Movido a
Diesel de Cana

AMYRIS

Renewable Diesel made from Sugar Cane

Adilson Liebsch
Product Marketing
Amyris Brasil

October 2010

Agenda

- Corporate Overview
- Technology
- Renewable Products – Diesel de Cana
- Manufacturing and scale-up
- Cost of Amyris Diesel

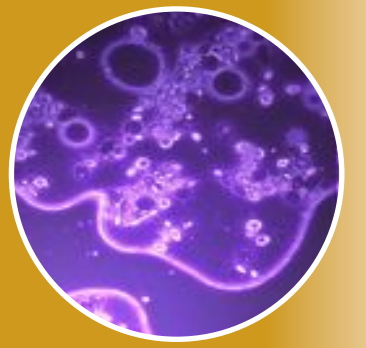
AMYRIS

Berkeley UNIVERSITY OF CALIFORNIA

BILL & MELINDA GATES foundation

Renewable fuels and chemicals for a sustainable world

Business Model



TECHNOLOGY

- Pioneering technology platform capable of making >50,000 molecules
- Engineer yeast to convert sugar into hydrocarbons

MANUFACTURING

- Access to lowest cost feedstock (first sugarcane, then cellulosic)
- Lowest carbon footprint
- Owned and 3rd party production assets

PRODUCTS

- No Compromise® fuels
- Family of renewable chemicals
- Anti-malarial ingredient (non-profit initiative)

Integrated renewable products company

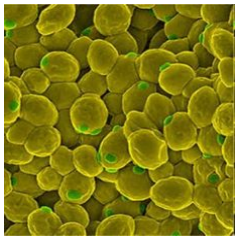
Our vision: Enable a bio-based economy…

Traditional oil source

Oil +  Refinery = Petroleum products

Amyris engineered yeast in fermentation

Sugar cane +



Amyris genetically engineered yeast +

Cane mill = Access to > 50,000 isoprenoid compounds

Wide range of possible products

Anti-malaria drug
non-profit: treat over 200 million people annually

Chemicals:
e.g. solvents, formulation ingredients for home care and personal care, polymers, lubricants, F&F, etc.

Diesel

Jet fuel

AMYRIS

Amyris today...

Emeryville, California
- ABI headquarters
- labs, pilot plant

Chicago, Illinois
- Amyris Fuels LLC
- Renewable fuels marketing and distribution

Europe
- Anti-malarial partnership with sanofi-aventis

Alabama
- sugar cane nursery project

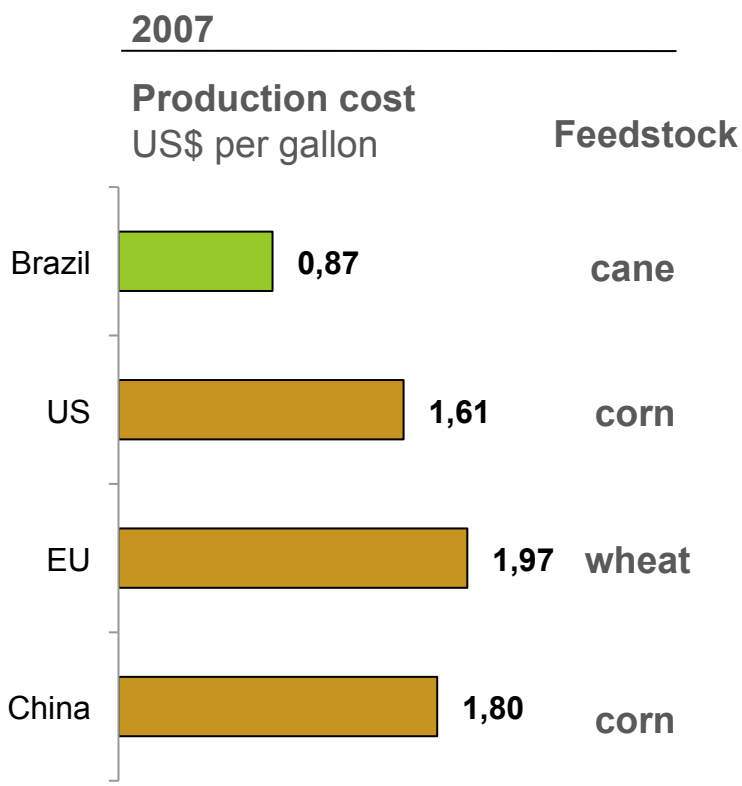
Pradópolis, Brazil
- SMA S.A.
- JV with São Martinho
- Commercial scale production in 2012

Campinas, Brazil
- Amyris Brasil S.A.
- labs, pilot plant & demo facility

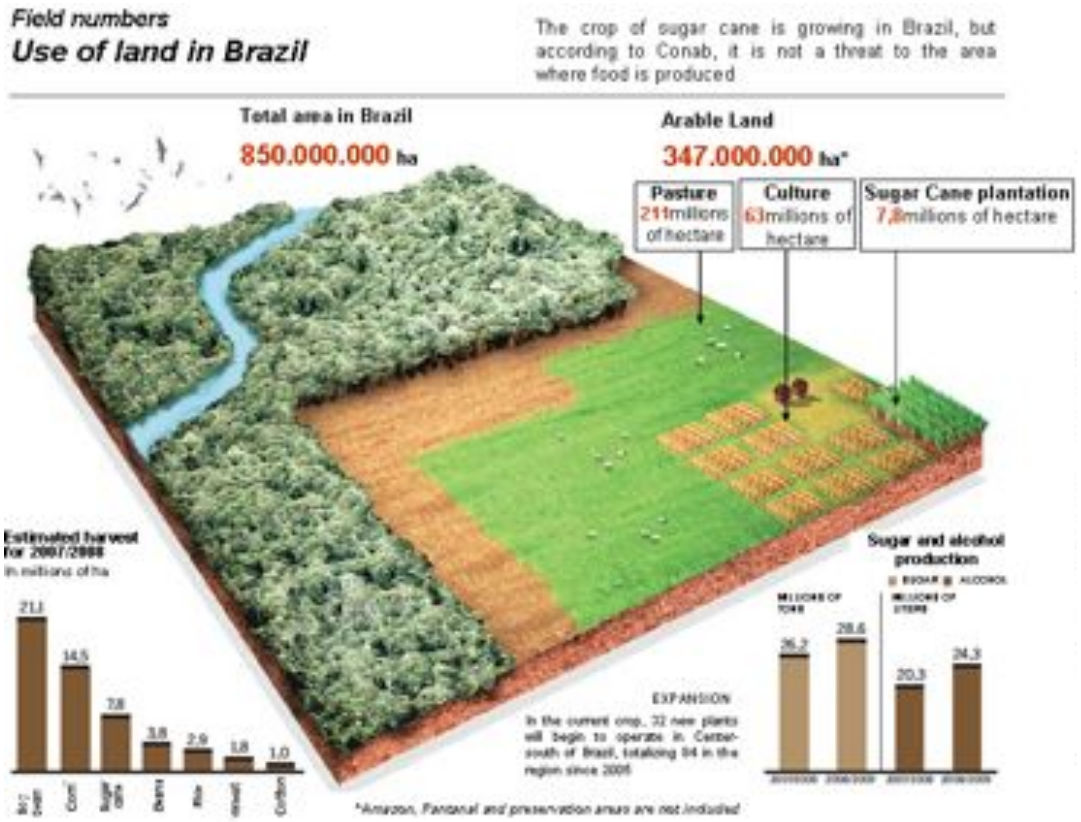
… combining great science and innovative business to create a more sustainable world

AMYRIS

Why Brazil?



