Options for International Support for Low-Carbon Transportation Policies in Brazil

Haroldo Machado Filho

Two Main Challenges

- Developing countries' transportation system faces two main different challenges, both at different scales.
- The first challenge is to improve the infrastructure of the transportation system throughout the country. This could ease the integration, expansion and improvement of the production system in order to facilitate a cooperative development effort among regions. In this regard, all transportation systems must be significantly improved and articulated in light of this need.
- The second main challenge related to the transportation sector is to ensure an effective transportation system in urban areas, especially in big cities.

Transport infra-structure (freight)

- Road transportation is the main transport system in Brazil. In the 20th century, Brazilian transportation policy overemphasised the importance of roads (often more expensive than other modes of transport and are usually less energy efficient), which resulted in 2005 in 58% of freight transportation being pursued on roads (measured in t/km).
- Prioritisation of roadways was implemented at the expense of railway investments. Although, railways represent the second most important transportation system in Brazil, in 2000, the country's total railway network was only 28,500 km.
- Country has abundant water resources and possesses a vast and dense hydrological network. However, vast waterways in most of the hinterland have not been fully exploited for waterborne transport.
- Transportation sector (main bottleneck of economic growth) will require a significant level of investment in coming years.
- It is fundamental to promote multi-modal investment alternatives.

Urban Transportation

- Big cities suffer from air pollution, congestion, noise and accidents caused by intense traffic.
- Governments have difficulties in providing the necessary road network infrastructure for the incredibly fast increase in the number of both light and heavy vehicles.
- Country's rapid motorisation - an annual average of more than 2 million new vehicles in the streets and roads every year (over the last 5 years).
- Public means of transportation usually are far from adequate.
- As an emerging developing country, Brazilian local governments have difficulties in finding the right balance between the level of funds needed to invest in public transportation with the need to meet their pressing social and economic needs.

Transportation Policies in Brazil

Policy

- the National Plan on Logistics and Transport, which is a policy that can promote a significant change in the modal split in the country;
- Pro-Transport, aiming at funding public transportation in urban areas.

Co-benefits

- reduce dependence on oil
- reduce local air pollutants
- reduce traffic jams, noise and accidents

Challenges

- leverage funds to provide more efficient and integrated public transport systems and their related infrastructure at the local level.

Metric

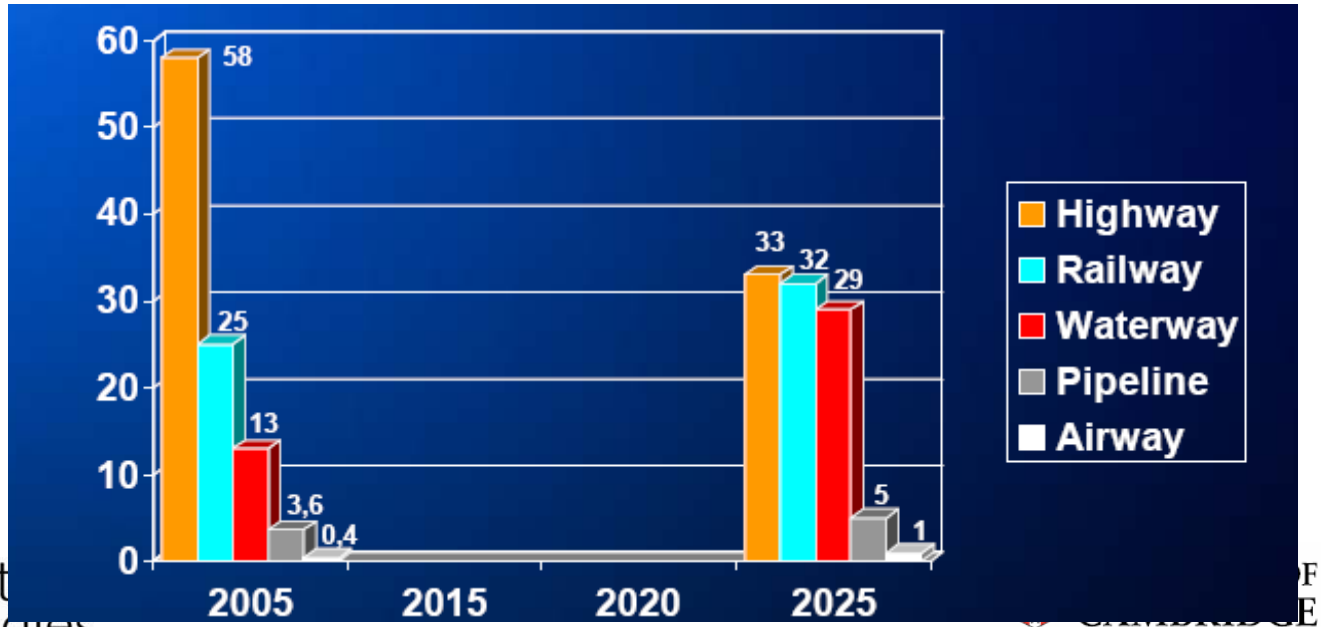
- beyond minus 18% of the BAU scenario (CCAP study, 2005)

Scope of international cooperation

- extend the network of long-distance passenger railway running on electricity
- concession
- CDM (including programmatic CDM)
- Positive Incentives (Bali Plan of Action – AWG – LCA)

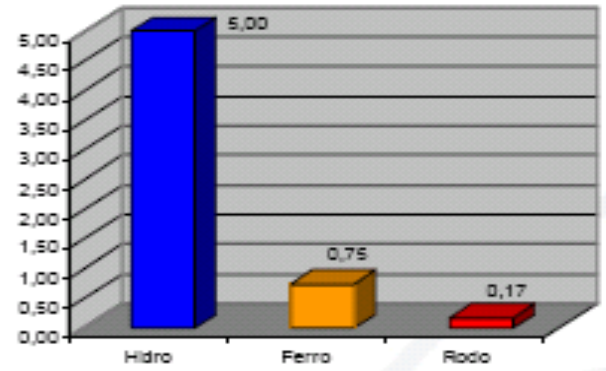
National Plan on Logistics and Transport

- Current and future freight transportation mix
- Indicators to be refined based on national circumstances (88% of electric power generation from hydro)
- Energy intensity of road freight (in MJ/t-km) is as much as ten times that for shipping or rail

