
Challenges for Large-scale Bioenergy Production in the World

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Fapesp: São Paulo Research Foundation

- Mission: support research in all fields
- Funded by the taxpayer in the State of São Paulo with 1% of all state revenues
- All proposals are peer reviewed (26,000 proposals in 2014)
 - Average time for decision – 65 days
- Expenditures 2014: \$PPP 500 M
 - Fellowships
 - 2,500 SI, 1,800 MSc, 3,500 DrSc, 1,800 Post-docs, 800 other
 - Academic R&D
 - RIDC/11 yrs, Thematic/5 yrs, Young Investigator/4 yrs, Regular/2 yrs
 - University-Industry Joint R&D:
 - Microsoft, Agilent, Braskem, Oxiteno, SABESP, VALE, Natura, Petrobrás, Embraer, Padtec, Biolab, Cristalia, Boeing , GSK, BP, BG, PSA (Peugeot-Citröen), ... (total of 100+ companies)
 - Engineering Research Centers (ERC): PSA, Natura, GSK, BG
 - Small bussiness R&D: 1,200 SBE's (two awards per week in 2014)

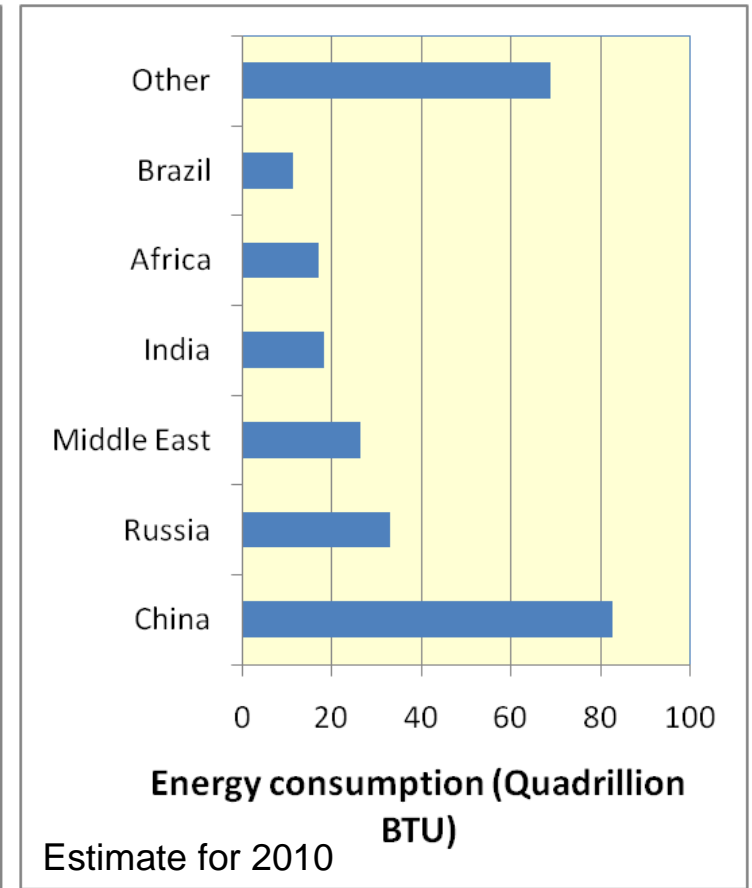
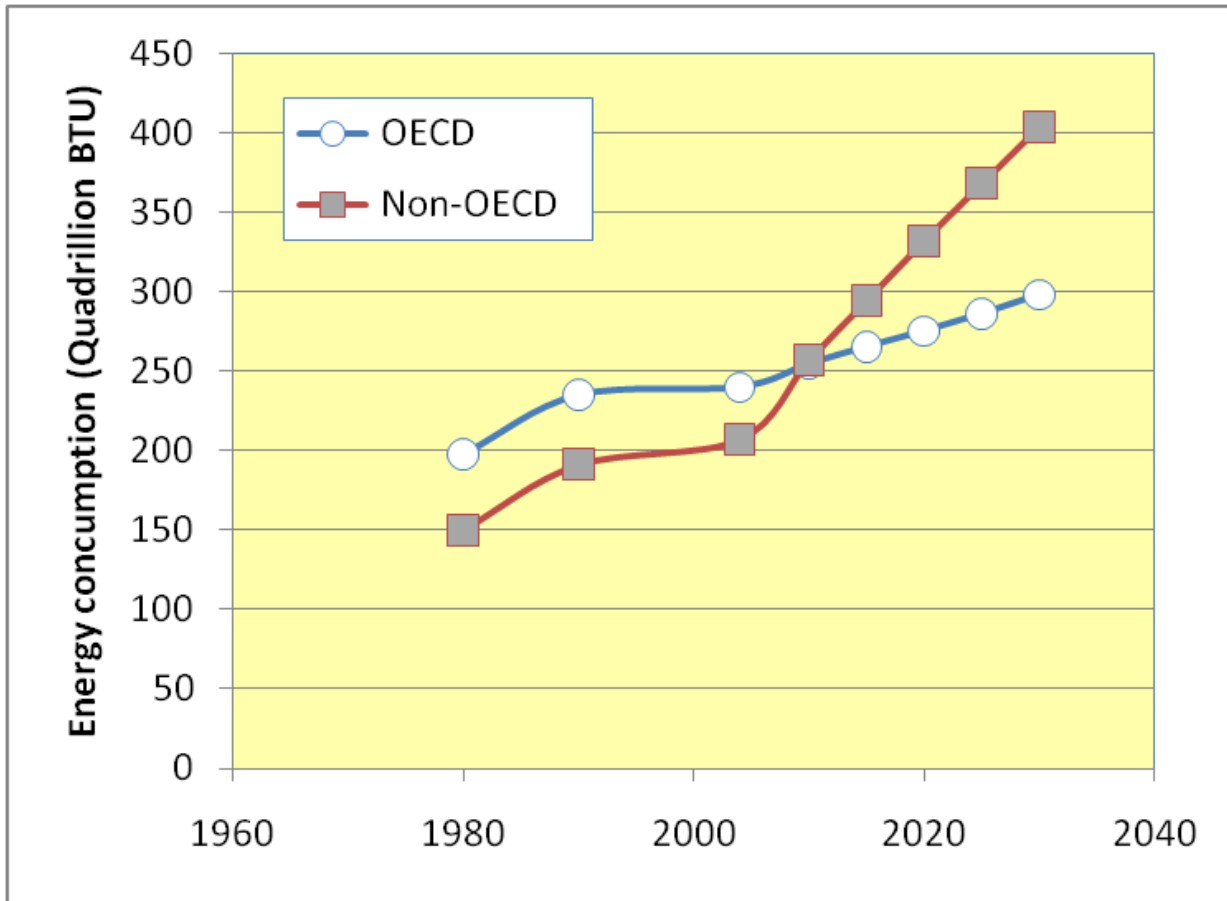
FAPESP's Bioeconomy Research Programs