Source: McKinsey & Company



AMYRIS

Agenda

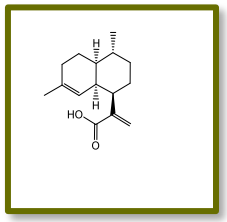
- Corporate Overview
- **Technology**
- Renewable Products – Diesel de Cana
- Manufacturing and scale-up
- Cost of Amyris Diesel

AMYRIS

Platform Delivers Multiple Products

Sugar Syrup

Artemisinic Acid



Anti-Malarial Drug

YEAST CELL

Mevalonate Pathway

p450

CPR

ADS

Diesel & Chemical Precursor

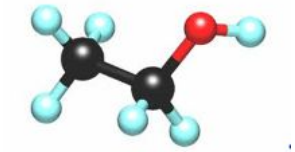
Farnesene Synthase

GPPS

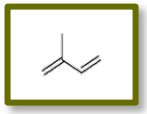
Farnesene

IS

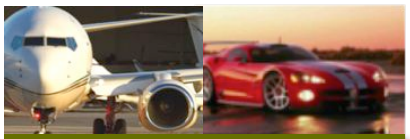
PS



Ethanol



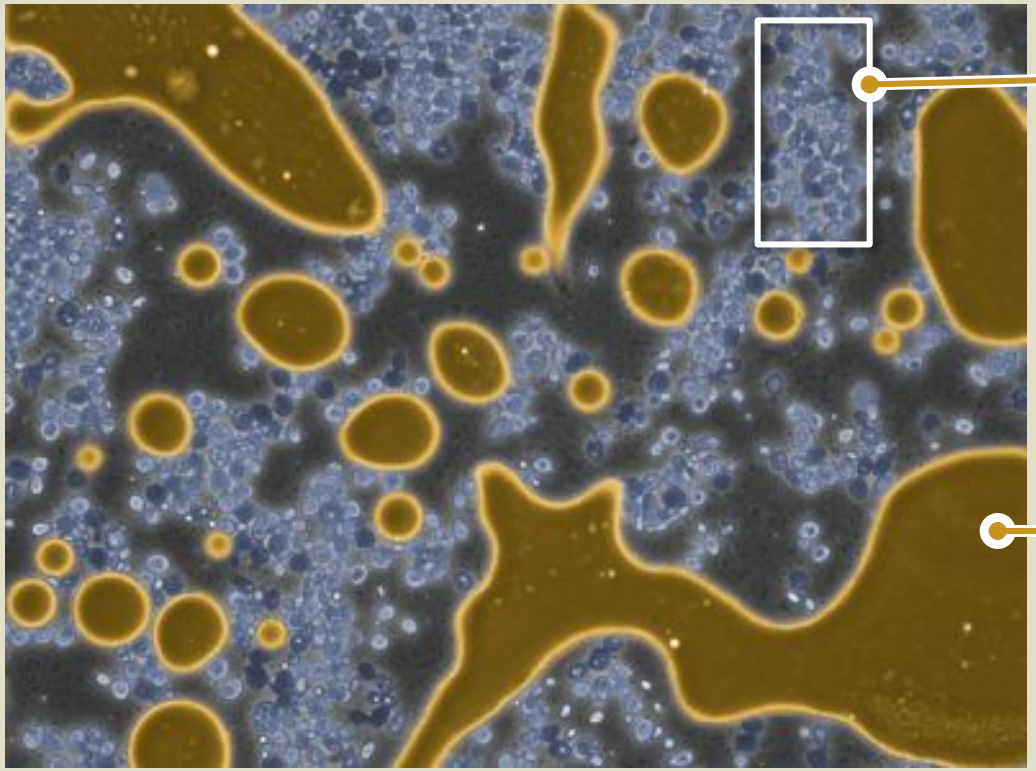
Isoprene



Jet / Gasoline Precursors

AMYRIS

Engineered Microbes Convert Sugar to Hydrocarbons



Amyris Engineered Yeast

Amyris Farnesene (Diesel Precursor)

Phase-Contrast Micrograph of Amyris Engineered Microbes Producing Farnesene

AMYRIS

Agenda

- Corporate Overview
- Technology
- Renewable Products – Diesel de Cana
- Manufacturing and scale-up
- Cost of Amyris Diesel

AMYRIS

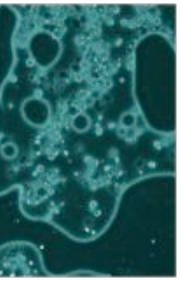
Producing High-Value Products through Low-Cost Fermentation

CHEMICAL FINISHING

FERMENTATION AT MILLS

CHEMICAL BUILDING BLOCK

Farnesene



Diesel Fuel

Jet Fuel

Surfactants

Lubricants

Cosmetics, Flavors and Fragrances

Plastics Additives

2012 and Beyond – Partners and Customers in Place

AMYRIS BIOFENE® FINAL TESTING IN MAJOR P&G PRODUCT

P&G

AMYRIS BIOFENE® IN PET BOTTLES

M&G GRUPPO MOSSI & GHISOLFI

AMYRIS DIESEL WINS INTERNATIONAL COMPETITION

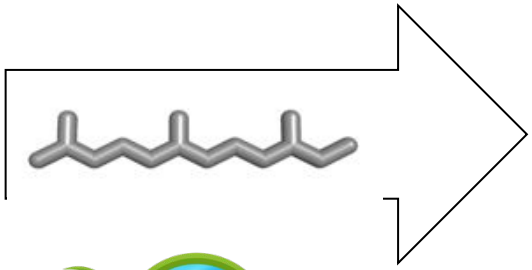
TOTAL
Cummins
Mercedes-Benz
cosan
NAVISTAR®
BR PETROBRAS
FedEx

