



lyondellbasell

Why use it,
When to use it,
How to use it.

ETBE



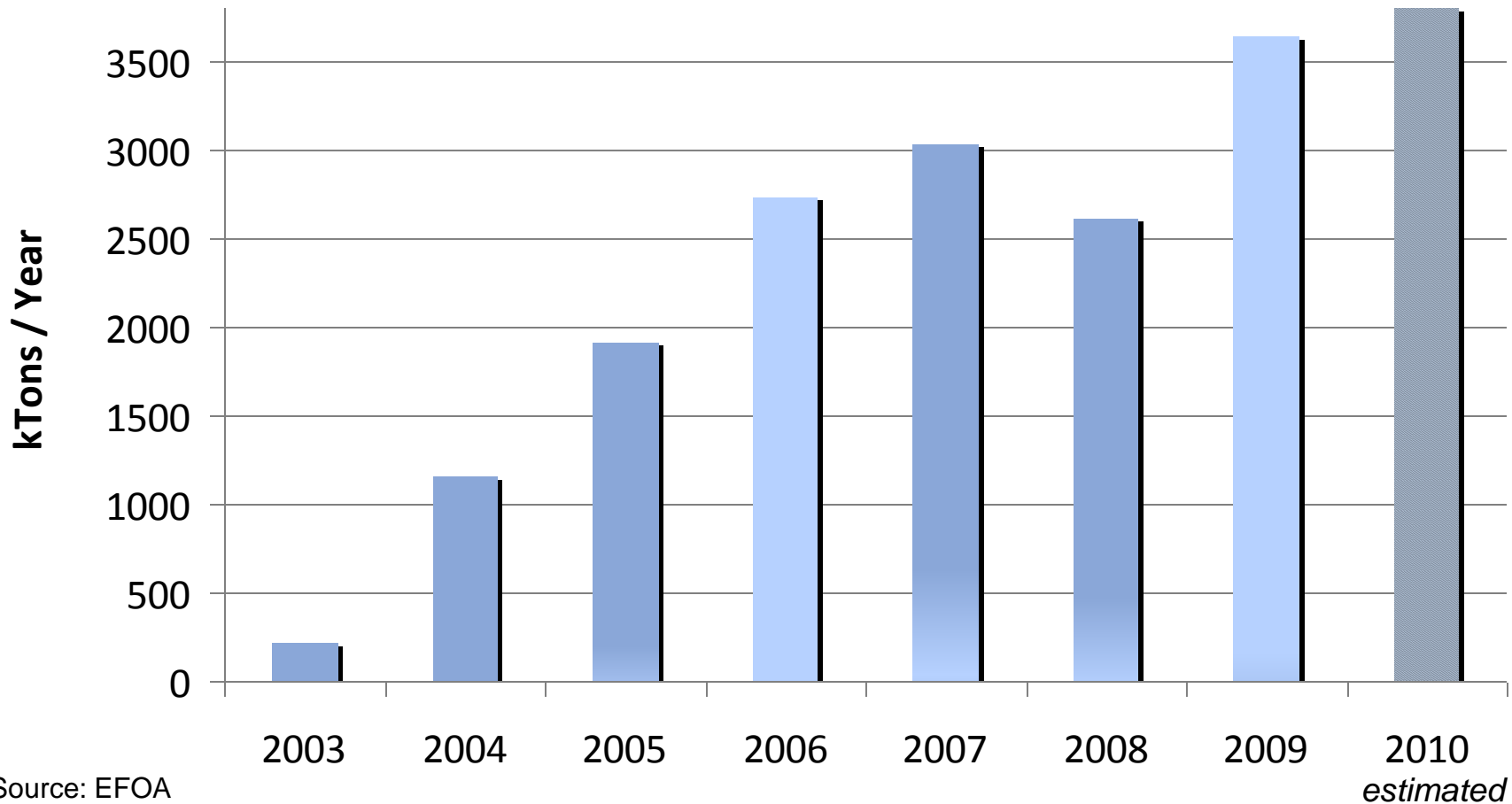
LyondellBasell: Fast facts

- 3rd largest independent chemical company in the world
- **Business segments**
 - Olefins & Polyolefins
 - Intermediates and Derivatives
 - Refining and Oxyfuels
 - Technology
- **2010 EBITDA** \$ 4 billion (Refining & Oxyfuels: \$ 452 million)
- Refining and Oxyfuels and other segments supply to the automotive and transport market, helping our customers to make lighter, stronger, safer and cleaner products
- As the largest merchant Oxyfuel producer, we supply high quality fuel components, provide reliable service and maintain excellent product stewardship

ETBE: Why use it...

