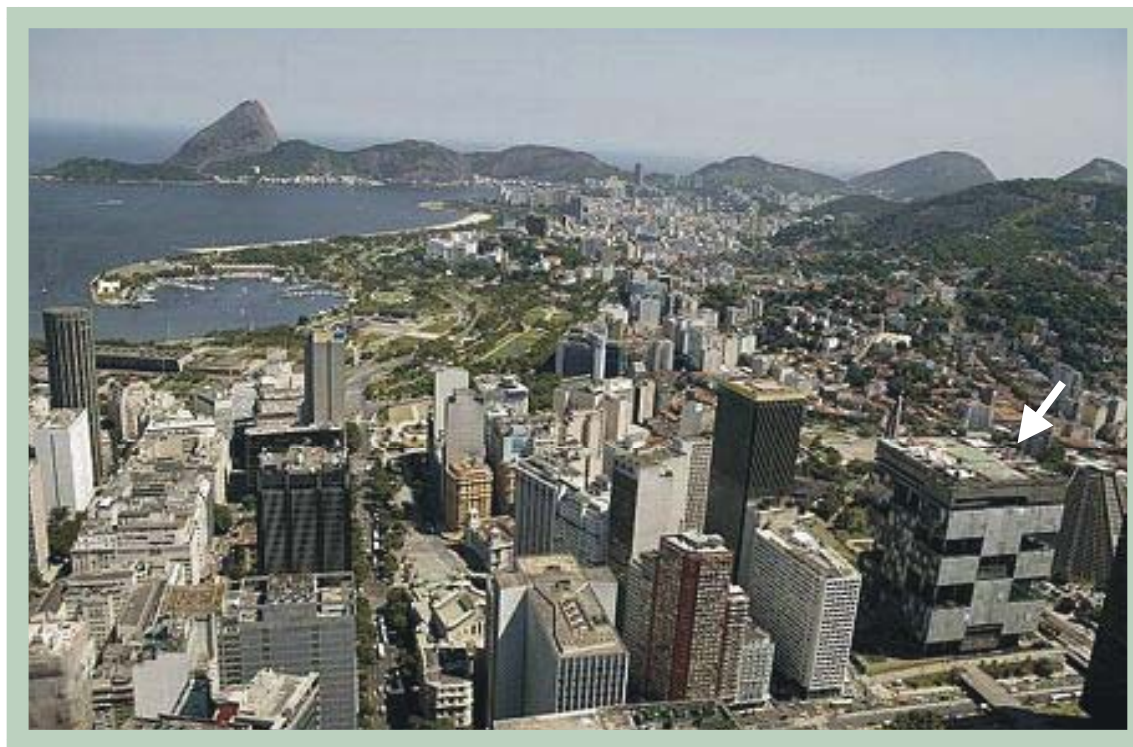


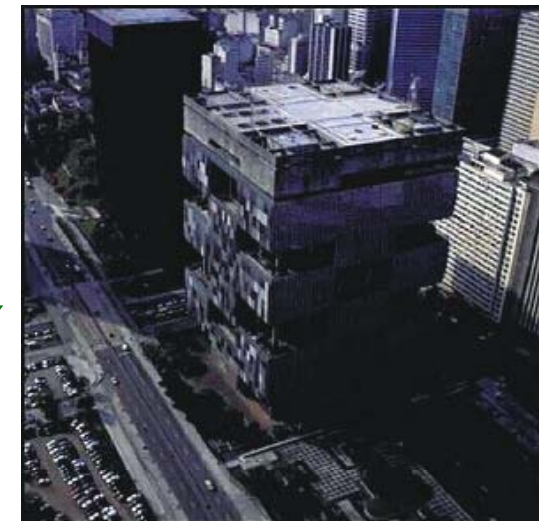
Renewable Energies at PETROBRAS

9th LAMNET – Ribeirão Preto, Sept 15-16 th 2004



Marcia Leite Drachmann - PETROBRAS – Gas & Energy
Energy Conservation / Renewable Energies

PETROBRAS HEADQUARTERS - RIO DE JANEIRO - BRAZIL -



Talk plan:

- **PETROBRAS in figures**
- **Energy overview of Petrobras and Brazil**
- **PETROBRAS Strategics for Renewables**
- **PETROBRAS' plans / accomplishments in Renewables**

- **Conclusions**

PETROBRAS in Figures

PRODUCTION PLATAFORMS

98 (68 fixed; 30 floating)