- BIOEN - bioenergy
 - Initiated 2009
 - 300+ Pis (52 foreign); core of fundamental research
 - Connections to application through partnership with companies
 - Oxiteno, Braskem, Dedini, ETH, BP, Microsoft Research, Boeing, Peugeot-Citroen
 - Training: Joint Graduate Course USP/Unicamp/UNESP (started 2014)
- BIOTA – biodiversity
 - Initiated 1997
 - 200+ Pis
- FGCCRP – Global Climate Change
 - Initiated 2009
 - 100+ PIs

Bioenergy drivers

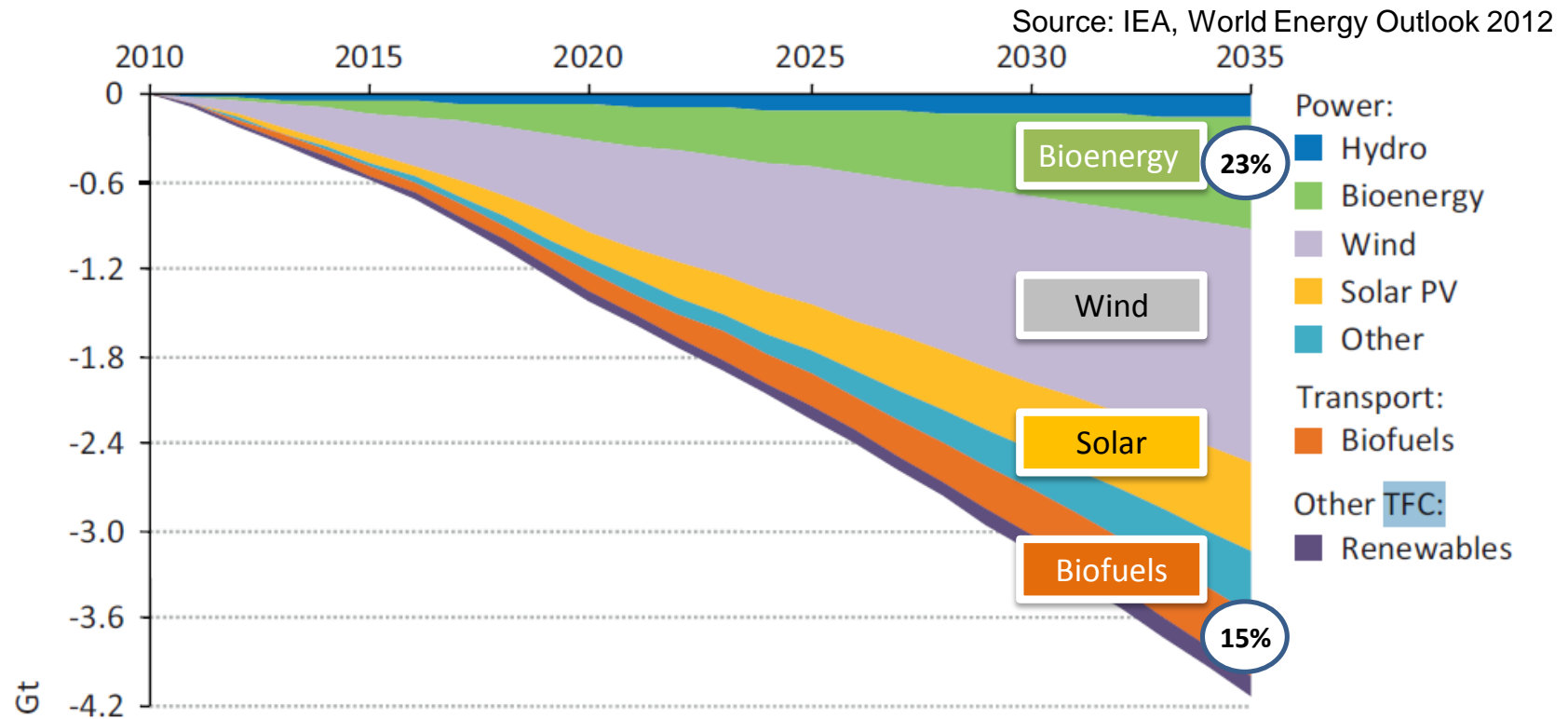
- Energy security
- Mitigating climate change
- Regional development