AMYRIS JET FUEL SELECTED FOR TEST FLIGHT

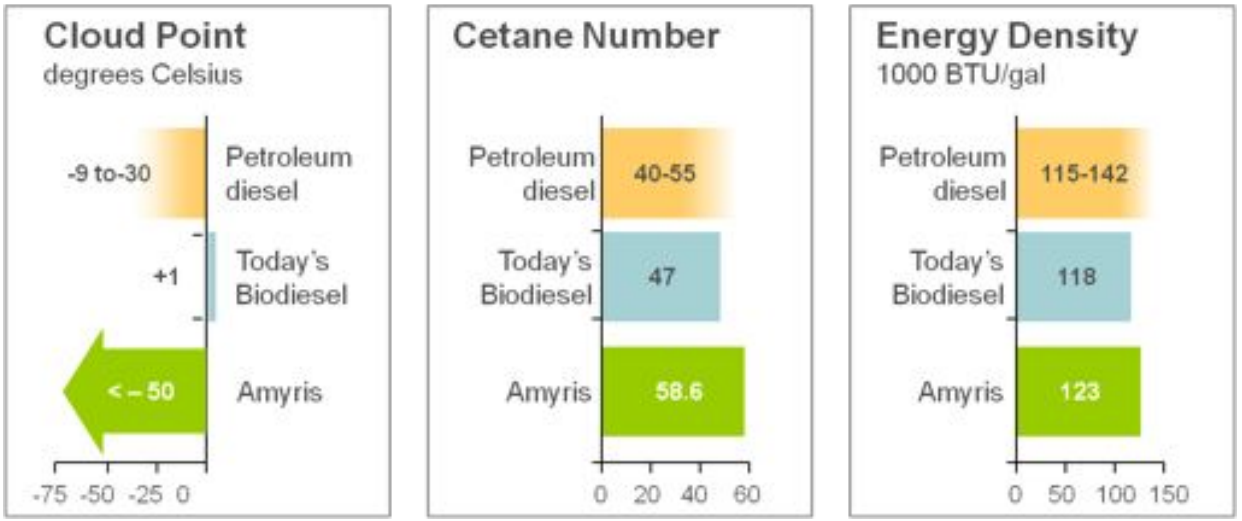
EMBRAER
Azul Linhas Aéreas Brasileiras

Diesel de Cana: a fuel with “drop in” properties...

A hydrocarbon
C15H32



Movido a
Diesel de Cana



Lubricity (HFRR)= 330um

No Sulfur

Blends up to 35% of Sugar Cane Diesel are approved for commercial use in the United States.

- *Amyris diesel will be used in blends with conventional fuels; values shown for Amyris diesel is for our biomass derived blending component*

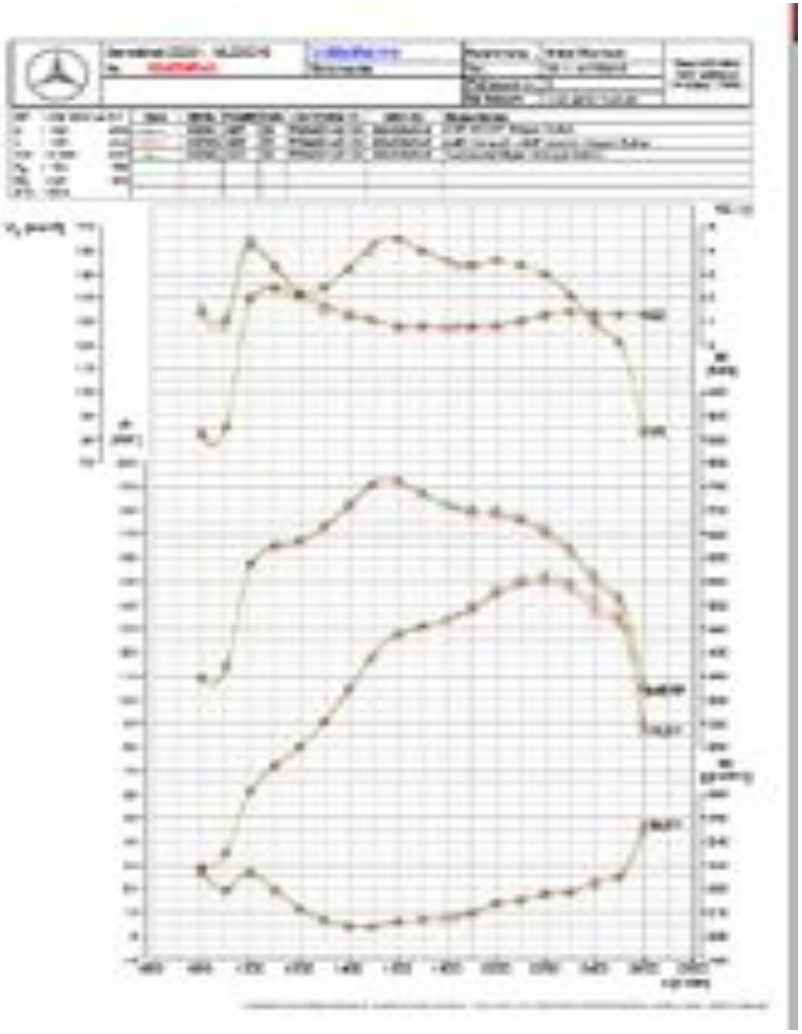
AMYRIS

Performance – Mercedes OM 924 (Brazil)

Fuel: Sugar Cane Diesel 10% + Diesel Euro III + 4% Biodiesel

- No performance difference between Sugar Cane Diesel, Diesel S500 and ANP32/2007
  - Torque
  - Power
  - Fuel consumption (BSFC)

- Engine control parameters were not affected by the use of the blend.