DAILY PRODUCTION

1,701 million barrels per day - bpd (oil and NG)

53 million m³ NG

REFINARIES

16

REFINING CAPACITY

1,732 million barrels per day – bpd

PIPELINES

27.120 km

SHIP FLEET

97 (54 Petrobras' property)

SERVICE STATIONS

5.074

FERTILIZERS (2 Factories)

2.141 metric tons ammonia, 2.437 metric tons ureia

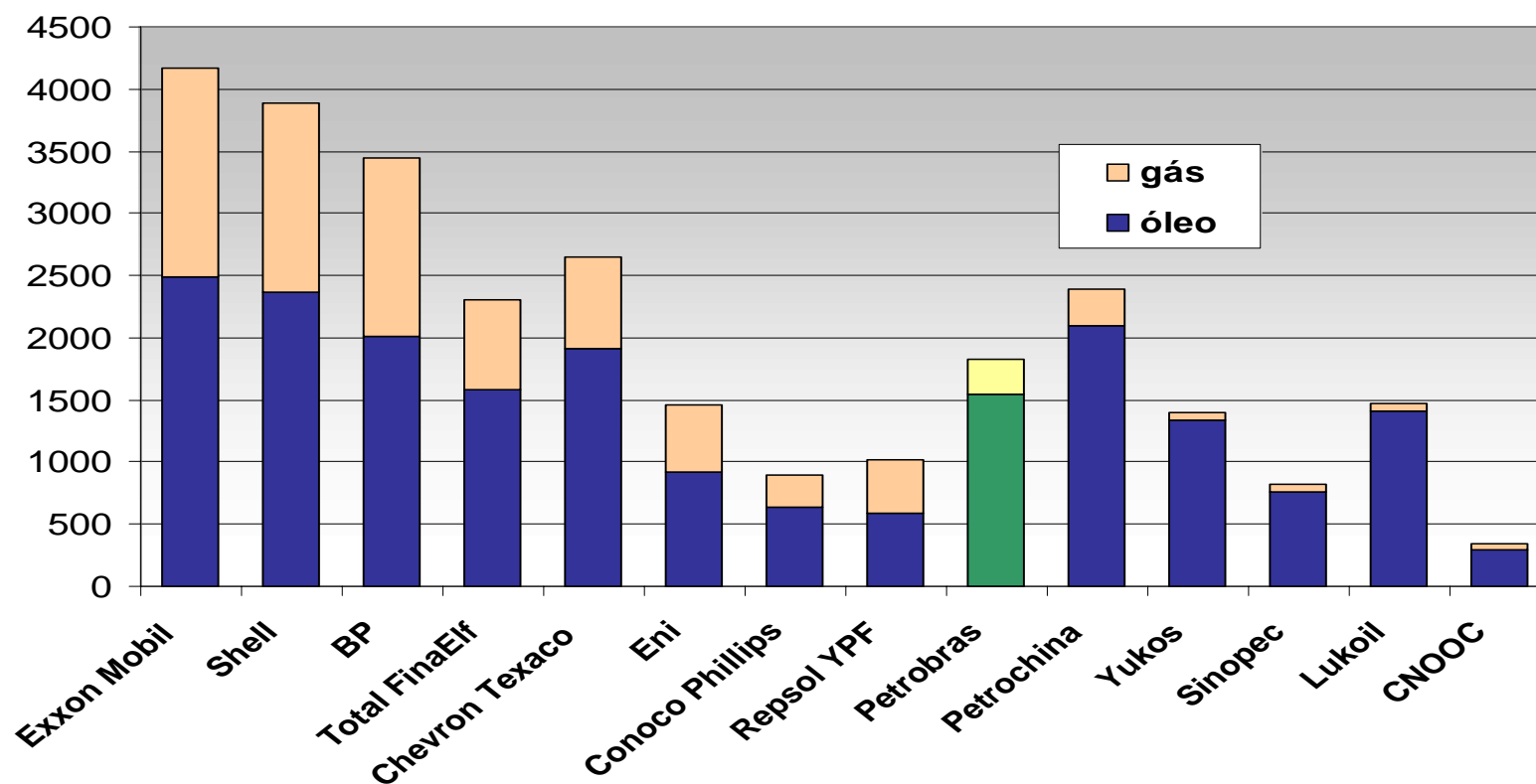


PETROBRAS – R & D Center – CENPES

1300 employees (1/2 university level)