Energy consumption OECD and Non-OECD



Source: International Energy Outlook 2009

Mitigating wedges: Carbon emissions reduction in NPS



* The emissions savings compared with the emissions that would have been generated for the projected level of electricity generation in the New Policies Scenario were there no change in the mix of fuels and technologies and no change in the efficiency of thermal generating plants after 2010.

WHAT DOES A REAL WORLD WEDGE POLICY LOOKS LIKE?

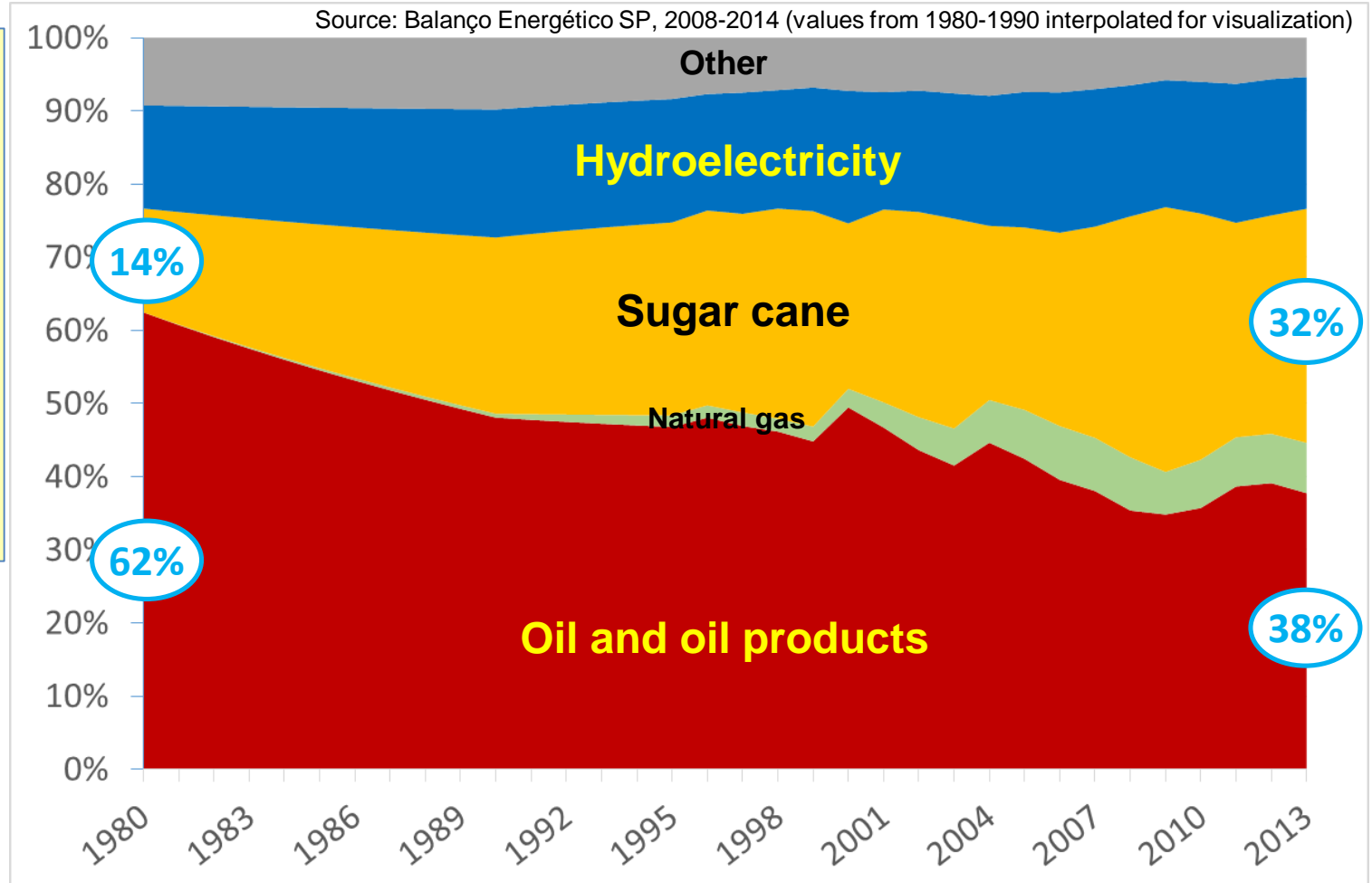
1980-2013: change in energy sources in the State of São Paulo, Brazil