- Significant CO₂ savings
- High energy content
- Supply chain benefits
- High Octane, low volatility
- Lower VOC emissions

ETBE Consumption EU 2003 - 2010



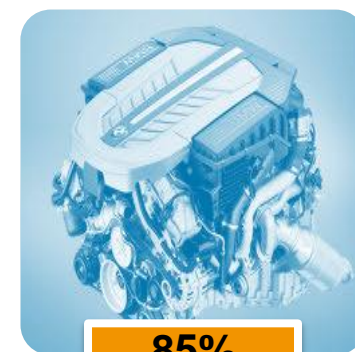
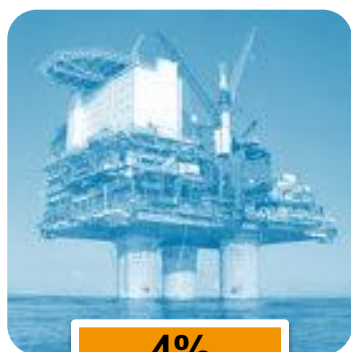
Source: EFOA

ETBE in Japan: the all-inclusive approach

- **Japan is world's 3rd largest oil market.** It fully depends on imports, there is no significant agricultural production for biofuels
- In 2005 government and oil industry started a joint project to determine the best biofuel to meet Kyoto targets, including refinery impact and use in car:
 - CO₂ reduction and availability of feedstock
 - Composition of gasoline and fuel economy
 - Car emissions and air quality
 - Product risk assessment and health impact
- **In 2007 Japan chooses ETBE (7%v/v)** as primary biofuel for the 60 million passenger cars running on gasoline

