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Assessing Impacts of Efficiency Programs in Brazil

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EXCEN

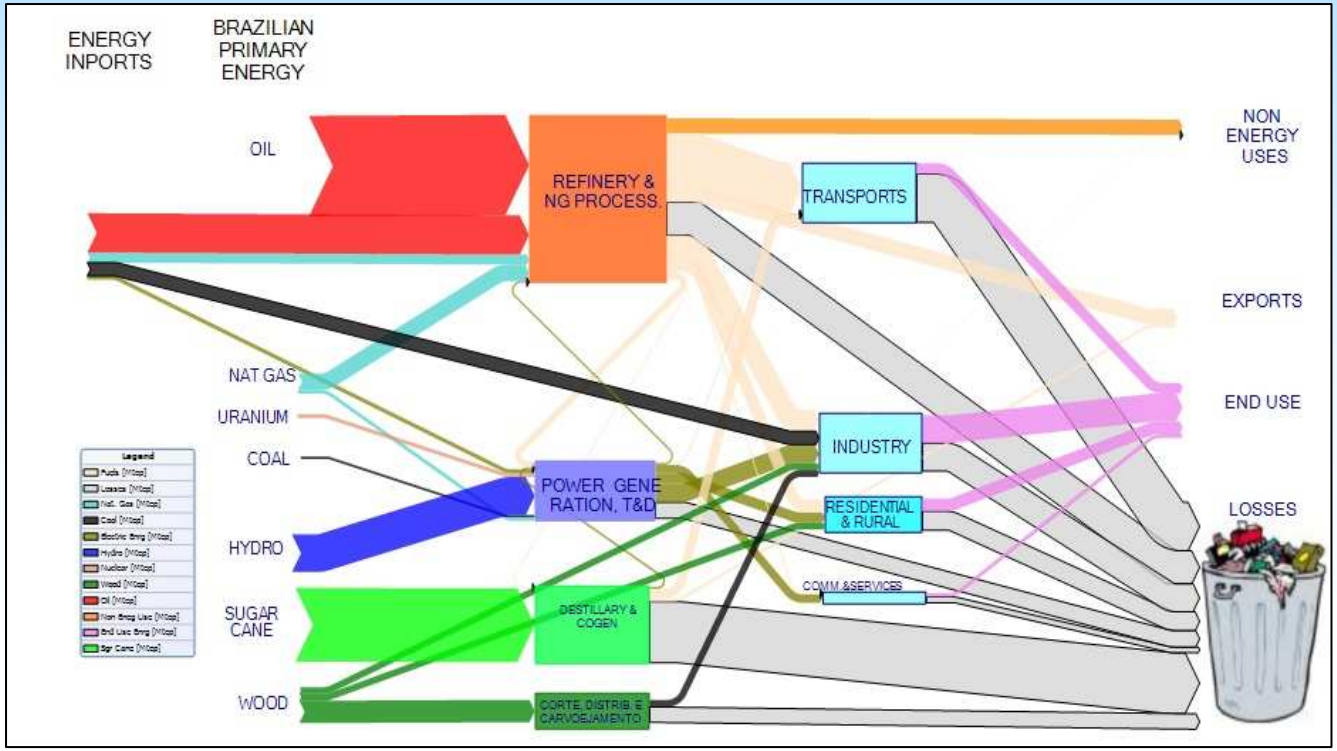
Outline

1. Energy in Brazil
2. Energy efficiency programs in Brazil
3. PROCEL/INMETRO Labeling Program
4. MEPS CGIEE Program
5. Final comments

Assessing Impacts of Efficiency Programs in Brazil

Brazil: Energy supply at a glance

- ✓ *Diversified base of energy reserves and potentials.*
- ✓ *50% of total energy production are renewable.*



Energy flows in Brazil in 2007

(INEE, 2009)