State of São Paulo

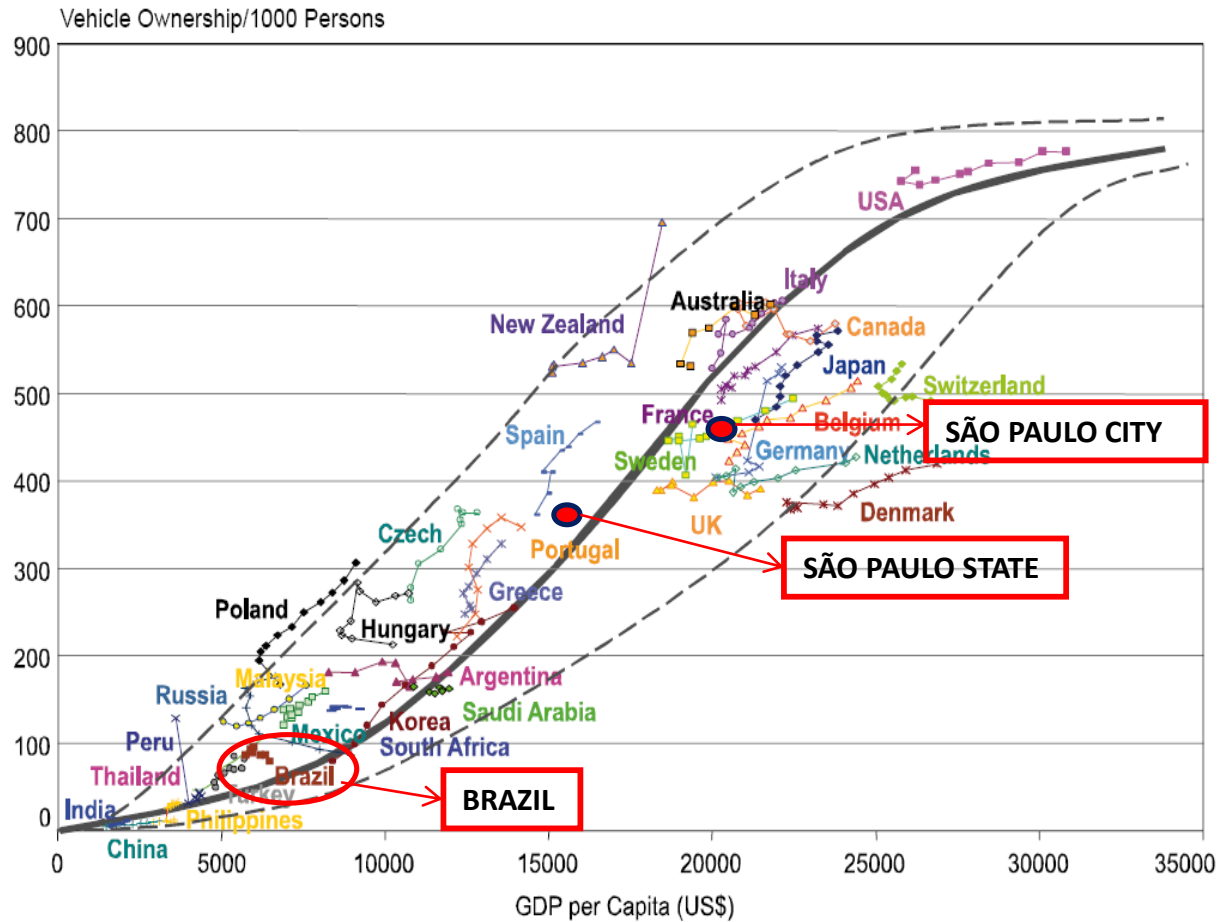
- 42 million people
- 32% of Brazil's GNP
- 55% of Brazilian ethanol production