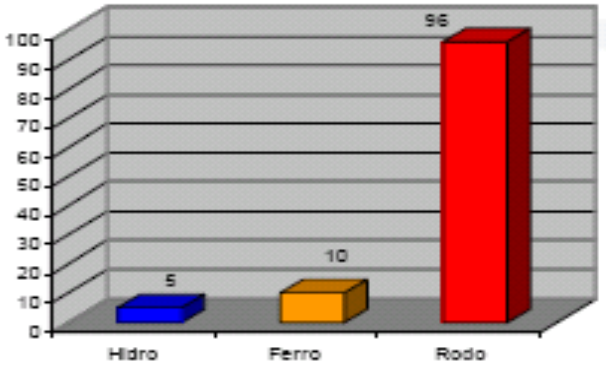


Aspectos Ambientais Relevantes

EFICIÊNCIA ENERGÉTICA: CARGA / POTÊNCIA (t / HP)



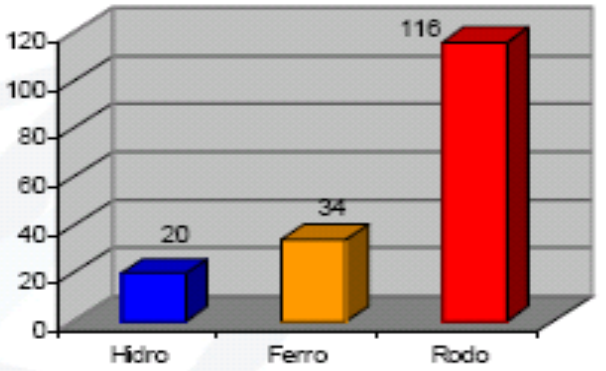
CONSUMO DE COMBUSTÍVEL: (LITROS / 1.000 TKU)



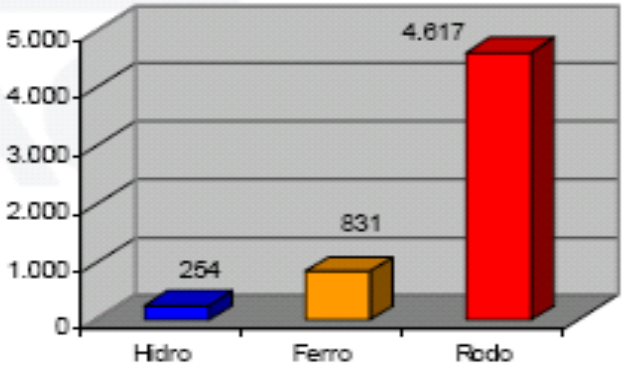
Fonte: Ministério dos Transportes - 1997

EMISSÃO DE POLUENTES:

CO_2 (kg/1.000 tku)



NOx (g/1.000 tku)



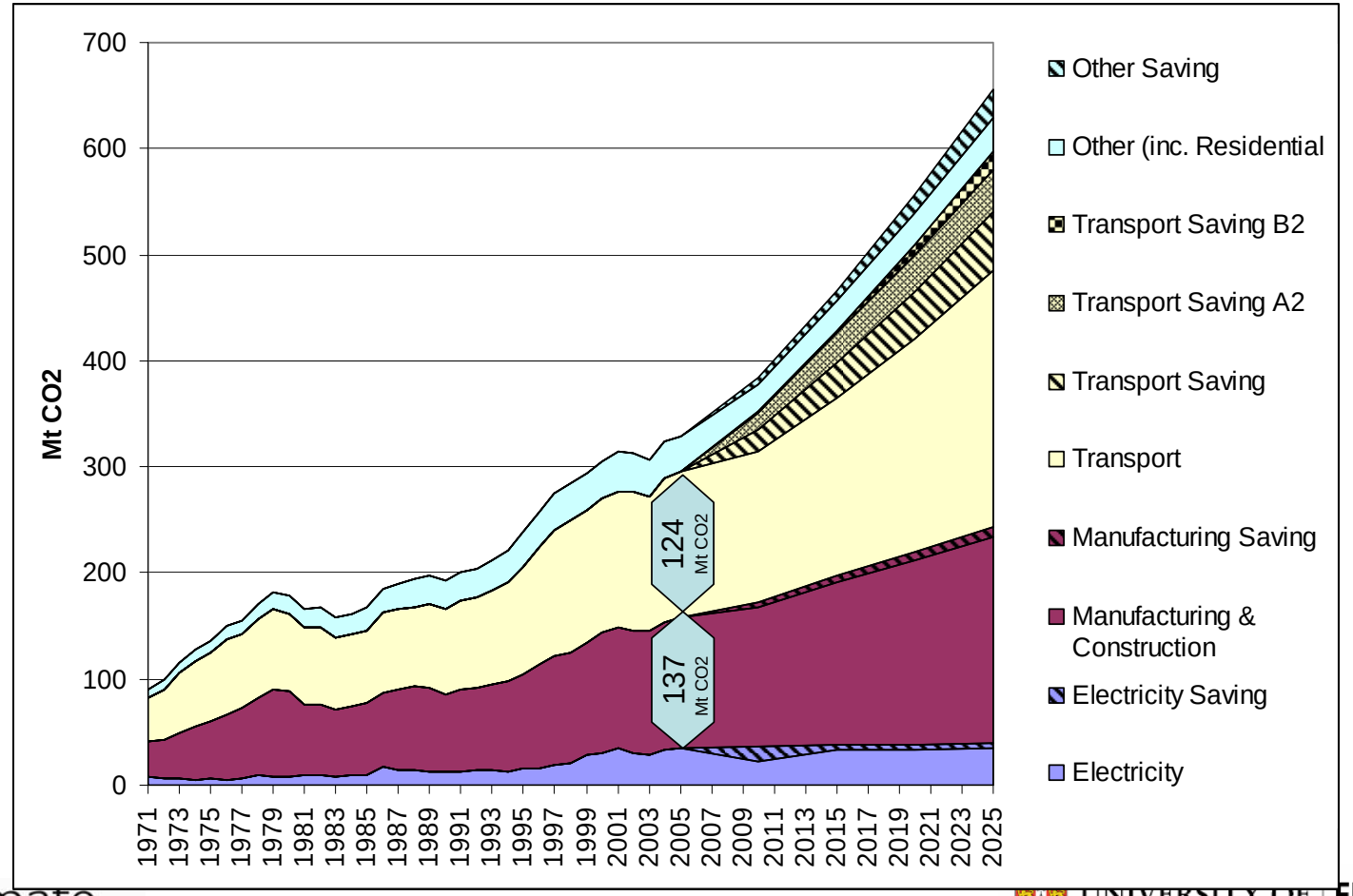
Fonte: DOT/Maritime Administration e TCL

Agência Nacional de Transportes Aquaviários

Pro-Transport

- Objective: finance infrastructure geared towards the public transportation of passengers using resources from the Government Severance Indemnity Fund for Employees - FGTS.
- Several actions can be financed under Pro-Transport, including segregated streets, exclusive streets and lanes for public urban passenger transportation traffic (BRTs).
- Need to refine indicators.
- Case of Curitiba: Bi-articulated buses ("surface subway" system) was achieved at the relatively low cost of US$3 million/km (typical tram system costs US$8-12 million/km and subway US$50-100 million/km). Estimated reduction of fuel consumption by 25-30% in comparison with eight comparable Brazilian cities. Estimated savings of 27 million litres of fuel a year, equating to approximately 62,505 tonnes of CO2. (by Tim Laing)
- Pro-Transport involves a considerable number of conditionalities and investment risks (higher long term interest rate) .