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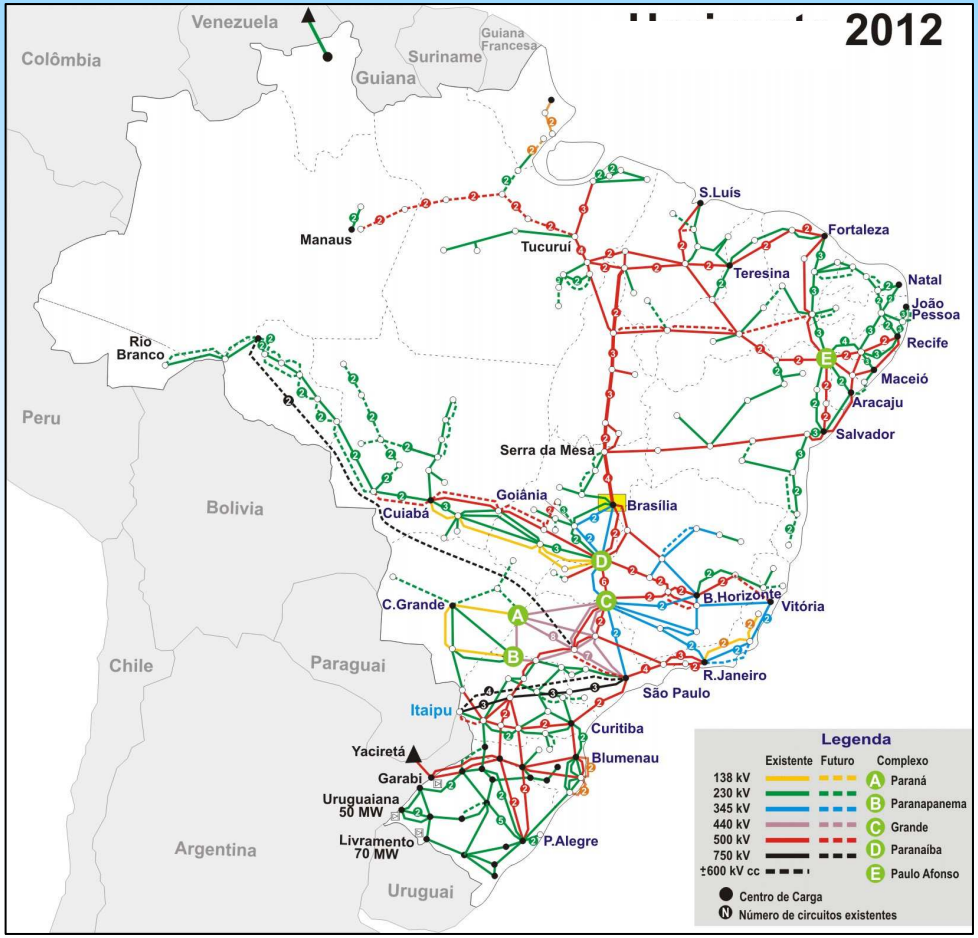
Electricity basic data in Brazil

- ✓ *115 GW installed capacity*
- ✓ *More 50 GW until 2020*
- ✓ *85% of electricity come from hydro stations*



Main transmission lines and power stations in Brazil

(ONS, 2011)

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Electricity consumption in Brazil

- ✓ *Electricity is available in 98,5% of Brazilian households*
- ✓ *Consumption increase associated to social and productive uses*

Electricity production:

kWh/inhab (blue curve)

kWh/1000 USD (red curve)

(MME, 2011)