1980 – 2013

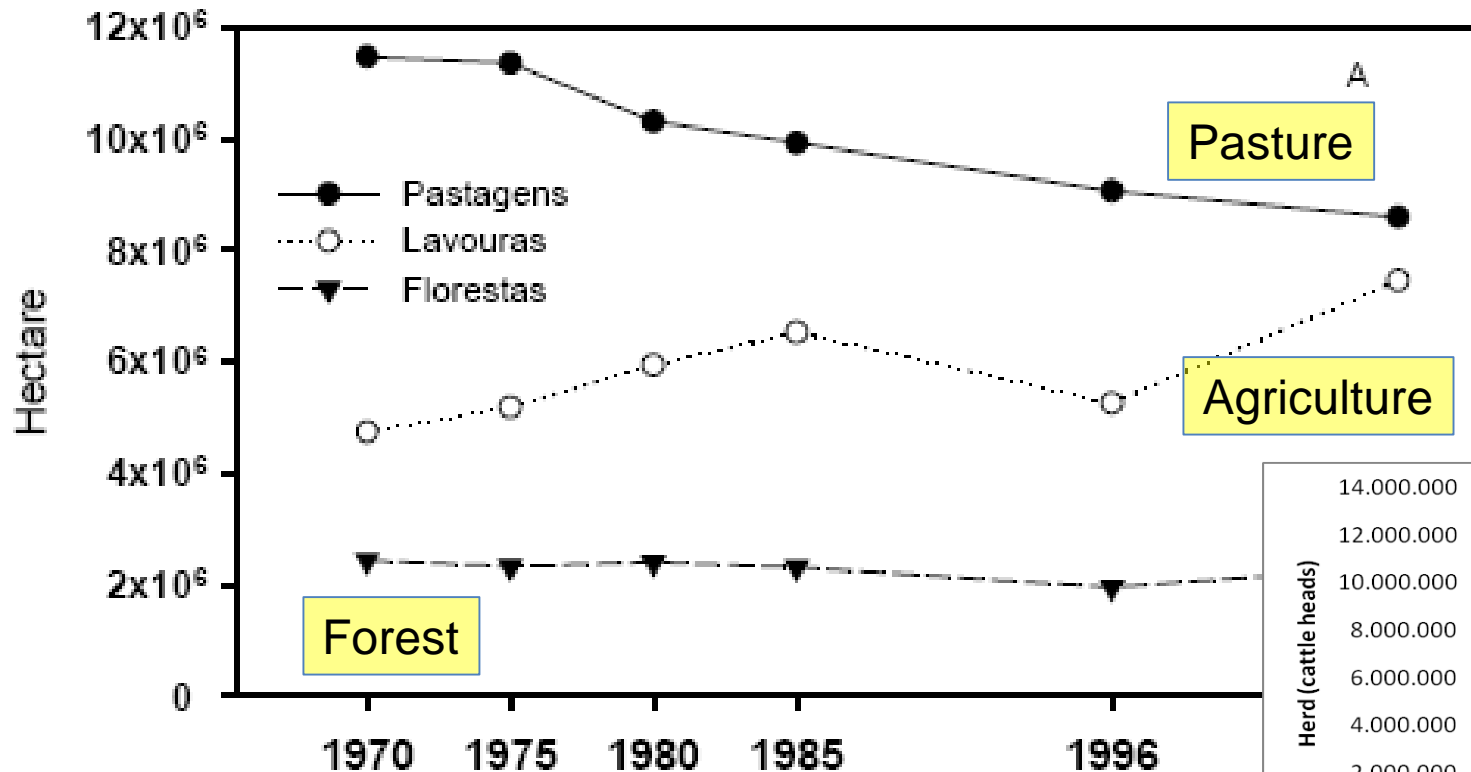
- Oil down from 62% to 38%
- Cane up from 14% to 32%