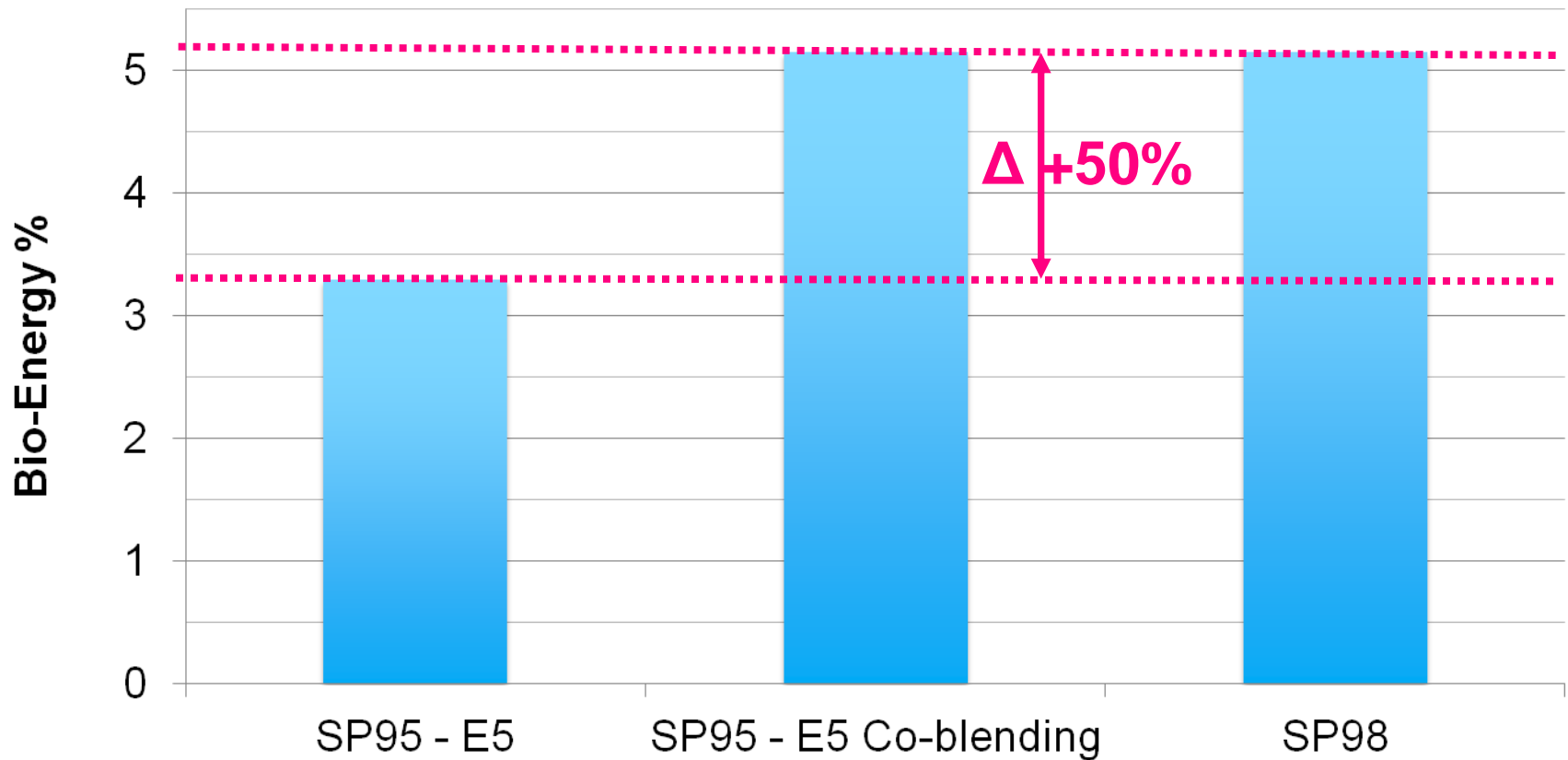
ETBE in the EU: the Directives approach

- RED: product driven CO₂ savings focusing on feedstock and energy content
- FQD: process driven CO₂ savings based on fuel life cycle up to refinery
- ETBE has significant positive effects on GHG emissions due to adjustments in refinery operations
- ETBE has a higher hydrogen / carbon ratio, forming less CO₂ for the same energy delivered to the engine and ETBE reduces fugitive VOC emissions from cars, resulting in lower CO₂ emissions (1 MT VOC ~ 3 MT CO₂)



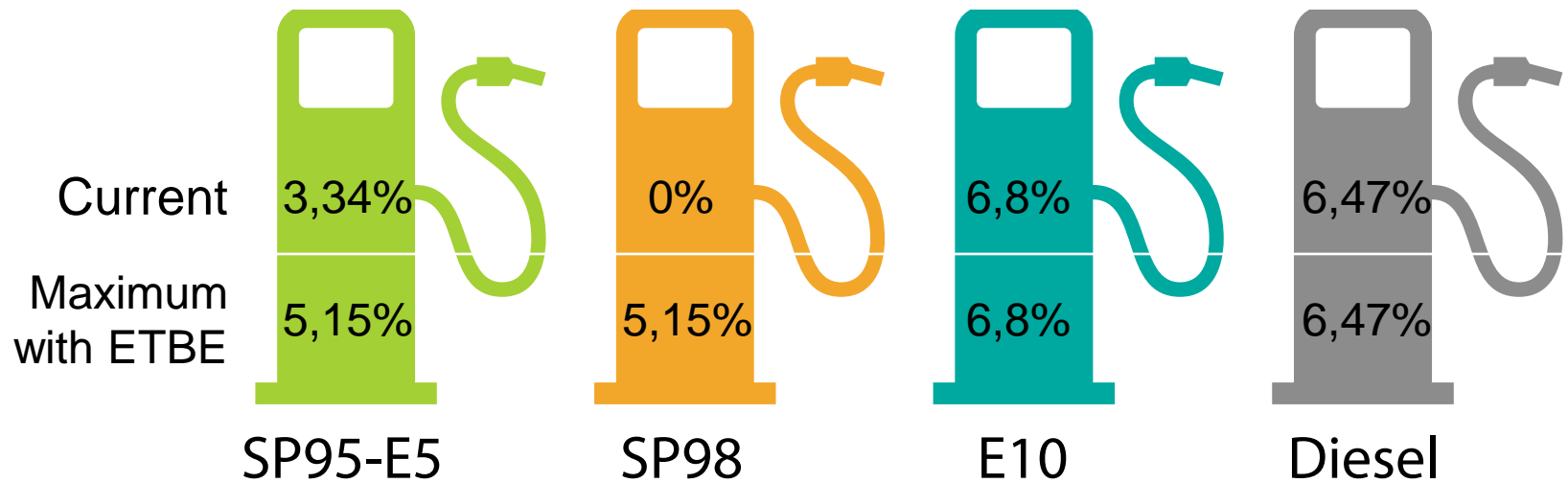
When to use it...

ETBE achieves higher Bio-Energy content



When to use it...

