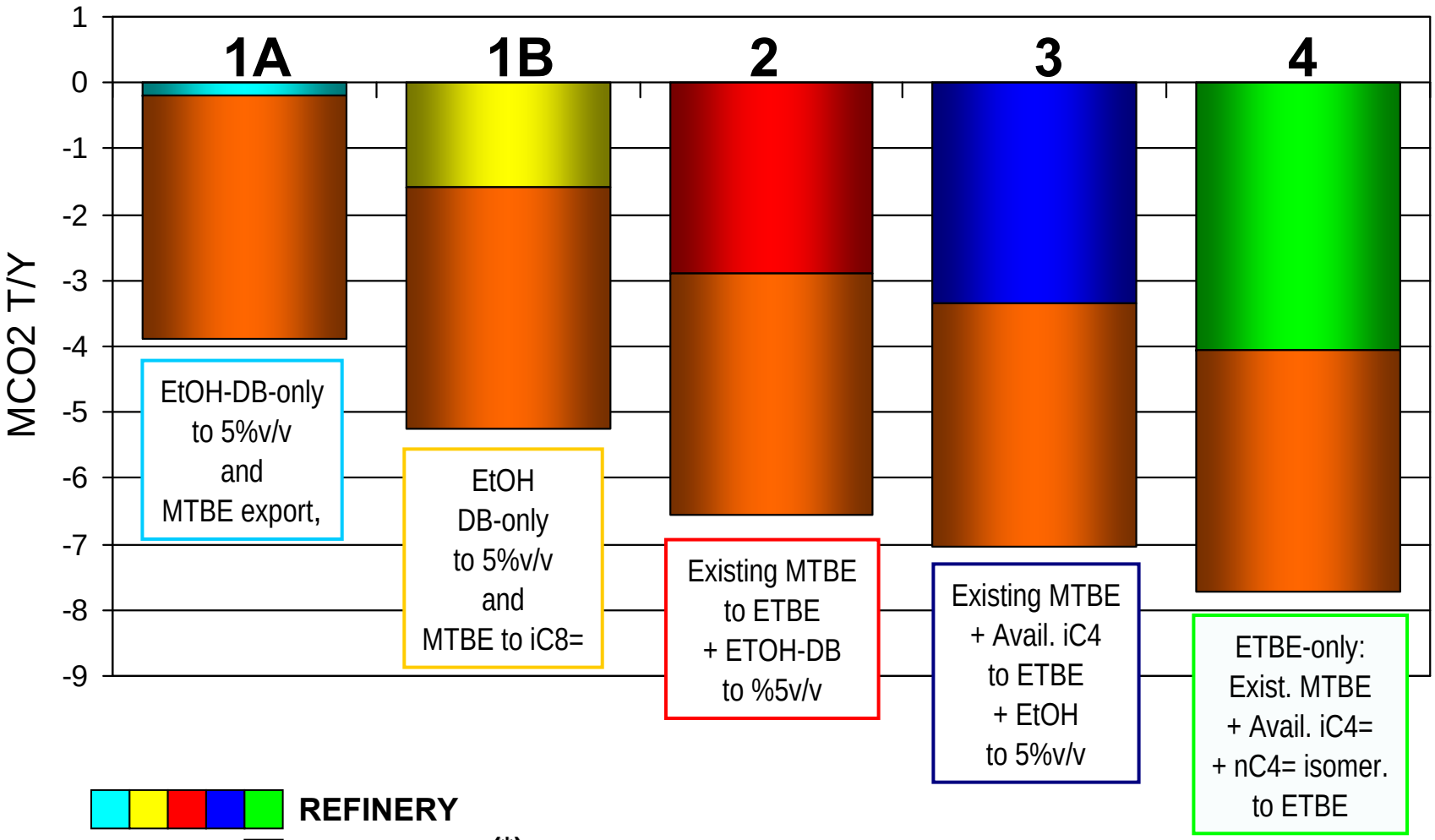
# ETBE/ETOH $CO_2$ Emissions Reduction:

## Refining Phase Contribution




*Source: "Study on Relative CO2 Savings Comparing Ethanol and ETBE as a Gasoline Component"; Hart Energy Consulting – July 2007*