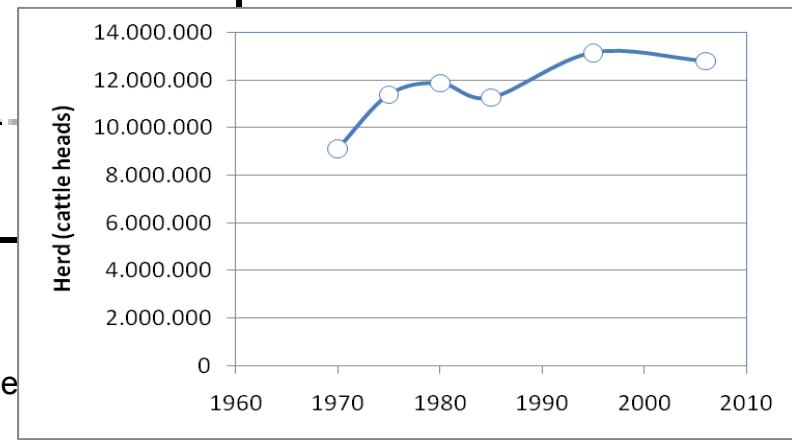
Vehicles per population



São Paulo: Land Use Change, 1970-2006

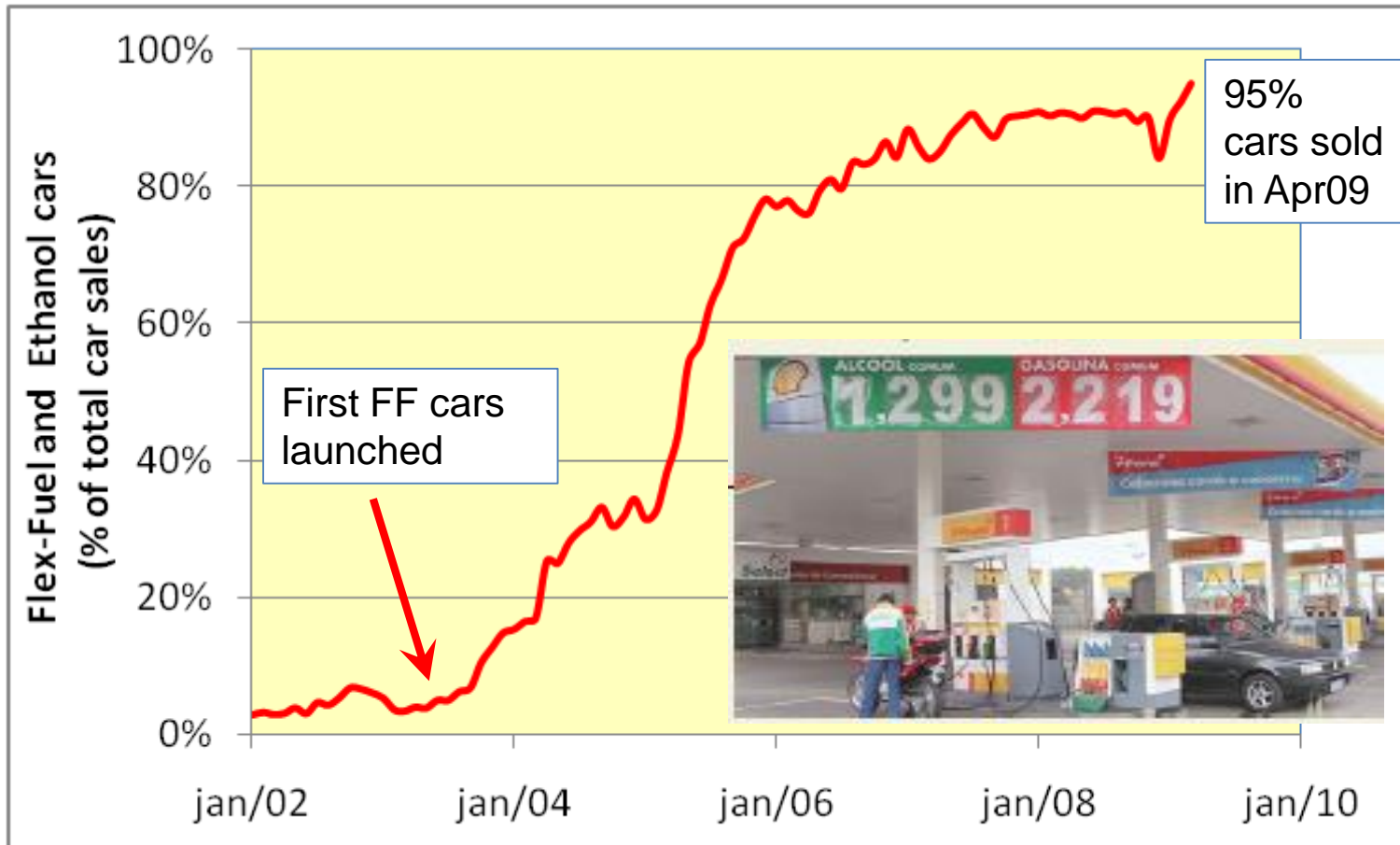


Sugarcane x Pasture: fixation of 0,5 Mg C/ha.yr