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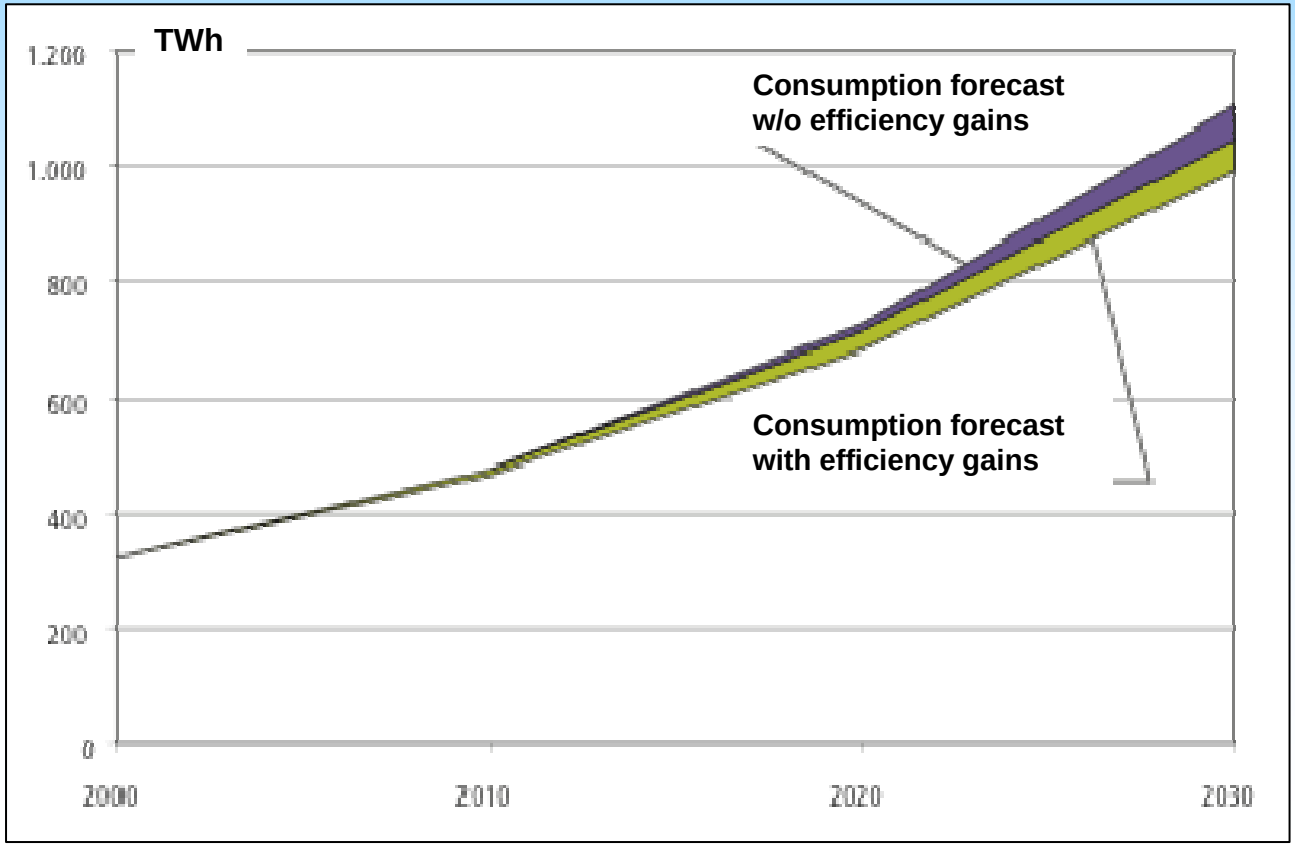
Energy efficiency requirement

National Energy Plan sets a reduction of 10% of baseline electricity consumption expected for 2030.

Final Electricity Consumption forecast

(in green savings induced by efficiency programs)

(EPE, 2009)



Energy efficiency programs in Brazil

Since 80's programs aiming to improve energy efficiency and reduce energy losses have been implemented.

Main programs

Program	Created in	Management	**Budget** (M USD/year)
PROCEL **National Program of Electrical Energy Conservation**	**1985**	**Eletrobras**	**~ 45**
PEE **Program of Energy Efficiency**	**2000**	**ANEEL (power sector regulatory agency)**	**~ 140**
CGIEE **Steering Committee of Minimum Energy Performance Standards**	**2001**	**Ministry of Mines and Energy**	**-**

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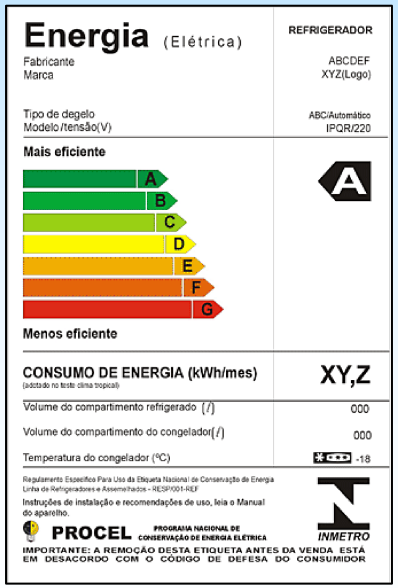
PROCEL/INMETRO Labeling Program

40 different equipment and approx. 3,800 models receive the performance labels: refrigerators, air conditioners, washing machines, lamps, TV sets, etc.



National Energy Conservation Label (PROCEL/INMETRO)

Energy Economy PROCEL Seal (Class A + other atributes)

PROCEL/INMETRO Labeling Program

Evaluation of results:

The energy impact of an equipment labeling can be estimated by comparing the park of such equipment before and after the introduction of the label.