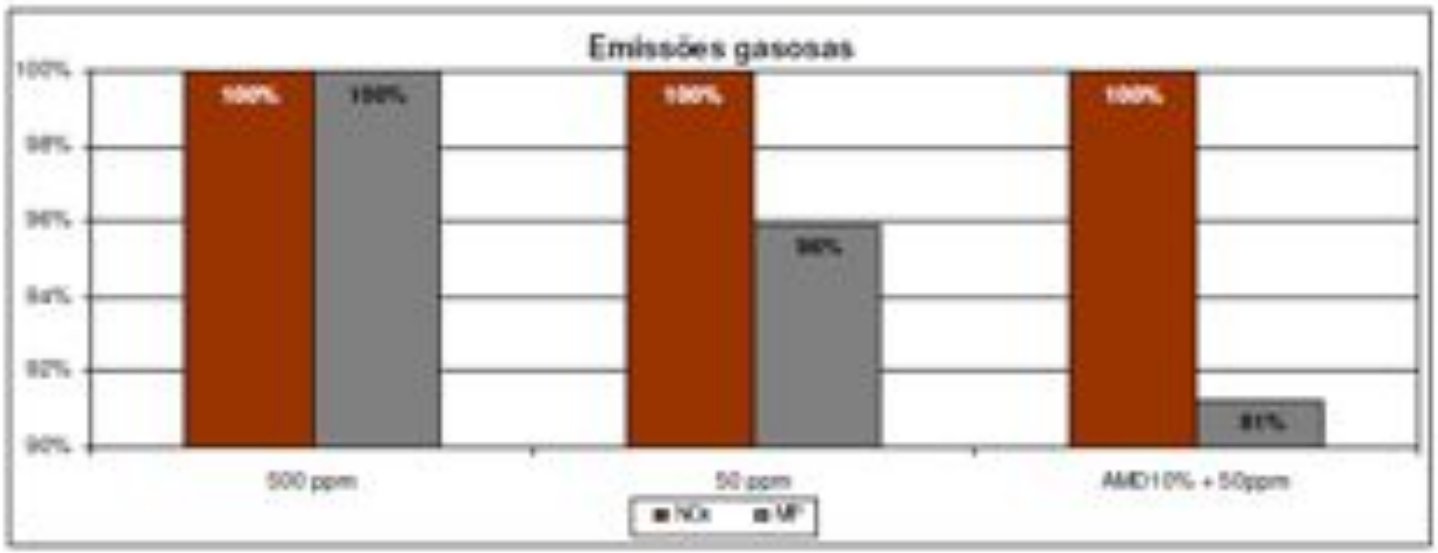
AMYRIS

Emissions on a Mercedes OM 924 engine

10% Sugar Cane Diesel + Euro III Diesel + 4% Biodiesel:

- 9% reduction in Particulate Matter emissions, when compared to 500PPM sulfur Diesel .
- No changes observed on other regulated gasses.

OM 924



Mercedes-Benz

AMYRIS

Teste de Frota São Paulo

Mercedes-Benz

AMYRIS

Santa Brígida

Teste de Frota SPTrans

Movido a Diesel de Cana

SPTrans

Frota:
- 3 10% AMD + Diesel B S50 (5% Biodiesel)
- 3 Diesel B5 S50 (5% Biodiesel) para referência

Km acumulada esperada:
- 100.000km

Parâmetros a serem monitorados:
- Consumo de combustível/óleo lubrificante
- Contaminação óleo
- Emissões (Opacidade)
- Durabilidade dos componentes de motor e veículo
- Performance dos veículos (percepção de motoristas)
- Características de manuseio do combustível (transporte, mistura & armazenamento)

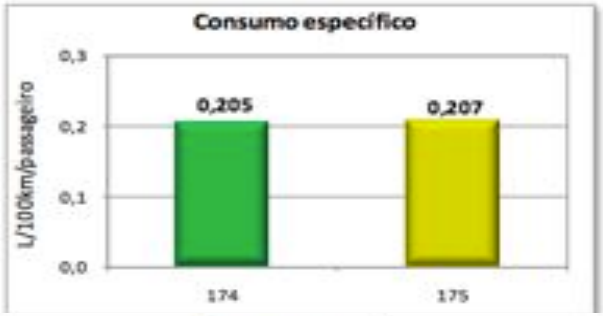
Duração prevista:
- 6 meses (Julho – Dezembro 2010)

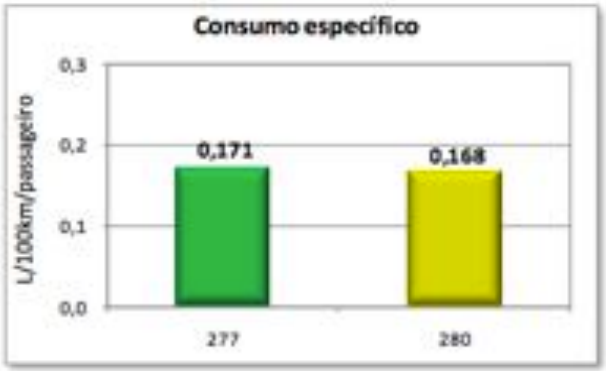
Local:
- Região Metropolitana de São Paulo em rotas representativas.

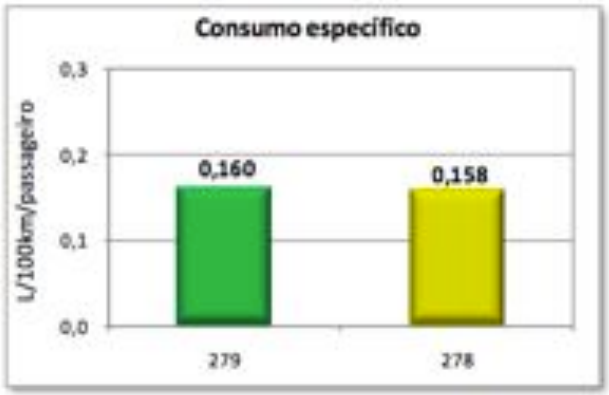
BR

AMYRIS

Teste de Frota SPTrans – 10% Diesel de Cana (resultados Intermediários = 3 meses)



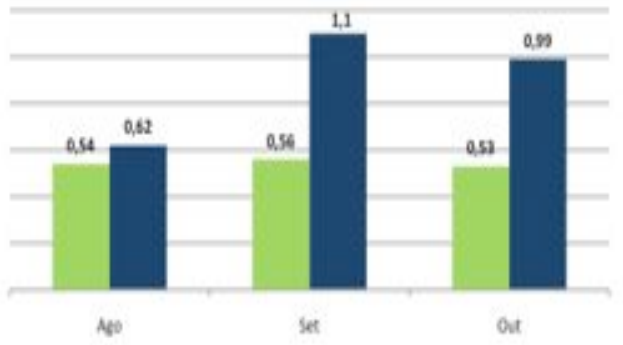


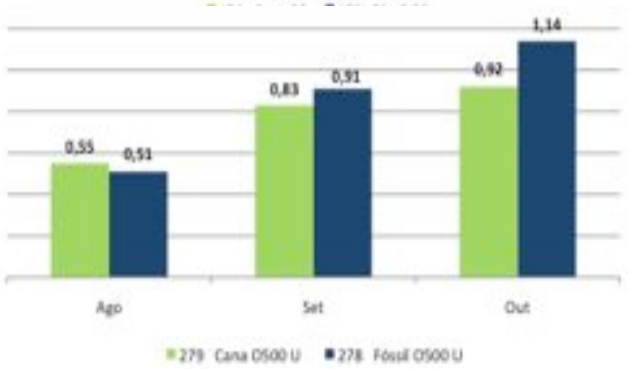


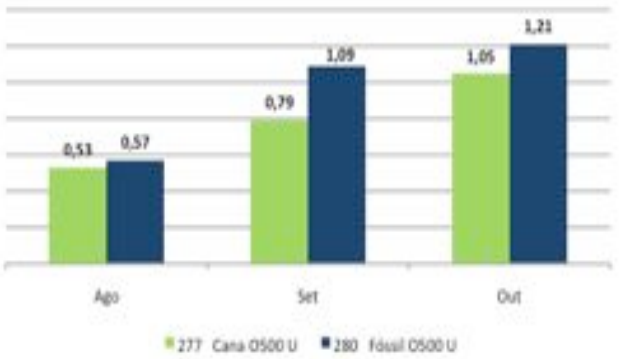
Sem impacto em Consumo

Com redução em Opacidade...