Oil & Gas Production (mboed)

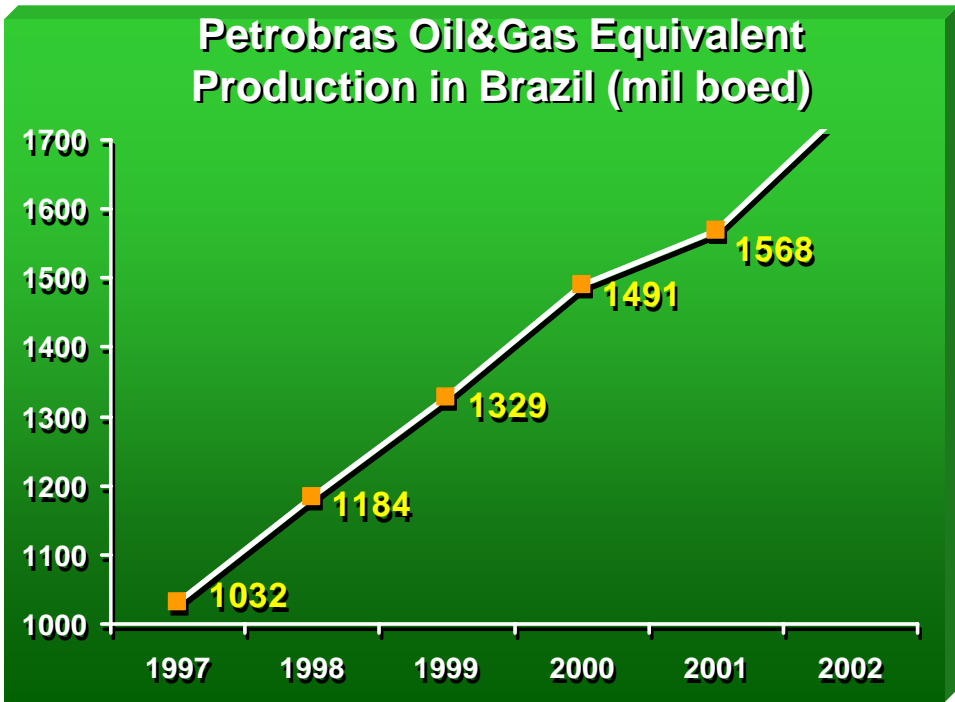
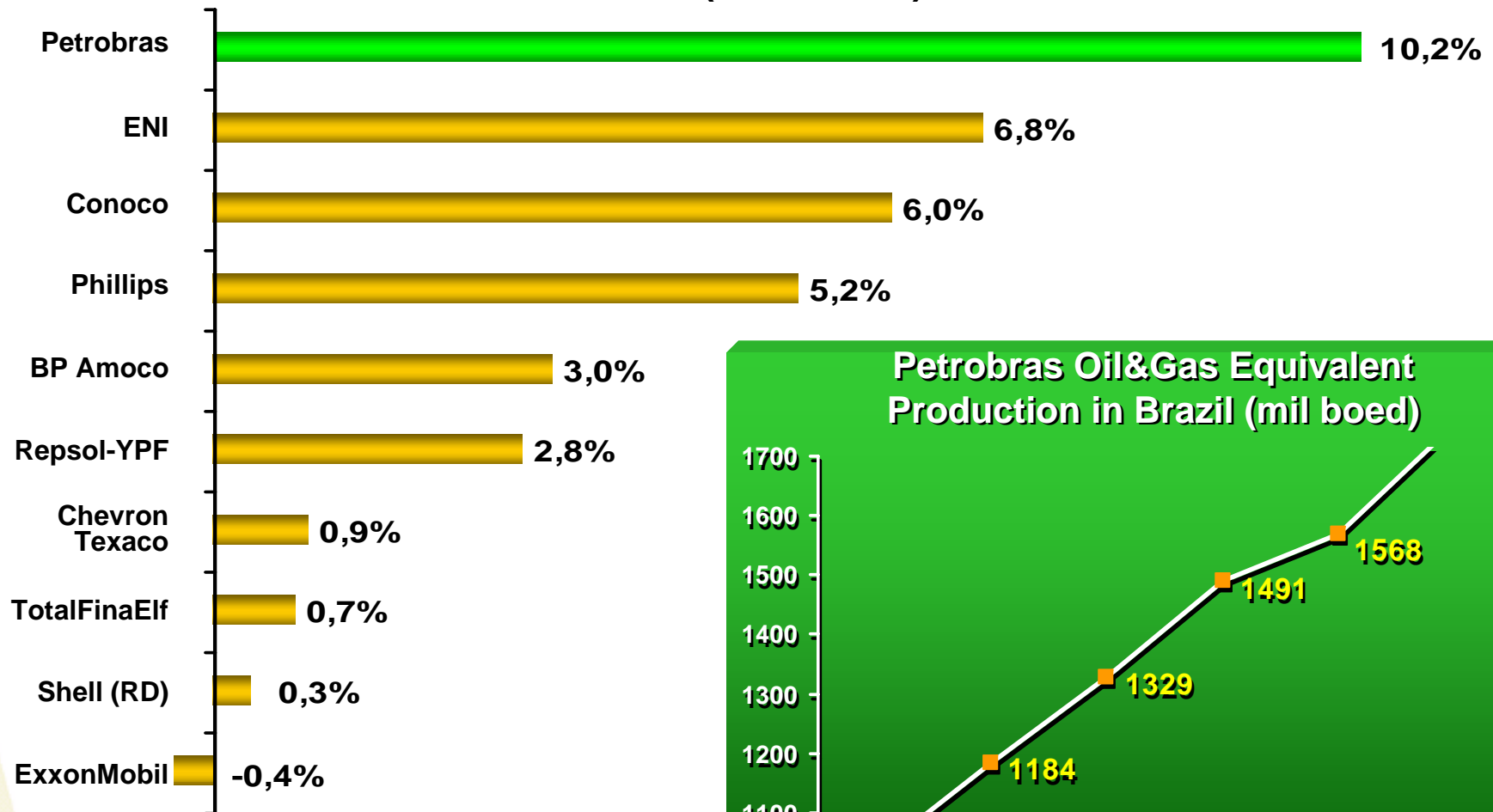