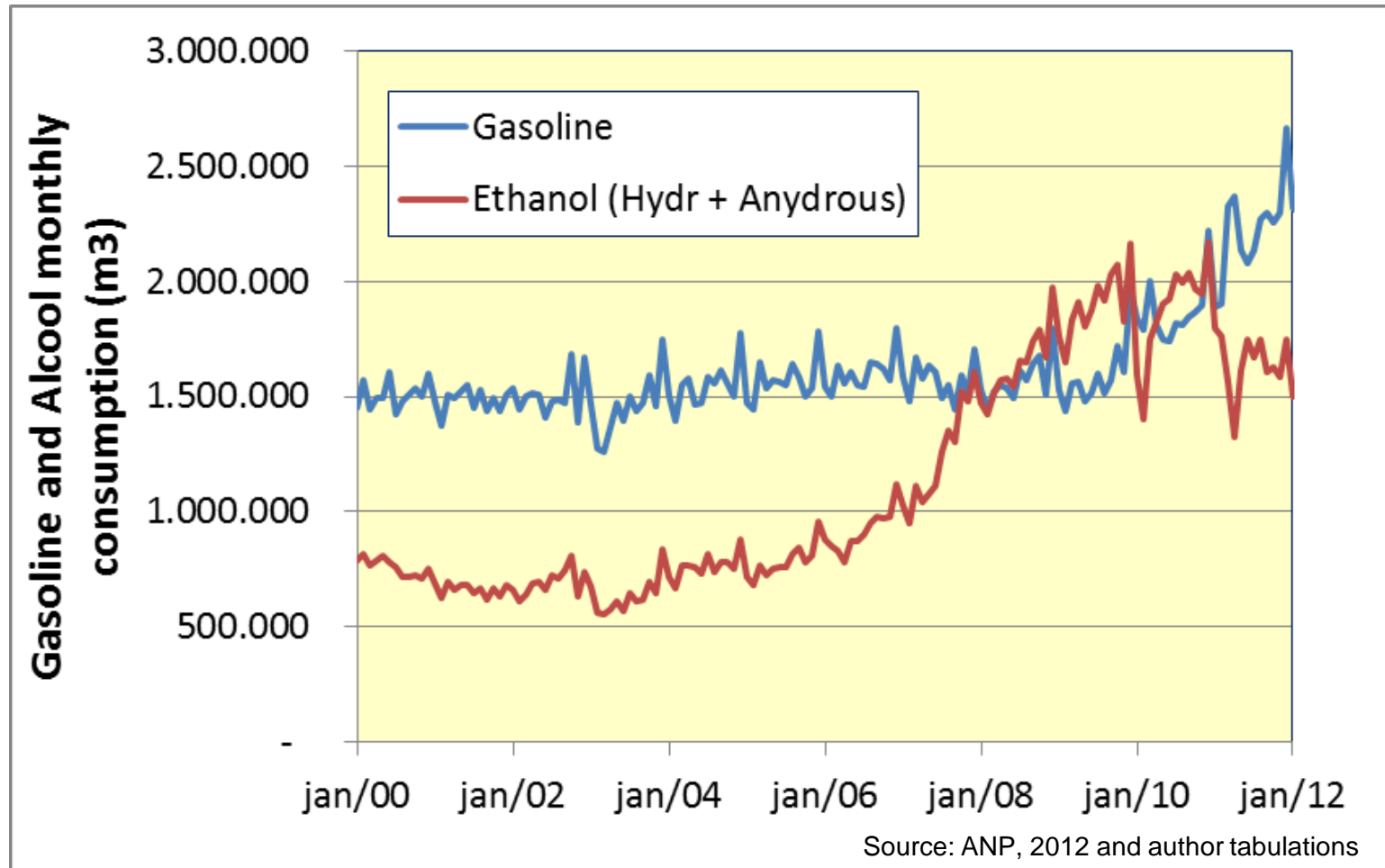


Source: Boddey, R.M., "GHG Emission Mitigation Through Ethanol from Sugarcane"

95% of cars sold monthly are Flex-Fuel (FF in Brazil: E10 – E100)

