RenovaBio - ROTA 2030 – Proconve

Integrated activities to attend Biofuel Policy & Biofuture Platform targets in Brazil

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Facts and figures – MAHLE Group

MAHLE worldwide

Employees: 77,000 (around 8,600 in SA)

More than 170 production locations in 34 countries and on five continents (7 Locations in SA)

Sales: EUR 12,3 billion (EUR 645,7 Mio in SA) (2016)

15 major development locations with around 6,000 development engineers and technicians in Germany, Great Britain, Luxembourg, Slovenia, the USA, Brazil, Japan, China and India
Government Programs that need to be interconnected

- **Biofuture platform**
- **Sustainability**
- **Fuel Efficiency**
- **Bio energy**
- **PROCONVE**
- **Rota 2030**
- **RenovaBio**
It’s not **either** ICE, **or** Electrification. It’s both used in the best way, using biofuels!
Ethanol route: Increase ICE energy efficiency using HOF, Hybrids to reduce well-to-wheel CO₂, leading to the use of SOFC.
Roadmap for efficient vehicles using ethanol as pure fuel or blending HOF gasoline

**Sustainable Energy Efficiency**
- Consider GHG well-to-wheel
- Assurance of ethanol supply
- International Competitiveness

**Global Fuel**
- Implementing high octane fuel (HOF)
- Ethanol fuel with common specification.
- Fostering lower Carbon Intensity

**New Ethanol/Flex Vehicle - worldwide penetration**
- Efficient vehicles with ethanol and gasoline with hybridization
- Advantages on Route 2030 for increased efficiency with ethanol.
- HD Ethanol vehicle to urban centers with restrictions on particulate matter

**Fast and effective contribution for reducing greenhouse gases (GHG)**
- Quick alternative for GHG reduction without large investments
- Bridge to the future in reducing CO₂ complementing the use of clean electricity
- Exclusive use of E100 on hybrid platforms and technologies such as Fuel cell
Well-to-wheel activities
CI Reduction
Sustainable Energy Efficiency

- Development and Certification of engines used on land machines
- Improved maintenance
- Technologies for heavy engines with ethanol and biogas
- MBE2
- Special filters
- Ethanol Dehydration
- Stationary eth/biogas SOFC
- Hybrid Bus / REX Eth-H₂
- ROTA 2030 Eth bonuses
- Special Technologies
- SOFC Vehicles
Relevant facts with MBE2 Technology

Competitiveness
~ 12% lower cost of cane ethanol production.

Sustainability
No increase in planted area or higher water consumption

Strategic Importance
Increases the production of Ethanol for pure use and as a mixture

Investment
Relative low value with fast return

Greenhouse gases
Reduces carbon intensity (CO$_2$/MJ) by 12%. The CO$_2$ emission from the well to the wheel in the vehicle is 12% lower.

Flexibility
Applicable to all generations of ethanol and crops.
Low Emission Vehicles using Ethanol can be an alternative for HD Vehicles

The Diesel fleet in Brazil: 4% of vehicles and 46% of CO₂ emissions

“Almost zero emissions " NOx and particulate matter with ethanol is very low.
Chemical reaction of Ethanol + water generates hydrogen

SOFC Cell (solid oxide fuel cell) uses hydrogen + air and generates electric power to supply the battery that powers the electric motor.

Source AVL
Thank you!

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