Majors e Petrobras: average production jan-set/2002
 Emerging: 2002 prediction, Morgan Stanley

Fonte: PIW, dados de 2001

Petrobras leading oil production growth

(1996-2001)



Source: Evaluate Energy

PROFITABILITY AND SOCIAL RESPONSIBILITY

“Business committed with sustainable development”

“Improvement of Energy Efficiency linked to mitigation of climate changes”

PETROBRAS MAIN LINES OF ACTION FOR RENEWABLES **/ ENERGY CONSERVATION**

1- Portfolio on Renewable Energies

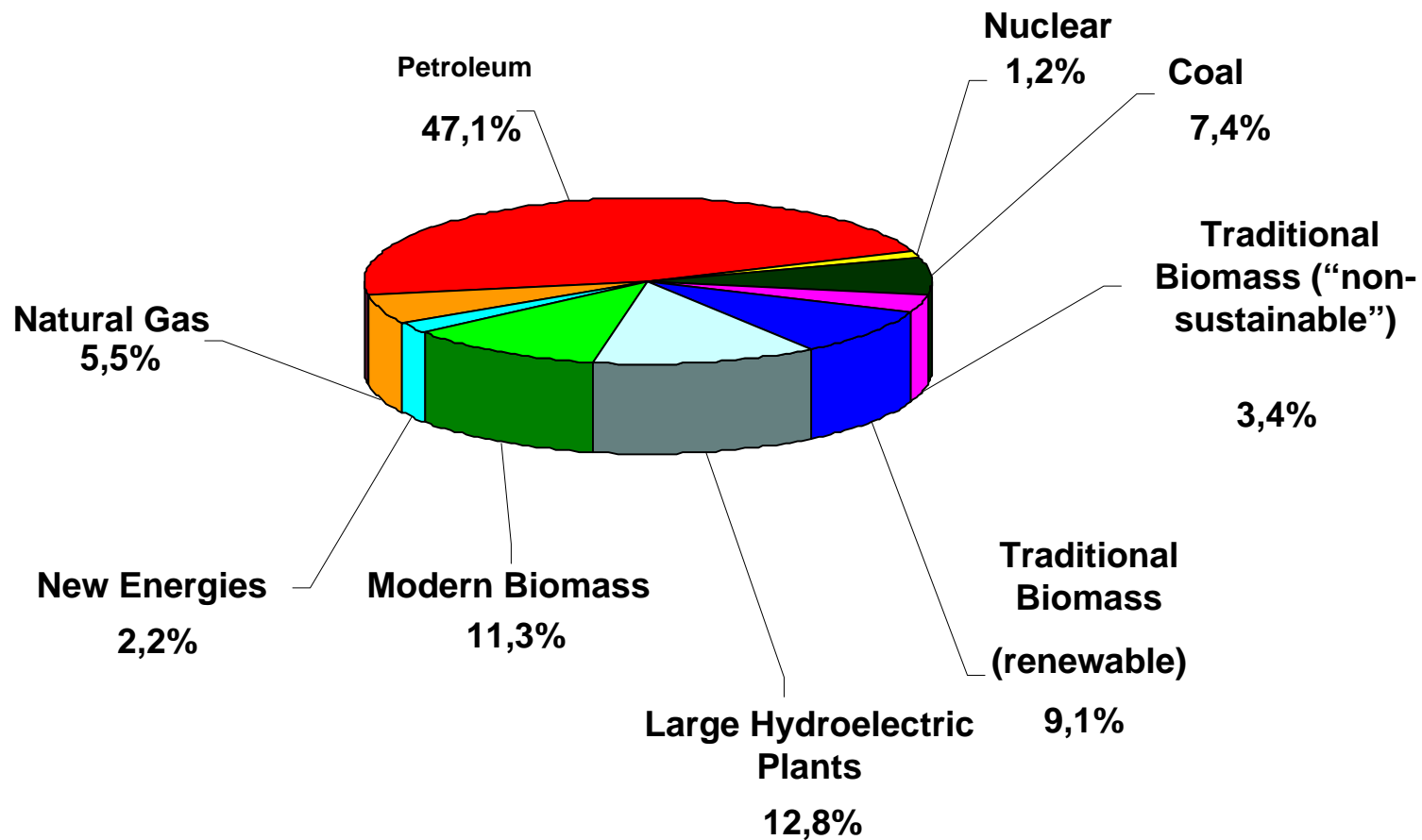
2- Large participation on “Pro- Alcool”, world’s largest renewable liquid fuel program (ethanol from sugar cane);

3- Energy Efficiency Internal Program

4- Rational Use of Fossile Fuels Programs

RENEWABLE ENERGIES

BRAZIL- ENERGY PROFILE

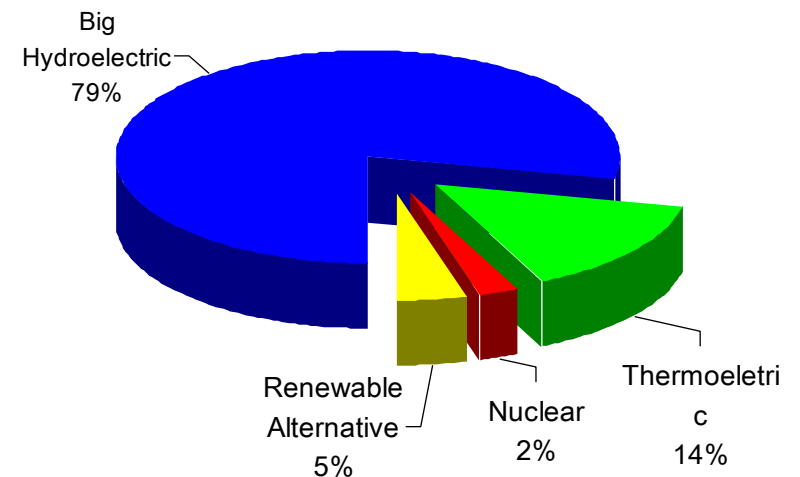


Sustainable Renewable energies:
35,4%

Fonte: MME

BRAZIL - INSTALLED CAPACITY (grid / off-grid)

❖ Hydroelectric (> 30 MW)	64.192 MW
❖ Thermolectric (*)	11.998 MW
❖ Nuclear	2.007 MW
❖ Wind	22 MW
❖ PCH (< 30MW)	1.740 MW
❖ Solar PV (PRODEEM)	5.8 MW
❖ Biomass (**)	1.972 MW
❖ Imports	8.000 MW



(*) NG: 5.248 MW; Petroleum: 5.288 MW; Mineral coal: 1.461 MW

(**) 57% Sugar- ethanol sector

Fonte: MME

CORPORATIVE STRATEGIES FOR IMPLEMENTATION OF RENEWABLE ENERGIES IN PETROBRAS

- 0,5% of Petrobras investments in Renewables
(~ US\$ 50,000,000.00 in 2004)**
- Investment Return Tax < conventional (O&G) -**
- Target: 10% participation of renewables in Petrobras
Electricity consumption up to 2010.**