# $CO_2$ Refinery Impact vs. current ETOH Minimum $CO_2$ saving requirement for qualification(*)

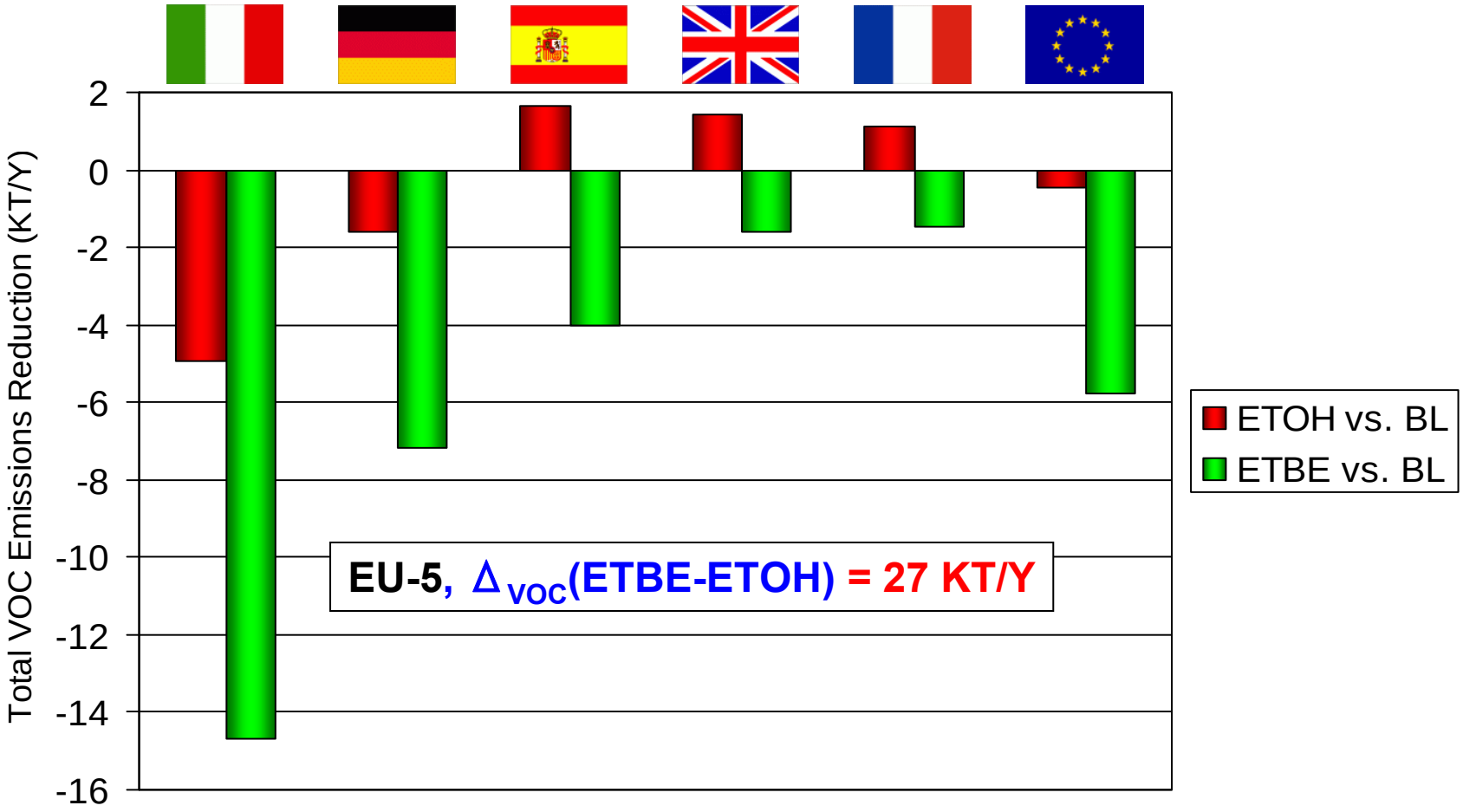



**REFINERY**

**UP-STREAM** (*) *35% $CO_2$ saving from bio-mass to ethanol*

*Source: "Study on Relative CO2 Savings Comparing Ethanol and ETBE as a Gasoline Component". Hart Energy Consulting – July 2007*

# COPERT 2010: VOC Reductions with ETBE




GHGs important, but VOCs very relevant too

Source: Emissions and Health Unit - Institute of Environment and Sustainability - EC-JRC Ispra
*"An assessment of the impact of ethanol-blended petrol on the total NMVOC emissions from road transport in selected countries"*

# Conclusions

Bio-ethanol contributes to reduce $CO_2$ impact; by conversion into ethers it can synergistically, and significantly, increase, even further, petrol global GHGs emission performance.

Bio-ethanol-ethers would, in addition, improve bio-ethanol technical performances and fungibility into engines and vehicles, representing the natural carrier for renewable ethanol.