e
Operação Idêntica



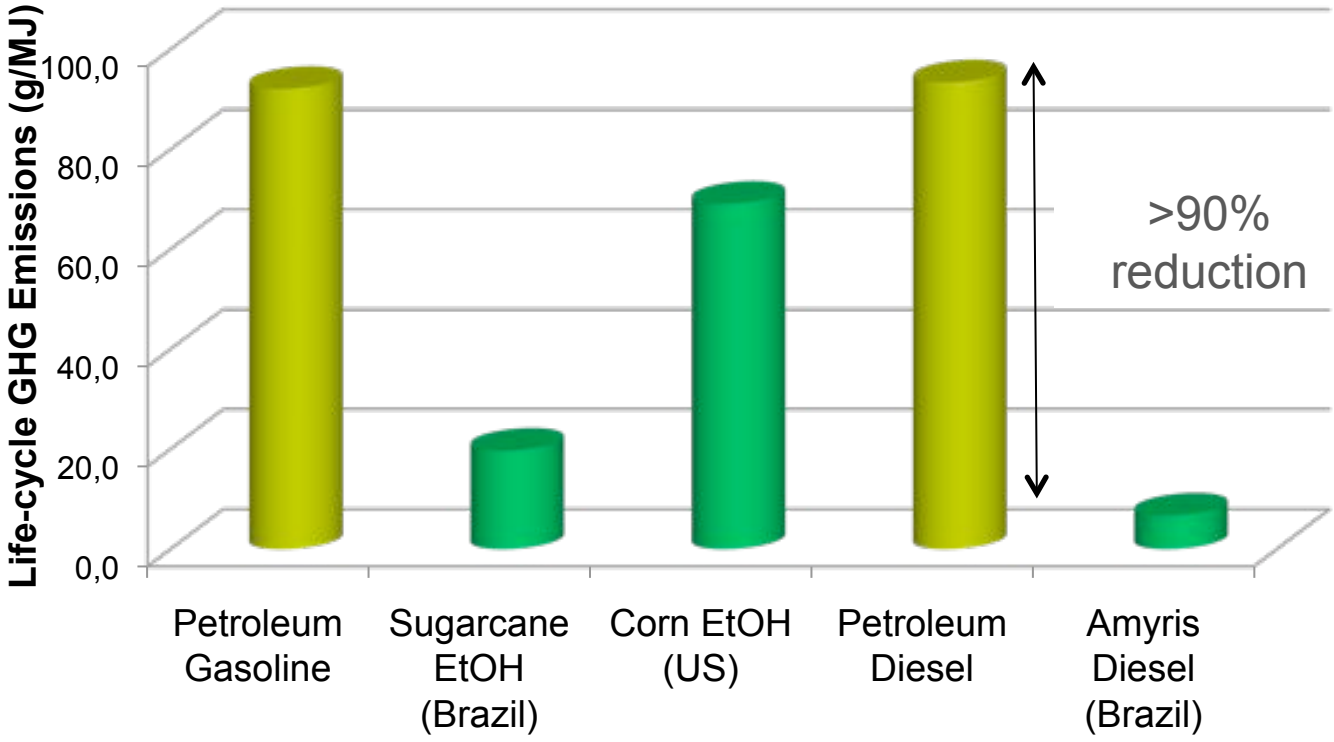




AMYRIS

“Well-to-wheel” Green House Gasses reduction...

Amyris Diesel shows a reduction in GHG’s, even vs. sugarcane ethanol…



Agenda

- Corporate Overview
- Technology
- Renewable Products – Diesel de Cana
- Manufacturing and scale-up
- Cost of Amyris Diesel

AMYRIS

Production Process – Conversion of Existing mills

The "Crush"

Fermentation
- Engineered yeast
- Modified fermenters

Purification
- Inexpensive process to remove low-level impurities

Dehydration
- This stage not required because hydrocarbons separate easily from water

Biomass Processing (Mouth) → **Fermentation (Stomach)** → **Recovery (Stomach)** → **Purification (Stomach)** → **Dehydration (Stomach)**

Cellulose Processing (Muscle)