RENEWABLE ENERGIES IN PETROBRAS

- **THERMO-SOLAR**
- **PHOTOVOLTAIC**
- **WIND**
- **BIOMASS**
- **BIO-FUELS (ETHANOL , BIODIESEL)**

THERMO-SOLAR

WATER HEATING IN REFINARIES VESTIARIES & KITCHENS

Replacement of electric systems by thermo-solar

Potential : 2 MW



Installed / under construction:
1345 m² pannels, 85000 liters /day

- BR Service Stations (2.7 MW) – potential

Internal / external “green” culture / image

PV in PETROBRAS

PV systems total capacity 100 kW :

- **Uninhabited oil platforms: process control, communication;**
- **Oil pumping in low-production wells in remote areas NE**
- **Comparison between alternative PV thin film technologies – 45 kW - CENPES, PETROBRAS R&D Center, largest installed capacity in Brazil;**



WIND ENERGY IN PETROBRAS

- **Pilot Plant Macau (RN) - 1,8MW Oper. since Jan 04**
- **2 X 3 MW - Environmental licensing stage**

**NEGOTIATION OF PARTNERSHIPS FOR PETROBRAS
LARGE PARTICIPATION IN PROINFA – wind energy**



BIO-ENERGIES IN PETROBRAS

BIO-ENERGIES IN PETROBRAS

- **BIO-FUELS (ETHANOL , BIODIESEL)**

- **BIOMASS (SUGAR CANE BAGASSE, BIOGAS)**

BIODIESEL IN BRAZIL

- **High interest from Brazilian Government for implementing biodiesel in large scale;**
- **B2 (2% biodiesel in fossil diesel to be authorized Jan 2005)**
- **Petrobras is planning large participation in biodiesel chain, including: production, distribution , transport, commercialization**

BIODIESEL IN BRAZIL

- **Extensive planted areas /mild climate**
- **Improvement of Diesel performance (ketane / lubricity)**
- **Compliance with Kyoto protocol (Carbon credits).**
- **Decentralized production (mini-plants).**
- **Social development / Job generation in rural zones .**

•Infra-Estrutura Logística da Petrobras:

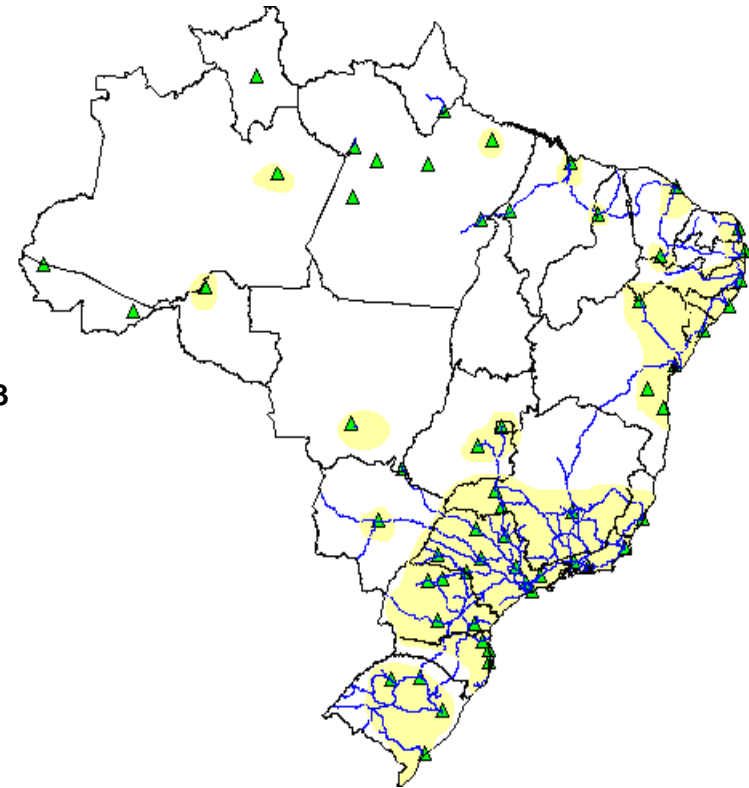
- Representação no Japão, Estados Unidos, Reino Unido, Cingapura, Angola, Nigéria, Argentina, Bolívia, Colômbia

