

RIO 02 - World Climate & Energy Event, Rio de Janeiro-Brazil, January 6-11 (2002).

Brazilian Greenhouse Gases Emission Baselines from Electricity Generation

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Reference Scenario or Baseline

- One key aspect of the Clean Development Mechanism (CDM) of the Kyoto Protocol is the reference scenario (baseline) to calculate the emissions reductions achieved in a particular project. From paragraph 5 of article 12 of the relevant protocol, comes the following (UNFCCC, 1997):
- Emission reduction resulting from each project activity shall be certified ... on the basis of ... reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

Baseline standardization?

- Parties agree that there should be opportunities for all Parties to participate in the CDM and decide that an equitable distribution of CDM projects will be fostered. Therefore, standardized baselines, which are based on appropriate Annex-I average, may be used (Pronk, 2000)
- Using data from 1998 (IEA/OECD, 2000a) the average carbon emission baselines for the production of electricity in the annex-I countries is calculated to be 168 kgC/MWh (616 kgCO₂/MWh).
- World Electricity Baseline evolution (kgC/MWh)

2000	2010	2020
179.6	184.6	185.9

Brazilian Emission baselines upper and lower bounds for the interconnected grid (installed capacity as that of Dec./1999)

	Emission Baseline (kgC/MWh)
Fossil fuel only (upper bounds)	
Interconnected systems (S/SE/MW+N/NE)	294.4
Isolated systems (Northern region)	243.7
All systems	280.1
All sources (lower bounds)	
Interconnected systems (S/SE/MW+N/NE)	15.82
Isolated systems (Northern region)	174.7
All systems	20.01

Brazilian S/SE/MW emissions baseline in kgC/MWh (Meyers *et al.*, 2000)

August 2003	August 2008
34	53

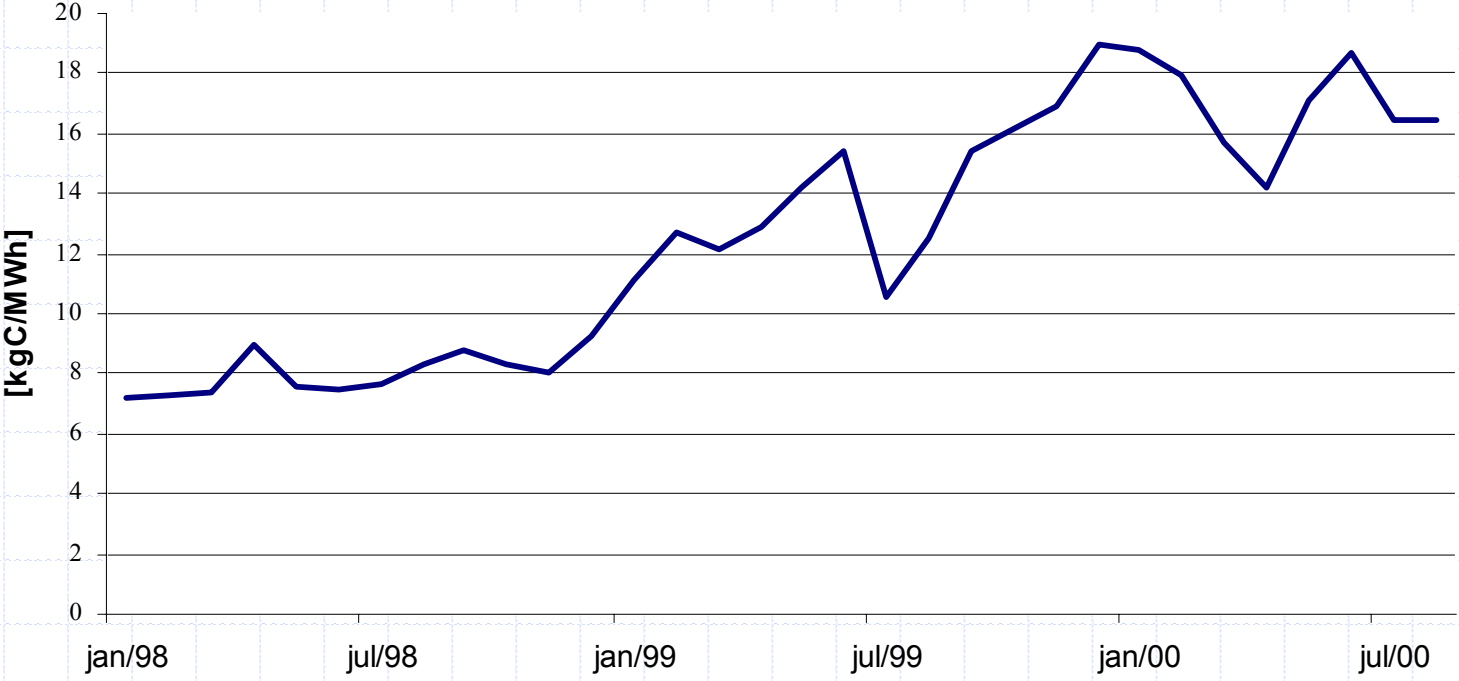
Emission baselines based on electricity capacity addition in Brazil (Bosi, 2000)

	(kgC/MWh)
All existing electricity capacity	13.36
Recent capacity addition – fossil fuel only	220.4
Recent capacity addition – all sources	29.45