Potential of GHG reduction: beyond minus 18% of BAU scenario



Benefits

- Efforts to develop transportation policies in Brazil have largely been undertaken for reasons other than climate change, as is the case in the two policies presented.
- Difficulties in defining the baseline.
- Given the complexity of Brazil's fuel supply market (availability of "gasohol", hydrated ethanol, VNG, diesel and biodiesel), it is certainly challenging to quantify the short-term and long-term climate change benefits of the described policies.

- If new train and underground systems powered by electricity are implemented, as is the case in Europe and Japan, an increase in electricity's participation in total energy demand in the transport sector is expected - Brazilian electrical mix is very clean due to the high share of hydroelectricity power (88.7% in 2007)
- Co-benefits in terms of health, noise and congestion, as well as economic gains.

Conclusion

- It is relatively easier to mobilise investment in transport logistics infrastructure at the national level, given the impacts on economic competitiveness for the country as a whole

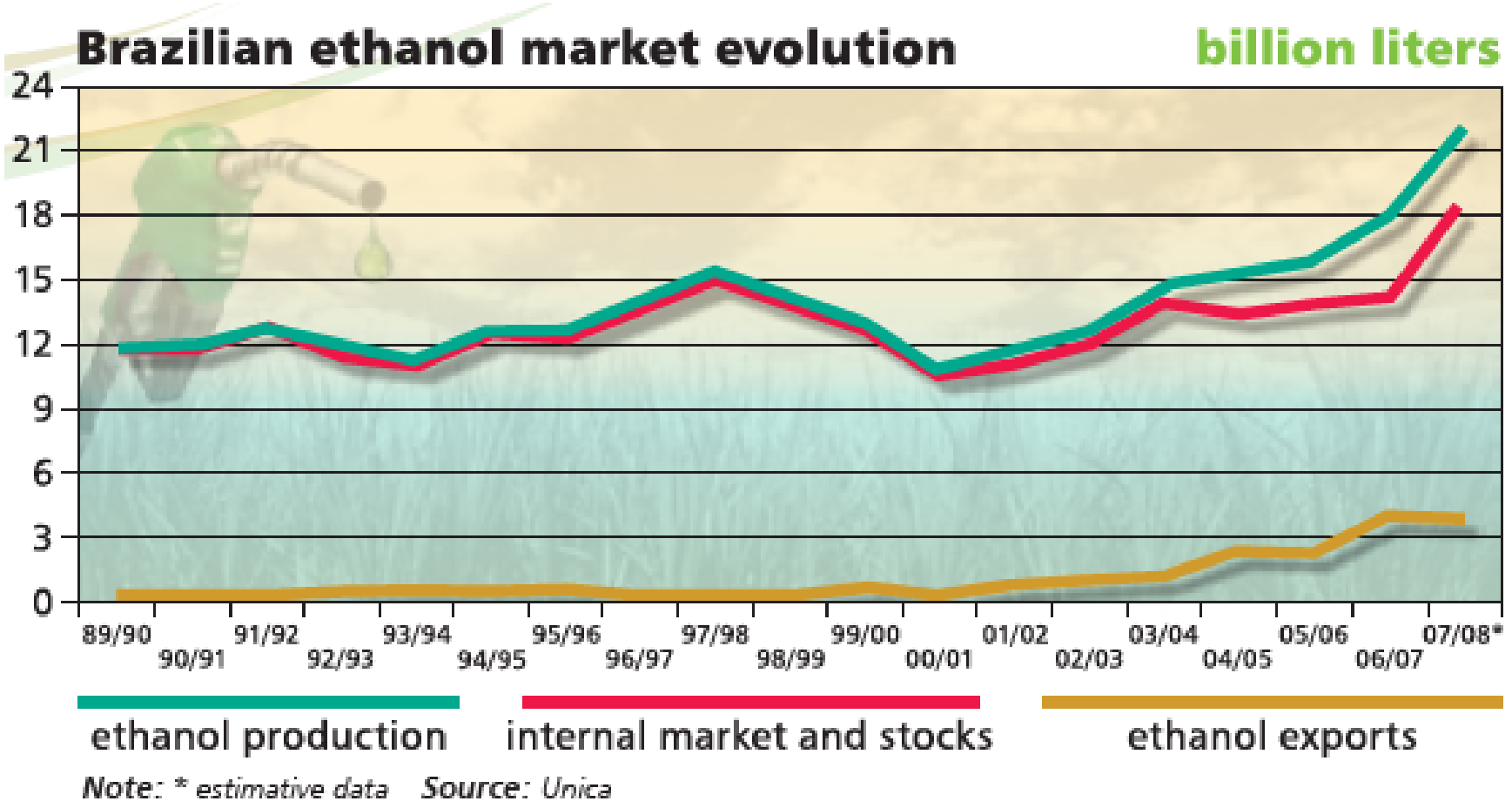
- It is more challenging to leverage funds to provide more efficient and integrated public transport systems and their related infrastructure at the local level.