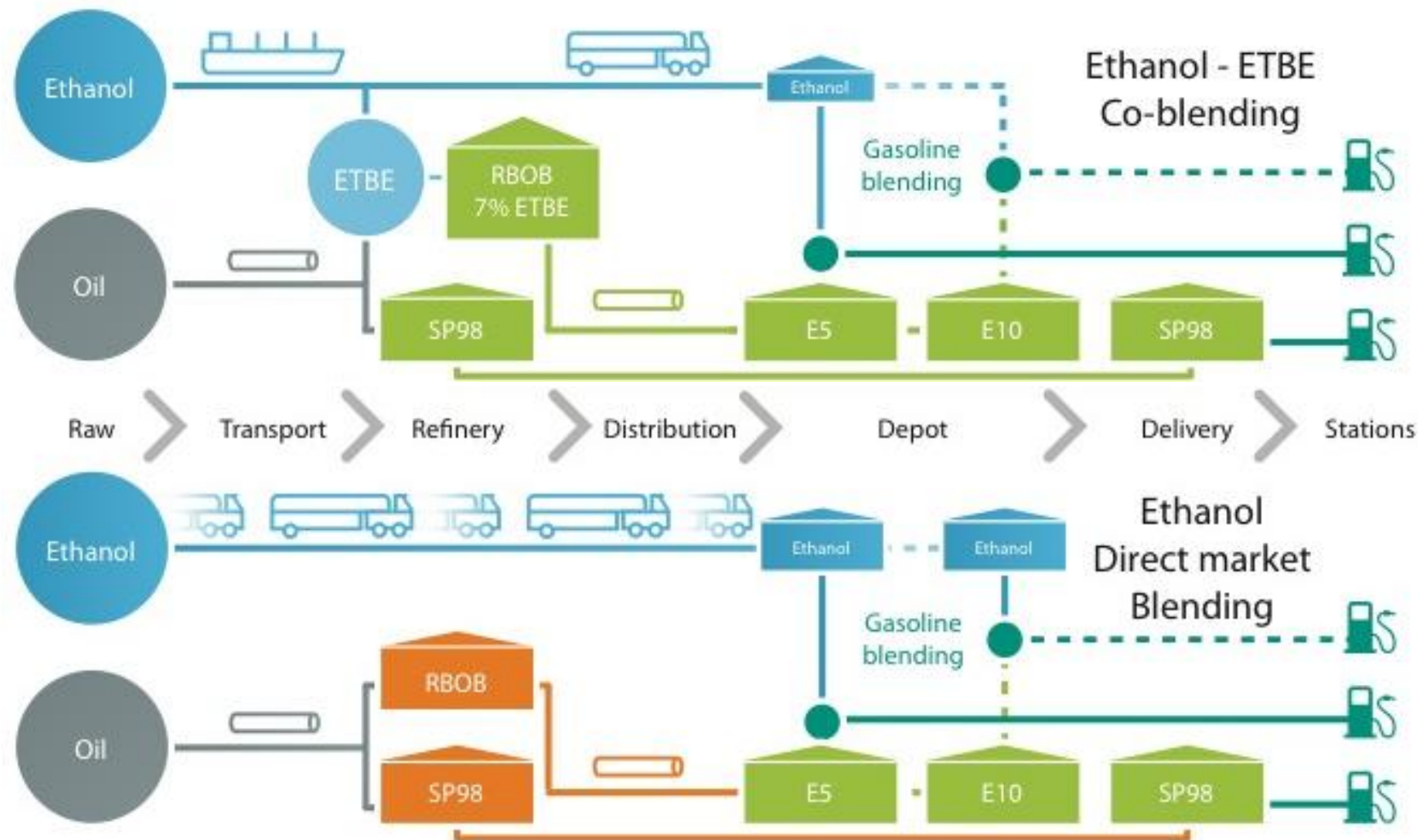
Maximum Bio-energy content options



How to use it...

- ETBE in Blendstock allows suppliers to market multiple grades and achieve higher bio-energy through co-blending
- One Blendstock / Basefuel in one tank serves E5 as well as E10
- Significant reduction of truck movements to depots and reduced tank storage with clear benefits:
 - Less trucks, less congestion, lower CO₂ emissions,
 - Minimize infrastructure investments, reduce working capital
 - Greater flexibility in planning, ease of handling at depots

Supply chain benefits: Ethanol through ETBE is blended at refinery



Summary

- Significant CO₂ savings
- High energy content
- Supply chain benefits
- High Octane, low volatility
- Lower VOC emissions

Back-up slide

Studies

HART July 2007

Study on Relative CO₂ Savings Comparing Ethanol and ETBE as a Gasoline Component

Sponsored by:
Hart Energy Consulting

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"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 CO₂ emissions"

CE-Delft October 2007

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**ETBE and Ethanol:
A Comparison of CO₂ Savings**

Report

Delft, October 2007

Author(s): Harry Croezen
Bettina Kampman
Gerdien van de Vreede
Maartje Sevenster

"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

ifeu
Institut für Energie- und Umweltschutz Heidelberg gGmbH

Bioenergie aus Getreide und Zuckerrübe: Energie- und Treibhausgasbilanzen

Endbericht (Kurzversion)

Im Auftrag des
Verbandes Landwirtschaftliche Biokraftstoffe e.V. (LAB), Berlin

Heidelberg, 13. 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"