•Infra-Estrutura Logística de Transporte:

- 20 Terminais terrestres;
- 23 Terminais marítimos e em rios;
- 9.289 km de dutos;
- Capacidade de estocagem: 9,8 milhões m³
- Manuseia anualmente 250 milhões de m³;

•Infra-Estrutura Logística de Distribuição:

- 51 Bases de Distribuição Próprias;
- 9 Bases de Distribuição em Pool;
- 11 Armazenagens em Bases de Terceiros;
- 8 Centros Coletores de Álcool;
- Terminal Ferroviário de Paulínia;



Biodiesel - Potential of Brazilian seeds

Type	Productivity (kg/ha)	Oil content (%)	Oil production (kg/ha.a)
Babaçu	450	62	279
Castor bean	1500	50	750
Sesame	900	48	432
Rapeseed	1700	39	663
Sun flower	1300	38	494
Palm tree	10 000	20	2 000
Soy bean	2200	17	374
Cotton		15	150

Biodiesel – Social / Environmental aspects

Castor Biodiesel

		B2	B5	B10
Biodiesel Volume	(milhões m ³)	0,8	2,0	4,0
Seed consumption	(milhões ton.)	1,44	3,6	7,2
Cultivated area	(milhões ha)	0,48	1,20	2,00
Rural Jobs		240.000	600.000	1.200.000
Imports reduction*	(million US\$)	280	700	1.400
CO₂ reduction	(million tons)	9,6	24	48

BIODIESEL

Castor Paraguaçu – Plantation in Monteiro (PB)