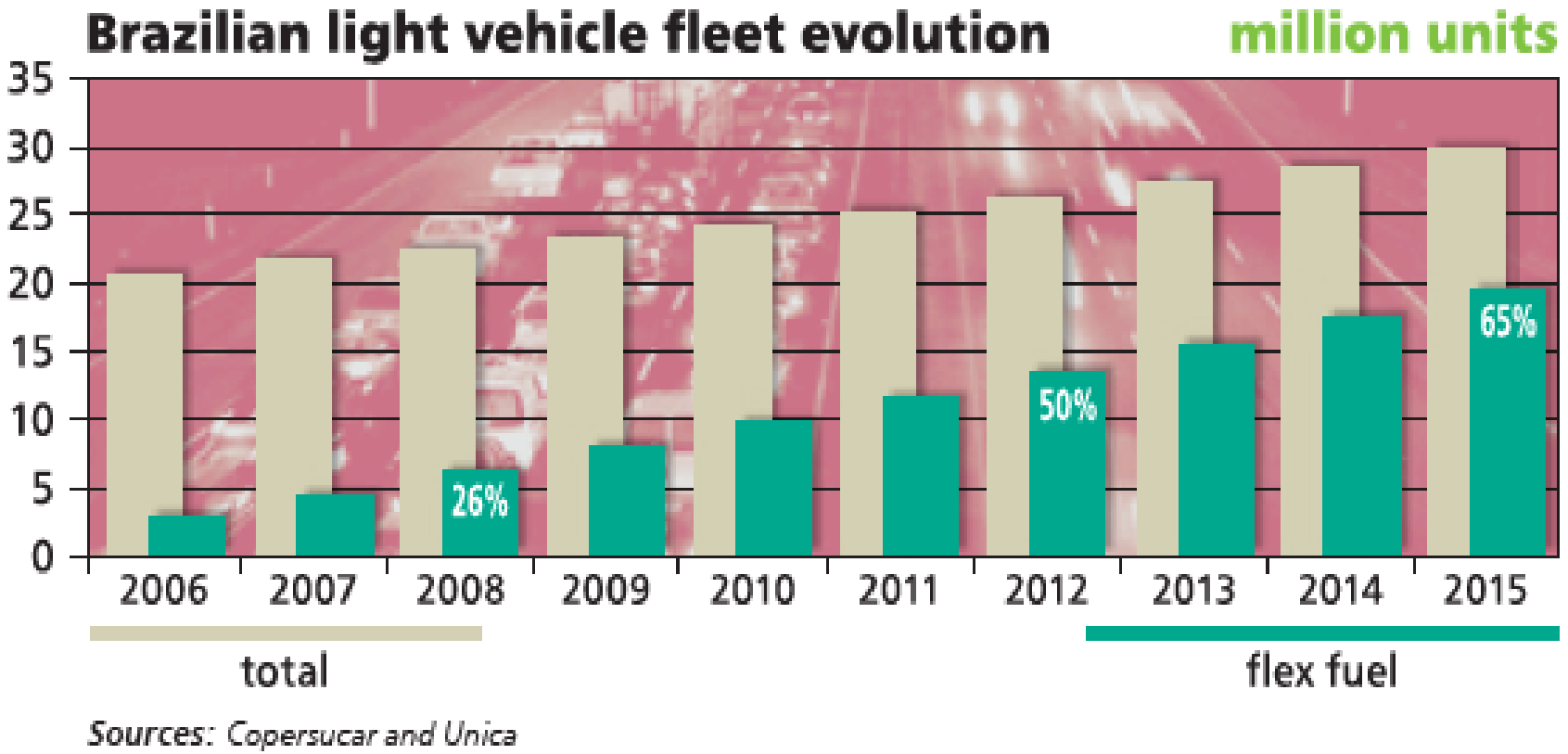
- International cooperation can play a significant role in supporting domestic policies, especially to complement and accelerate domestic efforts.

Data on Biofuels - BRAZIL

Haroldo de Oliveira Machado Filho

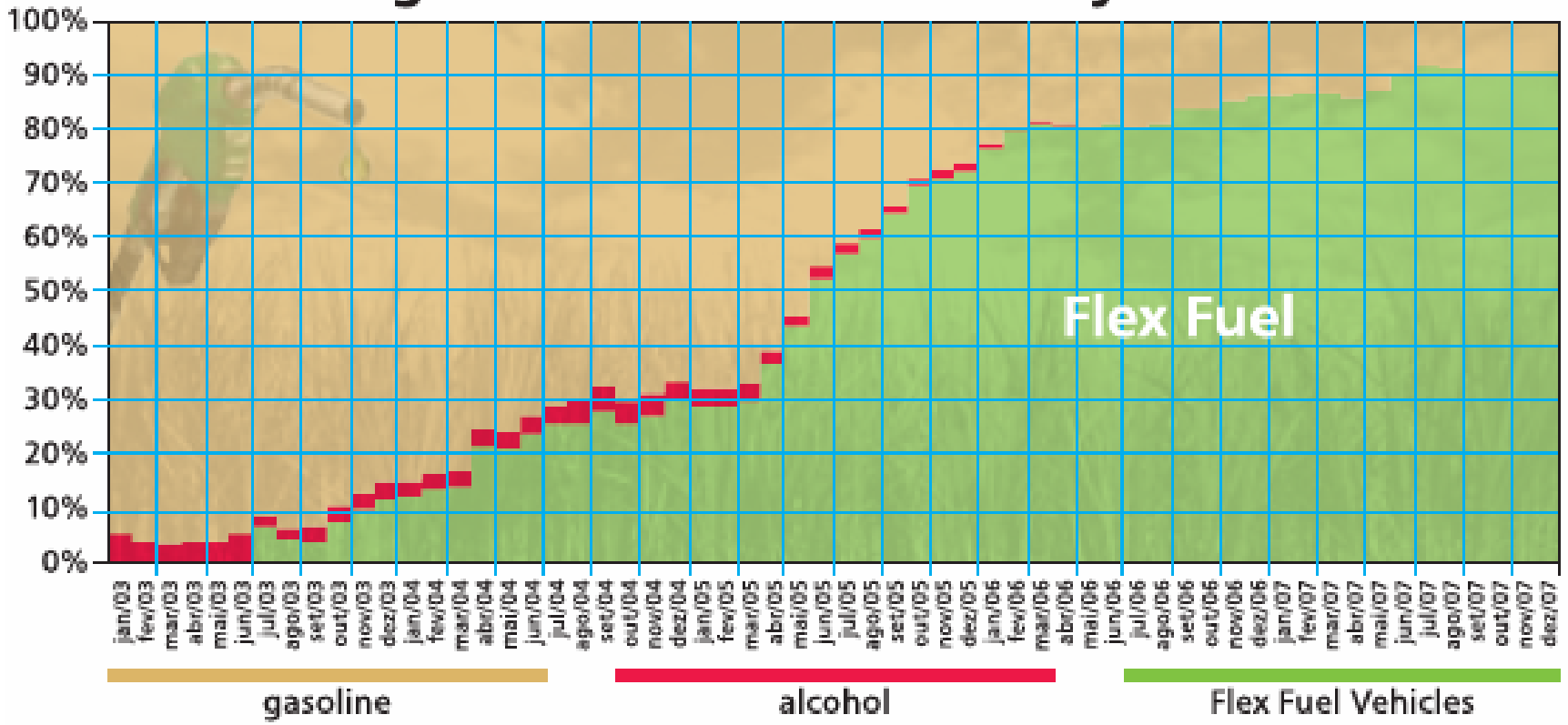
Cambridge, May, 2008


Brazilian ethanol market evolution
billion liters
24
21
18
15
12
9
6
3
0
89/90
90/91
91/92
92/93
93/94
94/95
95/96
96/97
97/98
98/99
99/00
00/01
01/02
02/03
03/04
04/05
05/06
06/07
07/08*
ethanol production
internal market and stocks
ethanol exports
Note: * estimative data
Source: Unica