Cogen, Steam, etc

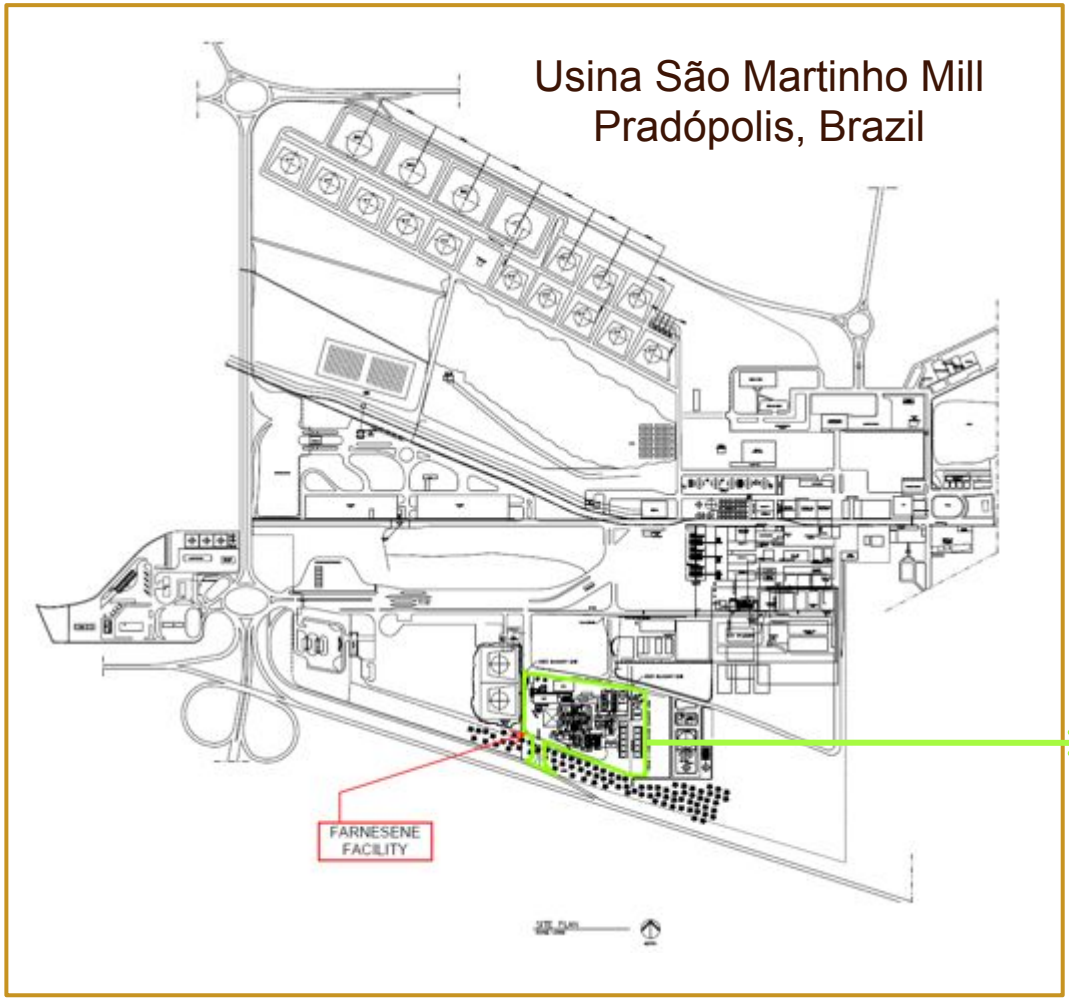
Production and Purification

Chemical Finishing

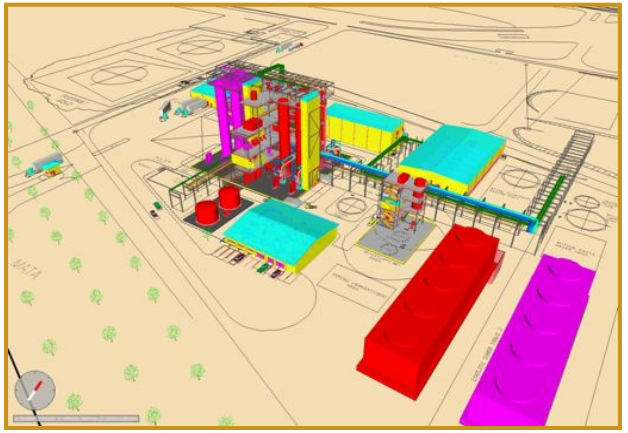
Finishing
- Chemical step converts precursor into fuel

AMYRIS

Amyris “Capital-Light” Industrial-Scale Production



“Bolt-On” Investment



AMYRIS

Production timeline

2009

R&D center inaugurated in Campinas, Brazil

Q2: Brazil pilot plant operational; selected EPCM and commenced commercial plant engineering & design

Q3: Brazil Demo Facility operational

Q4: Signed agreements with Brazilian mill owners for feedstock and production access

2010-2011

Begin conversion of **first mill to produce Amyris renewable products**

2012

First large scale production of Amyris renewable products at first mill

Continue mill conversion and expansion at other mills

2013

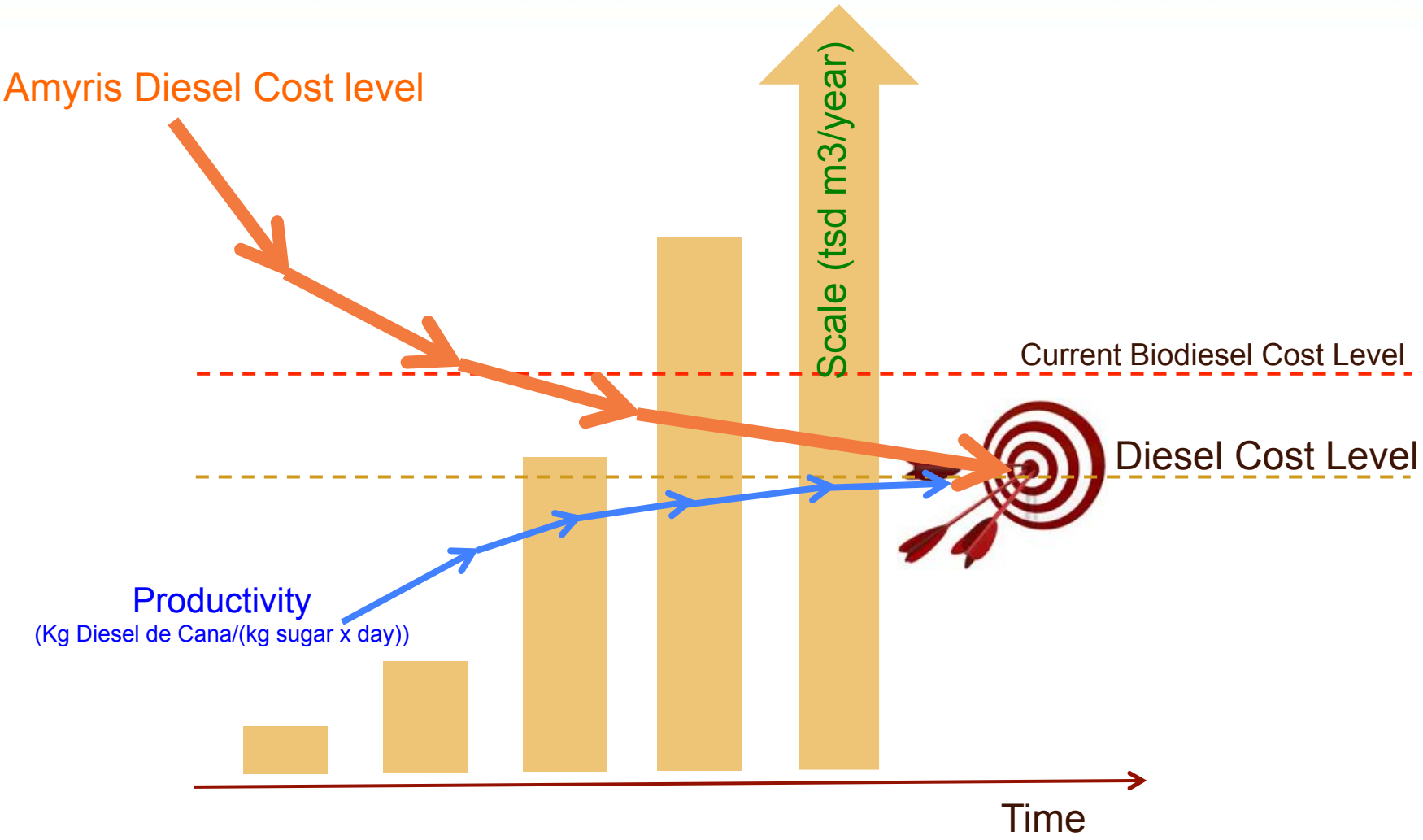
First commercial production by third party mills