Petrobras Process



Catalyst

Seeds

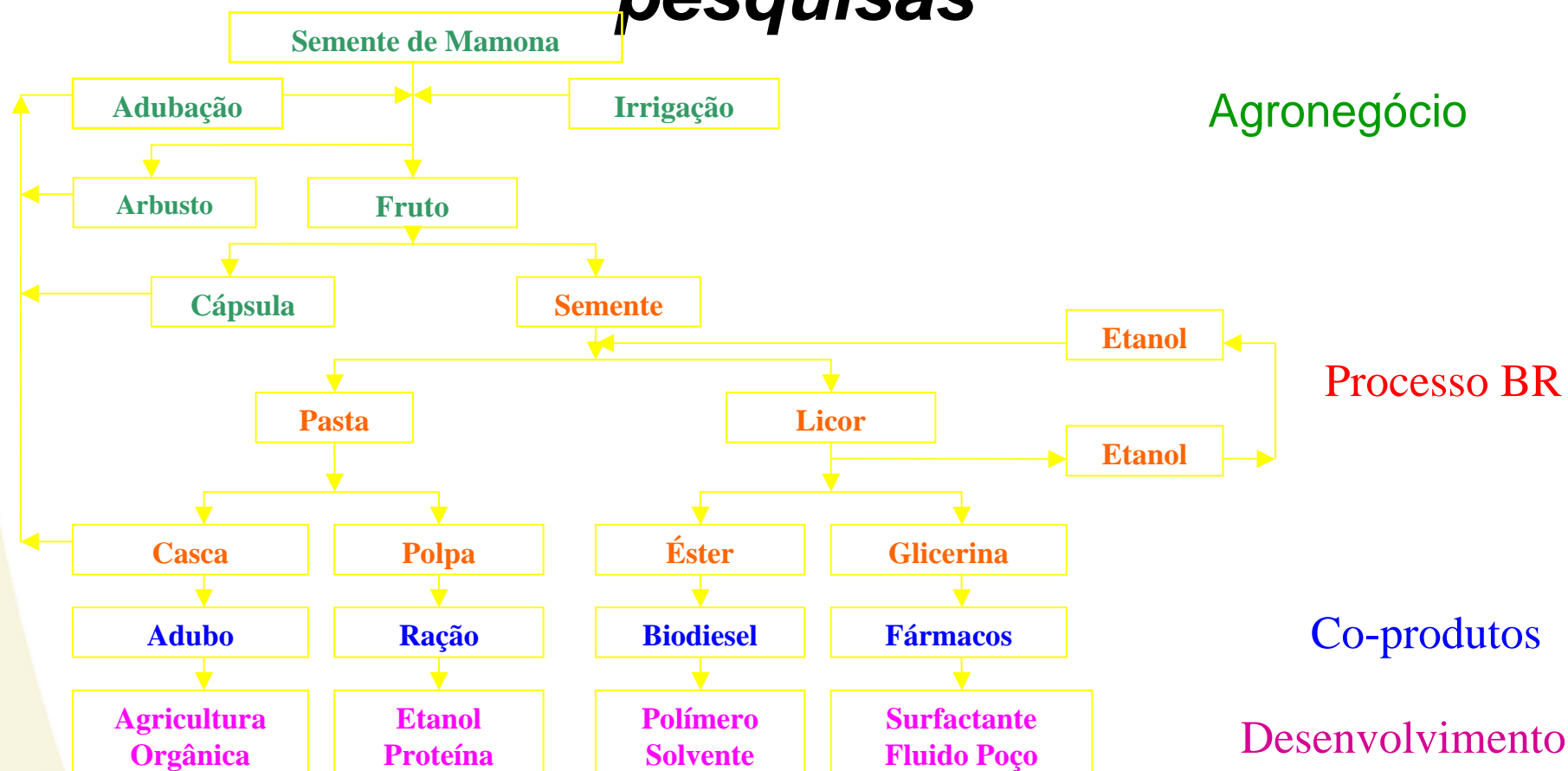
Ethanol

Petrobras Process: Co-products



Cápsula Glicerina Éster Casca Polpa Etanol

Processo Petrobras: Fluxograma da pesquisas



- **Biodiesel from seed is more attractive economically than classical (no oil extraction/ refining , valorization of co-products)**
- **Technology requires further development, specially concerning glycerol / ethanol separation / specification**

Ethanol

Ethanol Economical Aspects

- **Brazil has lowest production cost:**
 - **Brazil: US\$ 0,19/liter**
 - **USA: US\$ 0,33/liter**
 - **Europe: US\$ 0,56/liter**

Ethanol Economical Aspects

- Brazil has PRO-ALCOOL largest worldwide liquid renewable fuel program; 25% in gasoline as octane booster, **LARGE PARTICIPATION OF PETROBRAS BLENDING / DISTRIBUTION / COMMERCIALIZATION**

Environmental pressures are forcing countries worldwide to use renewable fuels : Europe, Japan,USA, etc are potential importers of Brazilian ethanol (octane booster in gasoline)

Ethanol Figures in Brazil (2002)

- **Production: 14 million m³/year**
- **Installed capacity - 16 million m³/year**
- **World ethanol production: 33 million m³/year**
 - **Brasil, 37%; EUA, 20%; China, 9%; other, 34%.**

Economical aspects

- **Ethanol fueled cars:**

1986: **76%** ⇒ 1998: **0,1%** ⇒ 2001: **1%**