Brazilian light vehicle fleet evolution
million units
35
30
25
20
15
10
5
0
26%
50%
65%
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
total
flex fuel
Sources: Copersucar and Unica

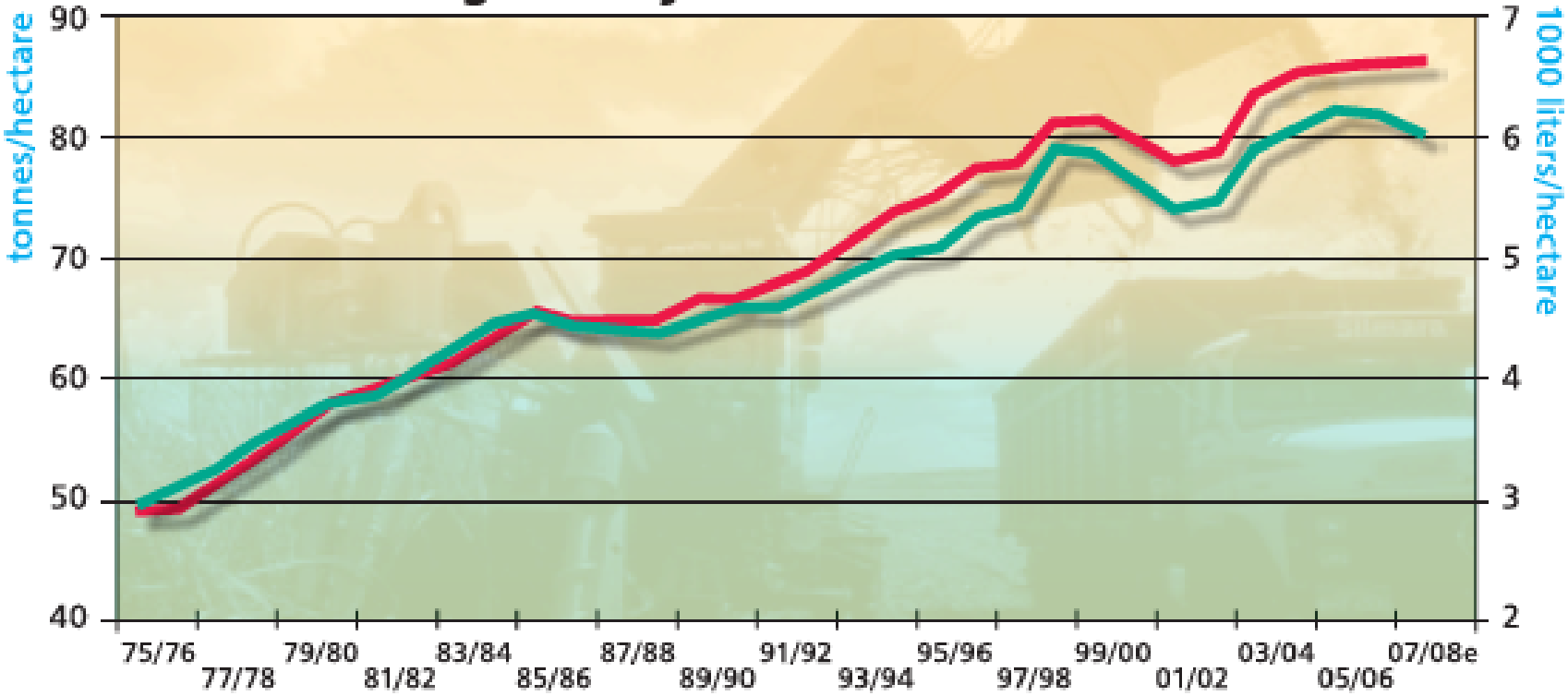
Brazilian automotive market by fuel

Brazilian Light Vehicles Sales – Otto-Cycle



Note: *Otto-Cycle refers to vehicles running on gasoline, alcohol and FFVs. Vehicles running on diesel are excluded.*
Source: *Anfavea (2007)* ***Data compiled*** *by Unica*

Ethanol and sugarcane yield evolution



Sugarcane production (tonnes/hectare)

Ethanol production (liters/hectare)