Agenda

- Corporate Overview
- Technology
- Renewable Products
- Manufacturing and scale-up
- Cost of Amyris Diesel

AMYRIS

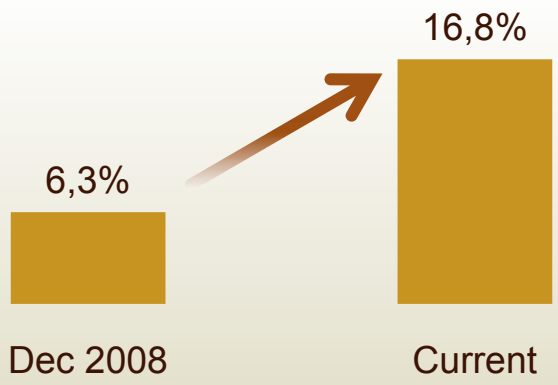
Path to competitiveness...



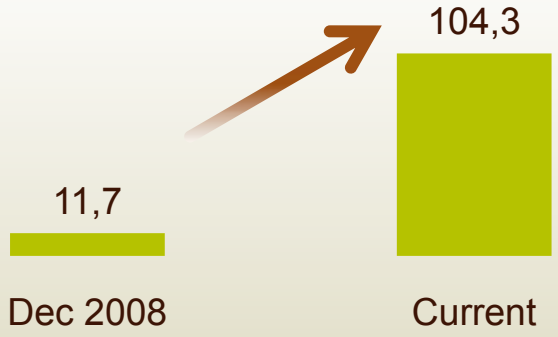
AMYRIS

A Track Record of Lower Production Costs

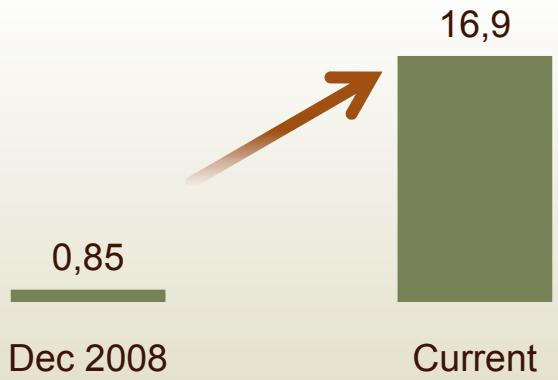
Peak Farnesene Yield



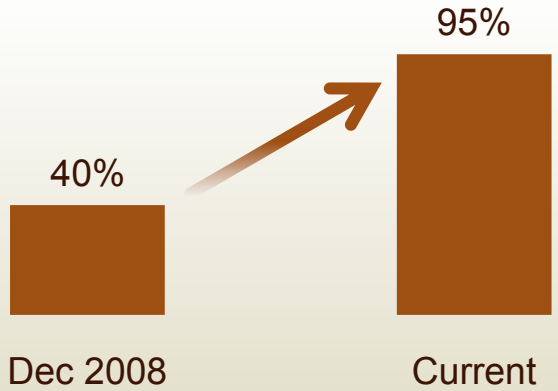
Farnesene Titer (g/L)



Farnesene Productivity (g/L/d)



Farnesene Recovery (%)



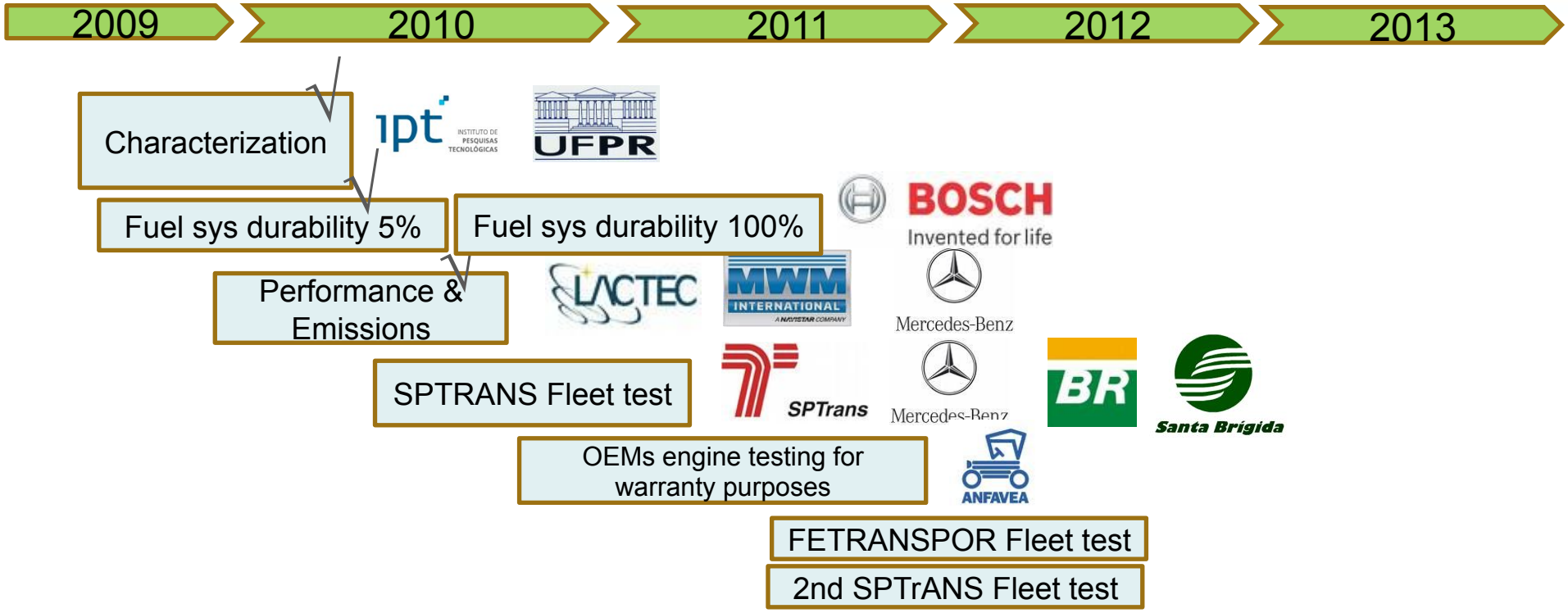
Cost dinamics similar to Ethanol - Feedstock is the main driver !