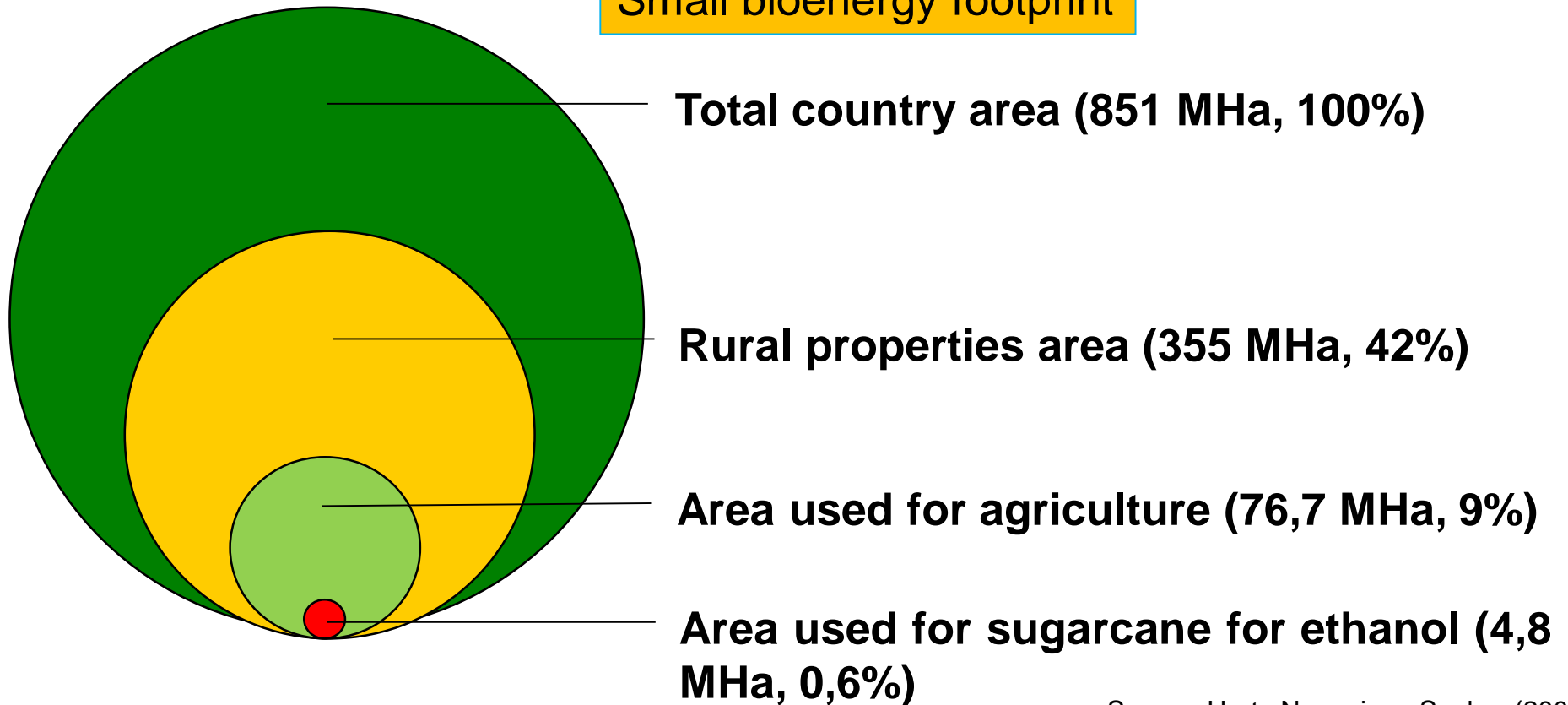


Ethanol and Gasoline use in Brazil



Sugarcane for ethanol uses 0,6% of total area

Small bioenergy footprint



Source: Horta Nogueira e Seabra (2008)
modified for 2008 data

Biofuels, according to the Nuffield Council on Bioethics

- 1) Biofuels development should not be at the expense of people's essential rights (including access to sufficient food and water, health rights, work rights and land entitlements).
- 2) Biofuels should be environmentally sustainable.
- 3) Biofuels should contribute to a net reduction of total greenhouse gas emissions and not exacerbate global climate change.
- 4) Biofuels should develop in accordance with trade principles that are fair and recognize the rights of people to just reward (including labour rights and intellectual property rights).
- 5) Costs and benefits of biofuels should be distributed in an equitable way.
- 6) If the first five Principles are respected and if biofuels can play a crucial role in mitigating dangerous climate change then, depending on additional key considerations, **there is a duty to develop such biofuels.**

Nuffield Council on Bioethics, "Biofuels: Ethical Issues" (<http://www.nuffieldbioethics.org/biofuels-0>).