Note: 07/08e = estimated data *Source: Unica*

Climate Strategies

UNIVERSITY OF CAMBRIDGE | Electricity Policy Research Group

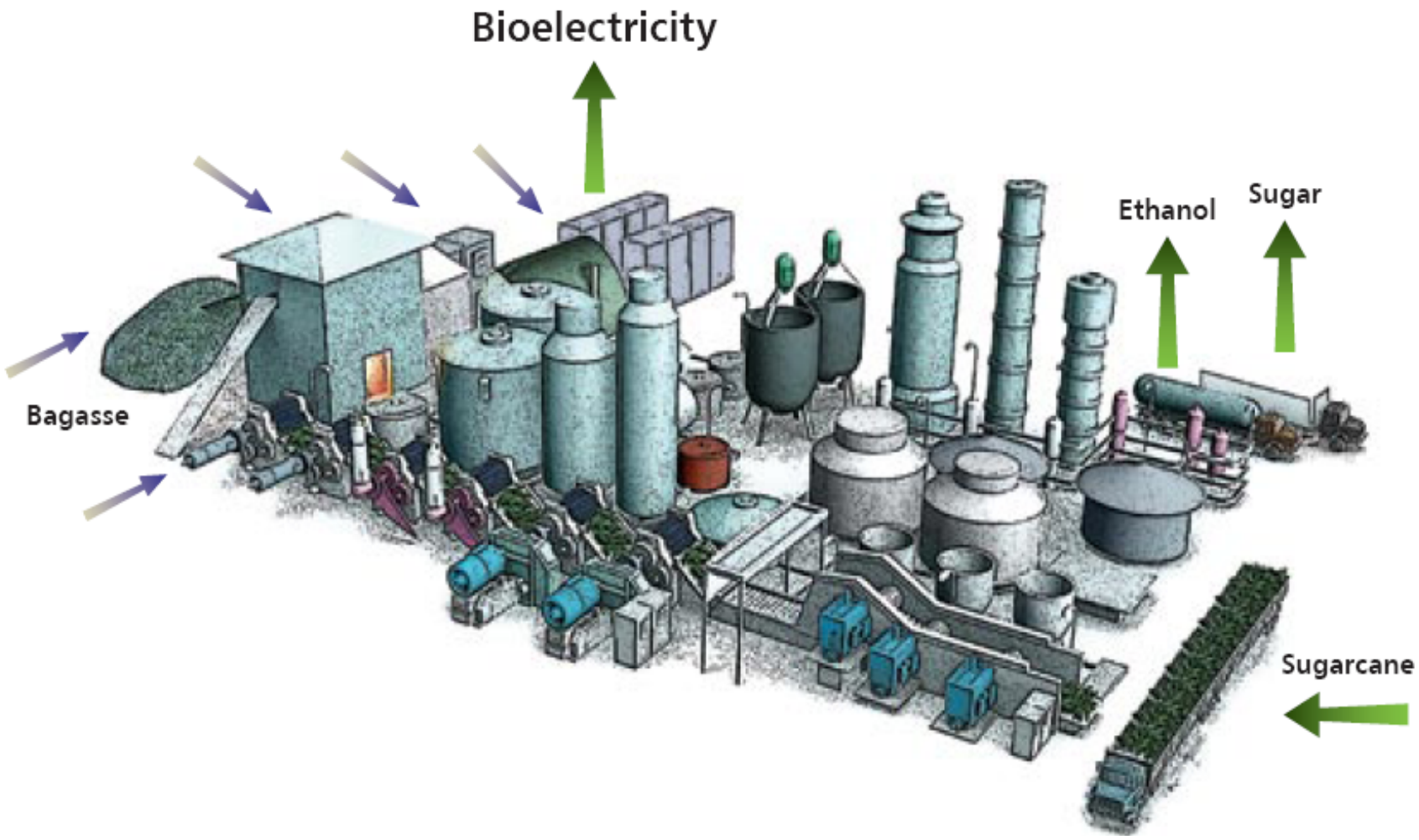
Projections for the Brazilian sugarcane industry

	2007/08*	2010/11	2015/16	2020/21
Sugarcane Production (million tonnes)	487	601	829	1,038
Cultivated Area (million hectares)	7.8	8.5	11.4	13.9
Sugar (million tonnes)	30.6	34.6	41.3	45.0
Internal Market	10.4	10.5	11.4	12.1
Surplus Export	20.2	24.1	29.9	32.9
Ethanol (billion liters)	22	29.7	46.9	65.3
Internal Market	18.4	23.2	34.6	49.6
Surplus Export	3.6	6.5	12.3	15.7
Bioelectricity (MWa) *	1,800	3,300	11,500	14,400
Bioelectricity in Brazilian Energy Matrix (%)	3%	6%	15%	15%

Note: * MWa = firm capacity. Potential generation of surplus electricity has been calculated as follows:

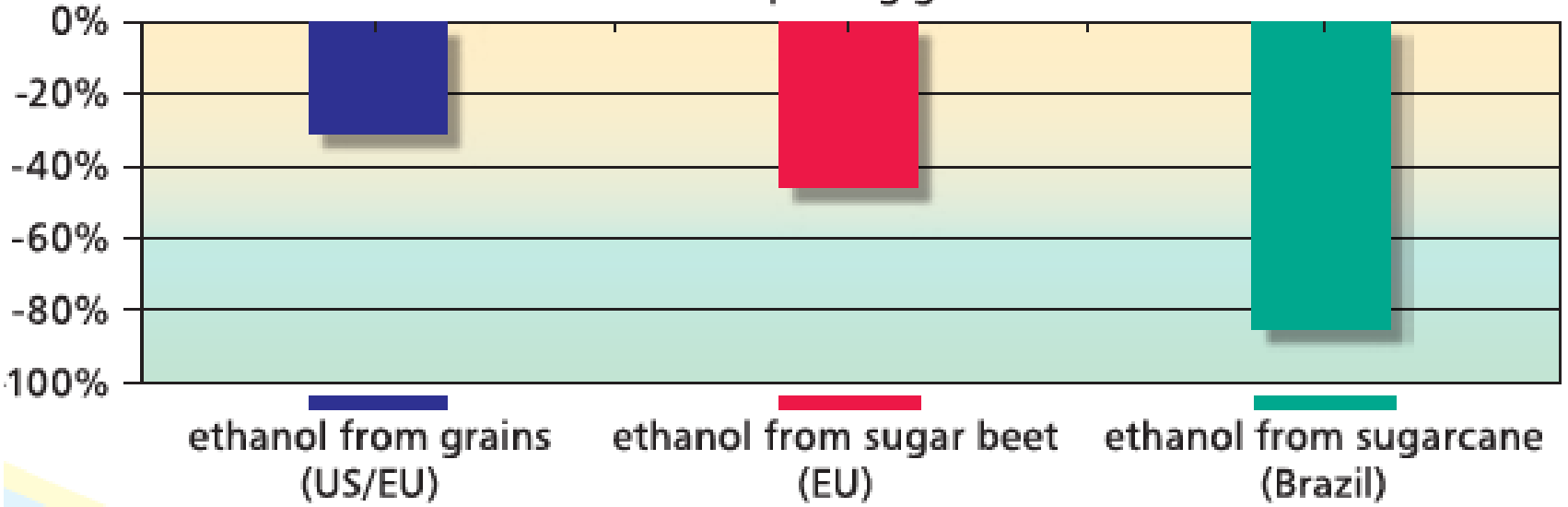
- For 2007/08 and 2010/11, remaining surplus in MWa to be sold on the commercial power market, once mill's own need for electricity has been used, based on the utilization of 75% of the available bagasse.
- For 2015/16 and 2020/21, remaining surplus in MWa to be sold on the commercial power market, once mill's own need for electricity has been used, based on the utilization of 75% and 50% of the available bagasse and straw. The remaining 50% of straw is left on the field as organic matter.