Annual Energy Economy = **Park of Equipment** (**Baseline Average Unit Consumption** - **After Labeling Average Unit Consumption**)

PROCEL/INMETRO Labeling Program

***Evaluated equipment*: refrigerators and freezers, air conditioners, fluorescent lamps and ballasts, electric motors, solar water heating systems and roof fans.**

***PROCEL results in 2011*:**

- ✓ **Energy saving: 6.70 TWh (1.6 % of national consumption)**
- ✓ **Capacity saving (demand reduction): 2,619 MW**
- ✓ **Economy due to postponed plants: 440 M US**

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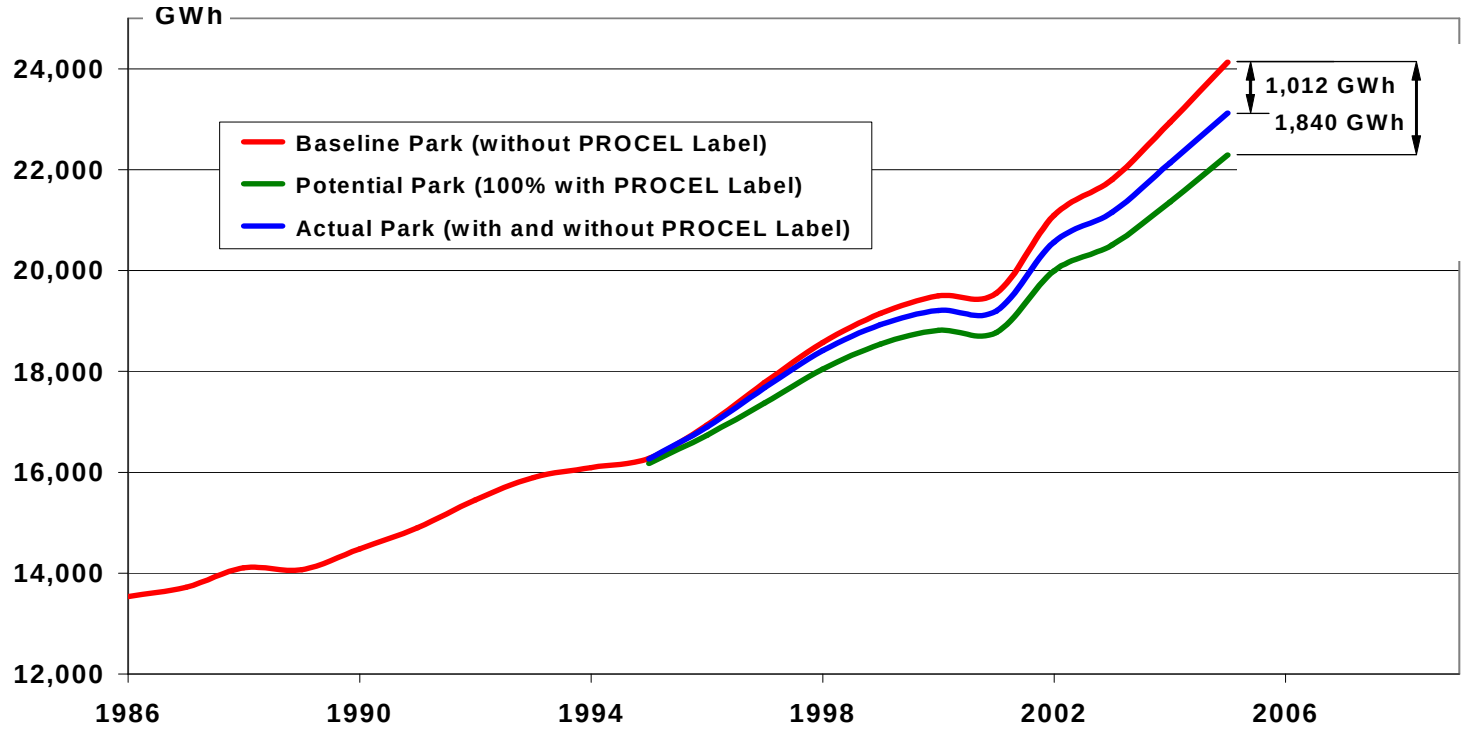
PROCEL/INMETRO Labeling Program

Partial results:

Scenarios of energy consumption of refrigerators in Brazil: a)without efficient equipment (red line), b) real (blue line) and c) only efficient equipment (green line)



(PROCEL, 2008)