Reasons:

- **Supply shortage (competes with sugar)**
- **Price increase as compared to gasoline**



2003: Introduction of flex fuel engines (VW, GM, Fiat) – 6.9% market.

Bosch: 500 000 cars /year by 2005 (30% market)

Jan 2004: 14,9% VW: end 2004: 40% sales - flexfuel

Biomass for EE

PROINFA

Governmental program to incentive electricity generation from renewables sources

Licenses (Operation by December 2006):

1100 MW Wind Power

1100 MW Biomass

1100 MW Hydropower < 30 MW

**PETROBRAS NEGOTIATES PARTNERSHIPS FOR
LARGE PARTICIPATION IN PROINFA**

BIOMASS ENERGY IN PETROBRAS

- **NEGOTIATION OF PARTNERSHIPS FOR PETROBRAS
LARGE PARTICIPATION IN PROINFA - Biomass**

Typical case: enlargement / modernization of sugar-ethanol plants (~20 MW), increasing electricity production for auto-consumption / commercialization of exceeding energy - Some case dual fuel bagasse – natural, generating all year round.

Other possibilities: **GASIFICATION**; etc

BIOMASS ENERGY IN PETROBRAS

CONCLUSIONS

**PETROBRAS IS OPEN TO STUDY
PARTNERSHIPS IN LARGE RENEWABLES
/ BIO –ENERGIES ENTERPRISES,
IN AGREEMENT WITH ITS COMMITMENT TO
SOCIAL RESPONSIBILITY AND
SUSTAINABLE DEVELOPMENT**

BIOMASS ENERGY IN PETROBRAS

THANK YOU!

Márcia Leite Drachmann

Petrobras – Gas & Energy – Renewables

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