Source: *Unica, Copersucar and Cogen.*


Bioelectricity
Ethanol
Sugar
Bagasse
Sugarcane

Average GHG Balance on a life-cycle basis

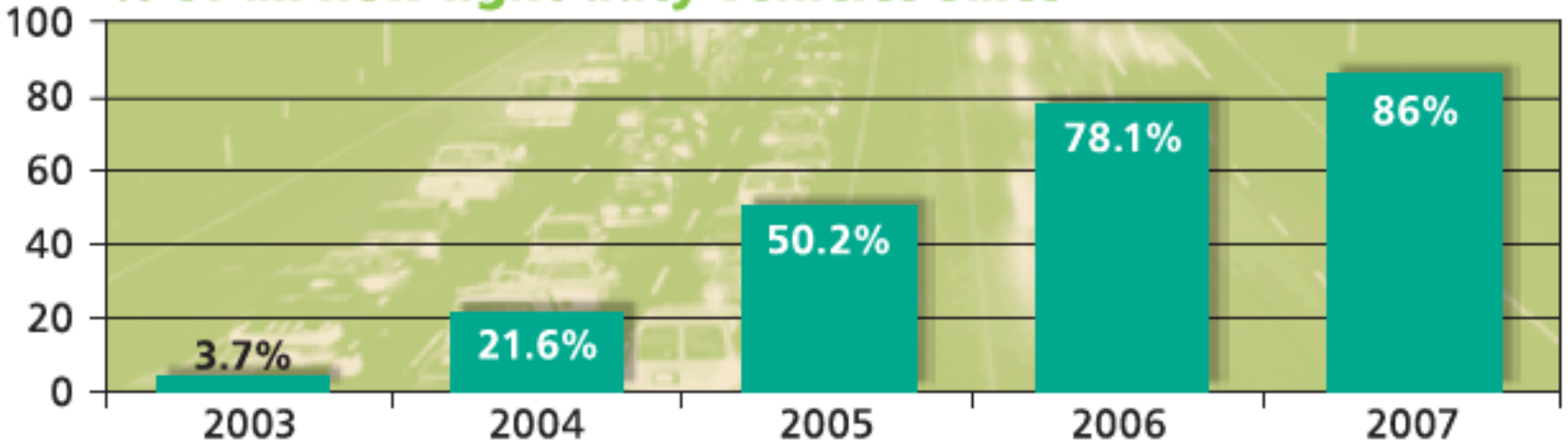
Emissions avoided with ethanol replacing gasoline



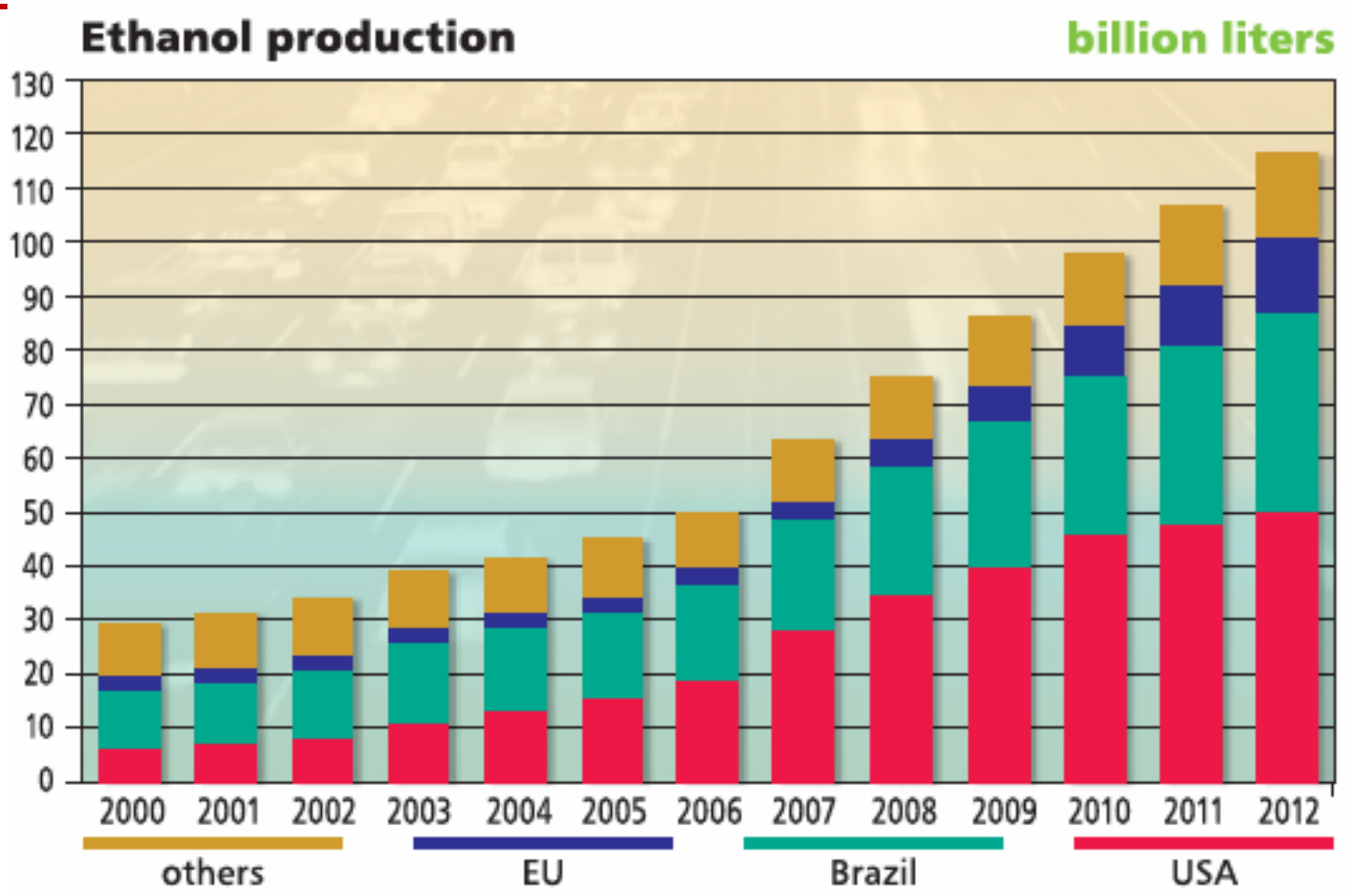
Note: Reductions in well-to-wheel CO^2-equivalent GHG emissions per km, from bioethanol compared to gasoline, calculated on a life-cycle basis.
Source: IEA – International Energy Agency (2004).
Data compiled: by Icone and Unica.