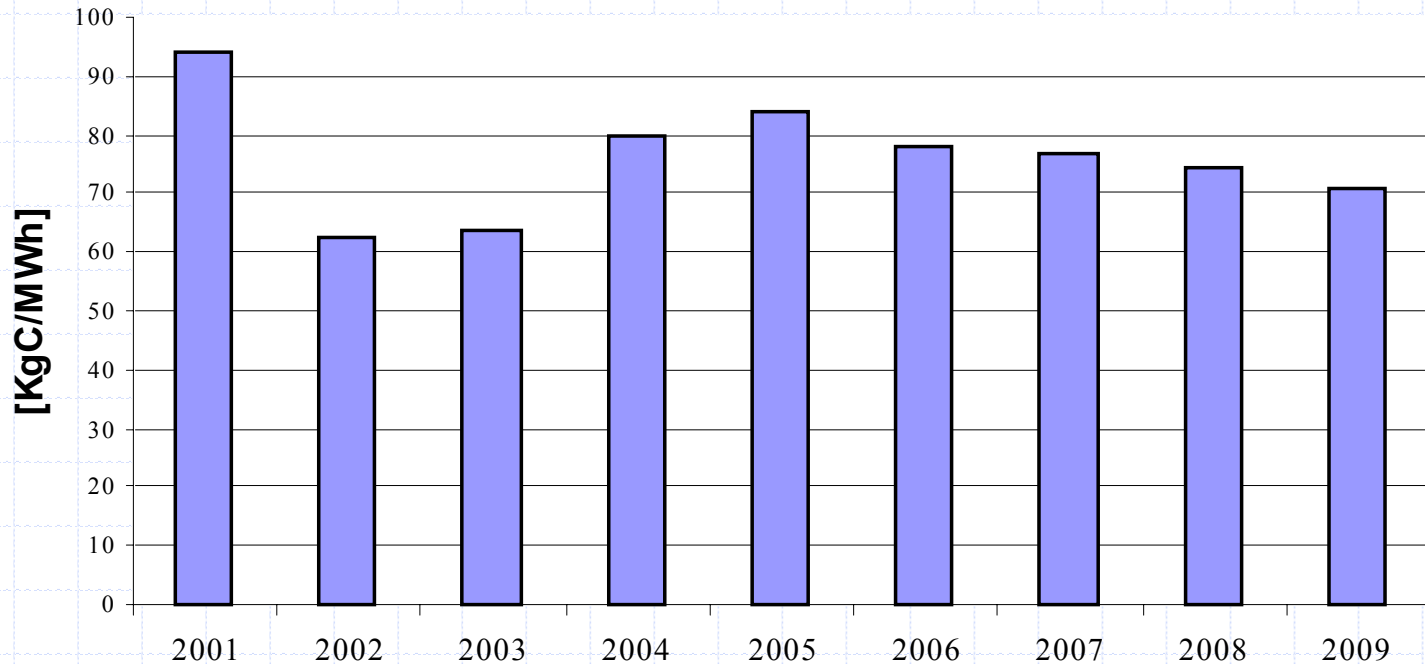
Emission baselines based on electricity output (Esparta et al., 2001).

Brazilian Electricity Generation Baseline - All Sources (S/SE/MW)



Additional generation capacity emission baselines (Esparta *et al.*, 2001)

Ten-Year Electric System Expansion Plan Baseline (2000-2009)



Variable dispatch cost – October 2000 (Source:ONS)

Plant Name	Fuel	Region	Cost (R\$/MWh)
System	Hydro	S	0.00
Angra	Nuclear	SE	8.50
P. Médici	Coal	S	27.74
J. Laçerda C	Coal	S	39.37
System	Hydro	N	41.45
J. Lacerda B	Coal	S	43.47
J. Lacerda A	Coal	S	50.37
Charqueadas	Coal	S	54.33
System	Hydro	NE	67.18
Figueira	Coal	S	78.48
Campos	Natural gas	SE	84.90
Igarapé	Fuel Oil	SE	85.23
System	Hydro	SE	99.47
Piratininga	Fuel Oil	SE	111.91
Alegrete	Fuel Oil	S	112.67
St. Cruz	Fuel Oil	SE	127.00
Camaçari	Fuel Oil	NE	230.27

S/SE/MW System – Weighted average capacity factors

	Hydro	Coal	Fuel Oil
Feb./1998	62.87 %	35.64 %	13.96 %
May/1998	59.78 %	34.78 %	16.41 %
Aug./1998	60.92 %	40.22 %	16.82 %

North/Northeast system

- **Two thermal plants (Jul./1998 to Aug./2000)**
 - Camaçari (290 MW, c.f.: 2.9 %)
 - São Luís (116 MW, c.f.: 0.0 %)

- **New feasible plants (Source: ANEEL)**
 - Seven using natural gas (1856 MW, 78.9%)
 - Five using hydro sources (496 MW, 21.1%)

Conclusions

- **Electricity generation GHGs emissions baselines in Brazil: values range from almost GHGs free emissions to about 300 kgC/MWh**
- **Actual choice is a political decision (public policy)**
- **What do we want?**
 - **Verify precisely every single emission reduction certified**
 - **“ ... to achieve stabilization of GHGs concentrations in the atmosphere ...”**

Wind power in Brazil versus natural gas in China or India

Country	Electricity Baseline (kgC/MWh)	CER (kgC/MWh)
Brazil	16	16
India	274	137
China	280	143

Conclusions

- **Stringent baseline calculation renders small-scale projects expensive and thus unfeasible**
- **To create a market to support carbon-free electricity generation baseline standardization is necessary**
- **Proposal: assignment of a worldwide standardized baseline for electricity generation using renewable energy sources considering a widely available technology and adopting the lowest carbon-intensity fossil fuel – i.e. about 137 kgC/MWh; which refers to natural gas with 99.5% fuel oxidation and 40% energy conversion efficiency.**

Thank you very much!

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