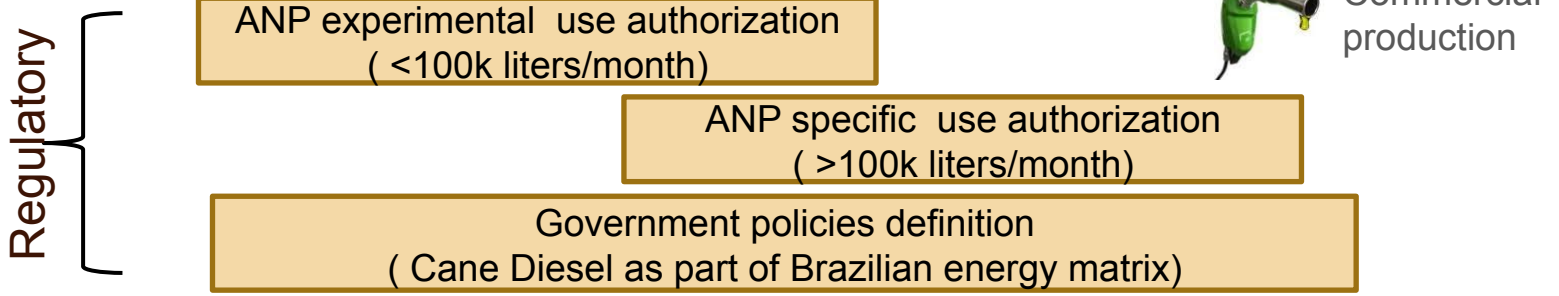
Etanol: Evolução de Preços do Açúcar e do Petróleo em Relação ao Etanol

Fonte: ESALQ, Platt's, Boletim Flextrading

AMYRIS

Brazilian AMD Certification Process





AMYRIS

Thanks !!

Adilson Liebsch
liebsch@amyris.com

Atendimento à especificação **1/3** (Puro)

Propriedade	*Unidade*	*Método*	*Legislação Brasileira**	*100% Amyris (IPT)*	*Euro III (IPT)*
Água e sedimentos	*% vol*	ASTM D1796-02	≤0,05	<0,05	< 0,05
Aspecto		CMQ-LCL-PE-083	Límpido isento de impurezas		
Cor		CMQ-LCL-PE-083, ASTM D 1796-02	Vermelho	incolor	Vermelho
Cinza	*% mass*	ASTM D482-07	≤ 0,01	<0,01	< 0,01
Corrosão	*3hr at 50°C*	ASTM D130-04E1	≤ 1	1a	1a
Destilação	*°C*	ASTM D86-07A			
50%			245-310	245	272
85%			≤360	245	320
Enxofre total	*mg/kg*	ASTM D5453-06	≤ 500/2000	< 10	177,5 ± 2,1
Índice de Cetano		ASTM D4737-04		84	56
		ASTM D976			
Massa específica	*20C kg/m³*	ASTM D4052-96(02)e1	820-865	768,7 ± 0,07	831,9
	15.56C API	ASTM D4052			
Ponto de fulgor	*°C*	ASTM D93-07	≥ *38*	103,5 ± 0,7	64,5 ± 0,7
Viscosidade cinemática a 40°C	*mm²/s*	ASTM D445-06	2-5	2,31	3,14
Numero de cetano		ASTM D 613	≥42	53,2 ± 0,9	52,5 ± 0,9
Lubricidade	*μ*	ASTM D6079	≤ 460	332 ± 63	281 ± 63

** Resolução ANP Nº 15, de 17.7.2006 - DOU 19.7.2006*

Atendimento à especificação **2/3 (Misturas)**

Propriedade	Unidade	Método	*Legislação Brasileira**	5% AMD/95% Euro III (IPT)	20% AMD/80% Euro III	5% AMD/5% BioD/90% Euro III
Água e sedimentos	% vol	ASTM D1796-02	≤0,05	<0,05	< 0,05	<0,05
Aspecto		CMQ-LCL-PE-083	Límpido isento de impurezas			
Cor		CMQ-LCL-PE-083, ASTM D 1796-02	Vermelho	Vermelho	Vermelho	Vermelho
Cinza	% mass	ASTM D482-07	≤ 0,01	<0,01	< 0,01	<0,01
Corrosão	3hr at 50°C	ASTM D130-04E1	≤ 1	1a	1a	1a
Destilação	°C	ASTM D86-07A				
50%			245-310	267	262	272
85%			≤360	314	312	322
Enxofre total	mg/kg	ASTM D5453-06	≤ 500/2000	160,5 ± 6,4	151 ±1,4	166,5 ± 0,7
Índice de Cetano		ASTM D4737-04		56	59	56
		ASTM D976				
Massa específica	20C kg/m^3	ASTM D4052-96(02)e1	820-865	828,8	819,4	830,8
	15.56C API	ASTM D4052				
Ponto de fulgor	°C	ASTM D93-07	≥ 38	66,5 ± 0,7	72,5 ± 0,7	70
Viscosidade cinemática a 40°C	mm^2/s	ASTM D445-06	2-5	3,09 ± 0,01	2,95 ± 0,01	3,16 ± 0,01
Numero de cetano		ASTM D 613	≥42	52 ± 0,9	51,9 ± 0,9	52,3 ± 0,9
Lubricidade	μ	ASTM D6079	≤ 460	343 ± 63	338 ± 63	177 ± 63

** Resolução ANP Nº 15, de 17.7.2006 - DOU 19.7.2006*

Atendimento à especificação 3/3 **(Misturas)**

Propriedade	Unidade	*Legislação Brasileira**	5% AMD/95% Euro III	10%AMD/90% Diesel B5 S50	20% AMD/80% Euro III
Água e sedimentos	% vol	≤ 0,05	<0,05	0,05	< 0,05
Aspecto		Límpido isento de impurezas	n.a.	Límpido isento de impurezas	n.a.
Cor		Vermelho	Vermelho	2,0 (Vermelho)	Vermelho
Cinza	% mass	≤ 0,01	<0,01	< 0,01	< 0,01
Corrosão	3hr at 50°C	≤ 1	1a	1a	1a
Destilação	°C				
50%		245-310	287	270	282
85%		≤ 360	314	340	312
Enxofre total	mg/kg	≤ 500/2000	160,5 ± 6,4	n.a.	151 ±1,4
		máx. 50	n.a.	15	n.a.
Número de Cetano Derivado**			50	50	51,3
Massa específica	20C kg/m³	820-865	828,8	833	819,4
Ponto de fulgor	°C	≥ 38	66,5 ± 0,7	71	72,5 ± 0,7
Viscosidade cinemática a 40°C	mm²/s	2-5	3,09 ± 0,01	2,92	2,95 ± 0,01
Número de cetano		≥ 42	52 ± 0,9	51,9 ± 4,3	51,9 ± 0,9
Lubricidade	μ	≤ 460	343 ± 63	140	338 ± 63

** Resolução ANP N° 15, de 17.7.2006 - DOU 19.7.2006*

***Dados Lacaut*