Flex fuel market grows in Brazil

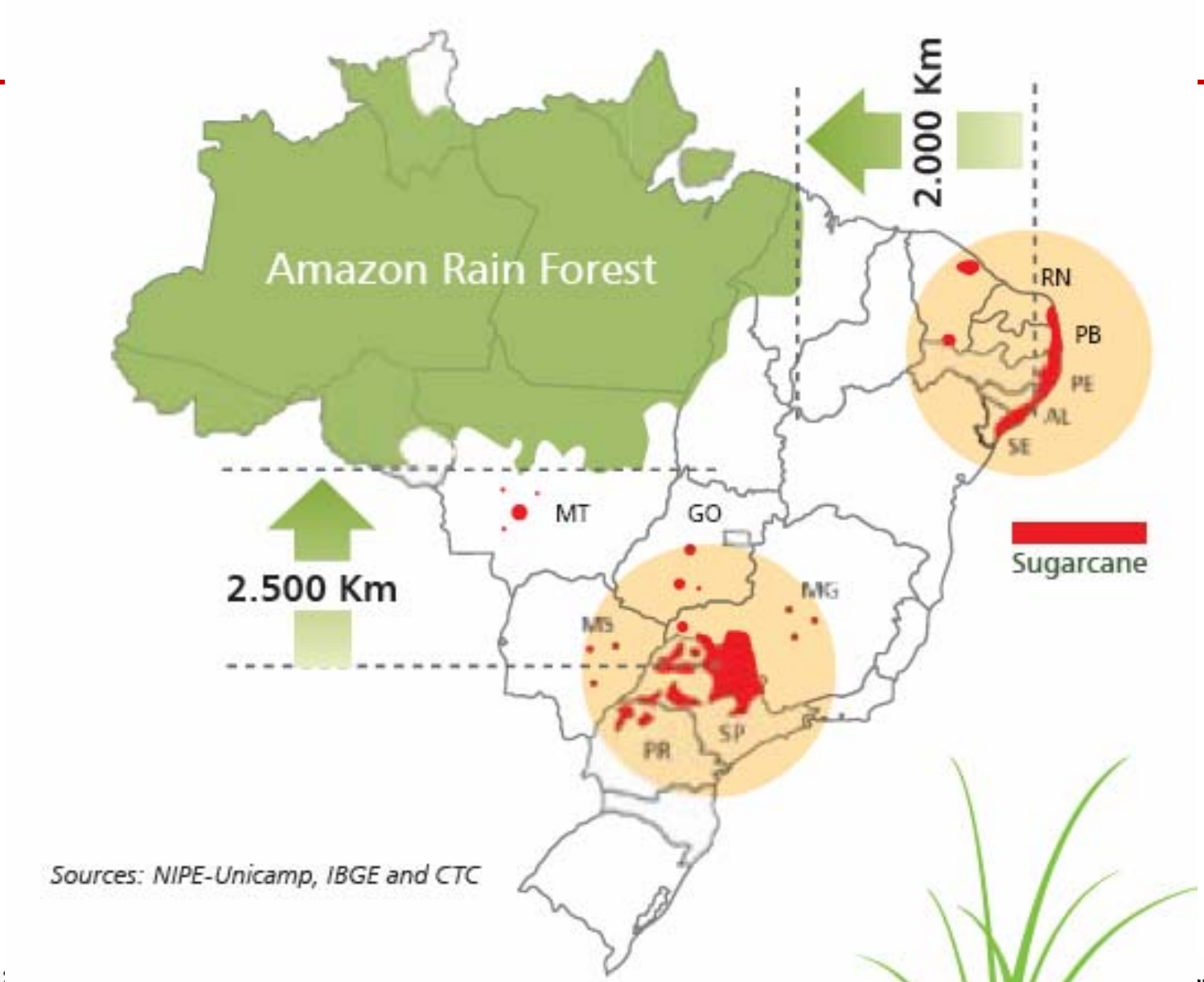
% of all new light duty vehicles sales



Note: *Data refers to all new light vehicles sold in the Brazilian market, including vehicles running on diesel.*
Source: *Anfavea (2007).*



***Note**: Projections for 2008/2012 based on announced production capacities and targets in main producing countries.*
***Sources**: Fapri, Acti, FO Licht, Unica and Toepfer*
***Data compiled** by Unica and Icone*


Amazon Rain Forest
2.000 Km
2.500 Km
RN
PB
PE
AL
SE
MT
GO
MG
MS
SP
PR
Sugarcane
Sources: NIPE-Unicamp, IBGE and CTC

Brazilian production of sugarcane, sugar and ethanol (2007/2008*)

REGION/STATE **	SUGARCANE PRODUCTION (million tonnes)	% OF TOTAL	SUGAR PRODUCTION (million tonnes)	ETHANOL PRODUCTION (billion litres)
Southeast	**335.9**	**69.0%**	**21.5**	**15.2**
São Paulo (SP)	295.0	60.6%	19.1	13.5
Minas Gerais (MG)	35.6	7.3%	2.1	1.8
Centerwest	**50.6**	**10.4%**	**2.1**	**3.0**
Goiás (GO)	20.8	4.3%	1.0	1.2
Mato Grosso (MT)	14.9	3.1%	0.5	0.9
Mato Grosso do Sul (MS)	14.8	3.0%	0.6	0.9
Northeast	**58.7**	**12.0%**	**4.4**	**1.9**
Alagoas (AL)	24.7	5.1%	2.2	0.7
Pernambuco (PE)	17.1	3.5%	1.6	0.4
South	**40.5**	**8.3%**	**2.5**	**1.9**
Paraná (PR)	40.4	8.3%	2.5	1.9
North	**1.3**	**0.3%**	**0.1**	**0.1**
Total	**487.0**	**100%**	**30.6**	**22.0**

Notes: **estimated data as of january/2008; **only states with more than 10 million tonnes are considered; Southeast = SP, MG, ES and RJ; Centerwest = GO, MT, MS and DF; Northeast = PE, AL, SE, BA, PI, CE, RN, PB and MA; South = PR, SC and RS; North = AC, AM, RR, PA, AP, AM and TO.*
Sources: *Unica (2008) and Mapa (2008).* ***Data compiled*** *by Unica.*

Climate Strategies

UNIVERSITY OF CAMBRIDGE | Electricity Policy Research Group

Availability of arable land in Brazil

Million Hectares (2007)			
Brazil	850		
Total preserved areas and other uses *	510 (60%)		
Total Arable Land	340 (40%)	% of total land	% arable land
1 Cultivated Land: All crops	63.1	7.4%	18.6%
Soybeans	20.6	2.4%	6.1%
Corn	14.0	1.6%	4.1%
Sugarcane **	7.8	0.9%	2.3%
Sugarcane for ethanol ***	3.4	0.4%	1.0%
Oranges	0.9	0.1%	0.3%
2 Pastures	200	23.5%	58.8%
3 Available land (ag, livestock)	77	9.1%	22.6%

Notes: *Estimated data; * These areas include Amazon Rain Forest, protected areas, conservation areas and reforestation, cities and towns, roads, lakes and rivers; ** cultivated area for sugar and ethanol production; *** harvested area for ethanol production.*
Sources: *IBGE, CONAB and UNICA.* ***Data compiled*** *by Icone and Unica.*