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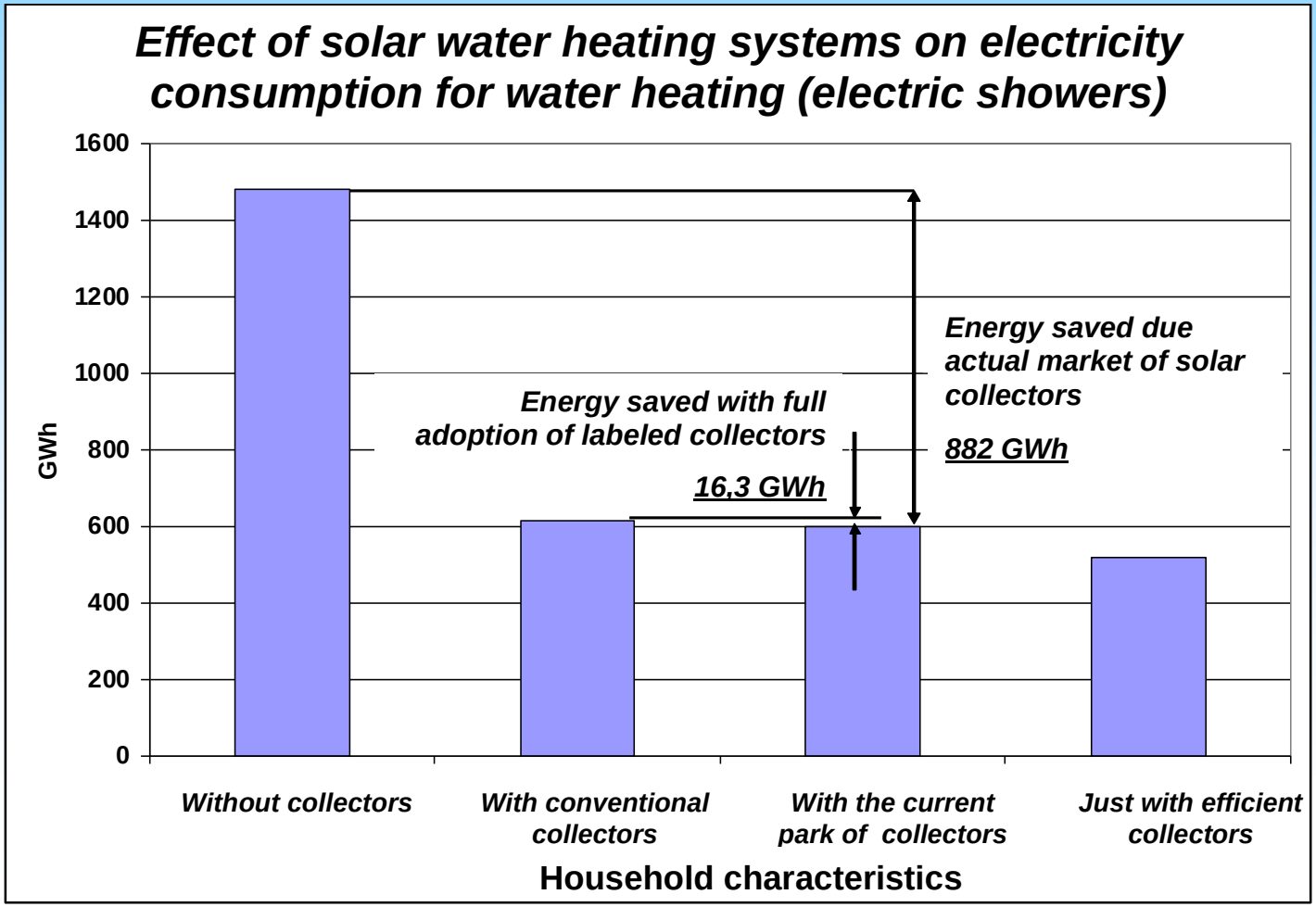
PROCEL/INMETRO Labeling Program

Partial results:



(EXCEN, 2010)

MEPS CGIEE Program

According to Law 10.295/2001, the Steering Committee of Minimum Energy Performance Standards of Ministry of Mines and Energy, sets efficiency limits and targets for equipment commercialized in Brazil, available on line.

Equipment with MEPS in place (2001/2010):

Electric motors, compact fluorescent lamps, refrigerators, freezers and air conditioners, electric lamps, gas stoves and ovens and gas domestic water heaters.

Equipment in final stage to receive MEPS:

Washing machines, transformers, ballasts.

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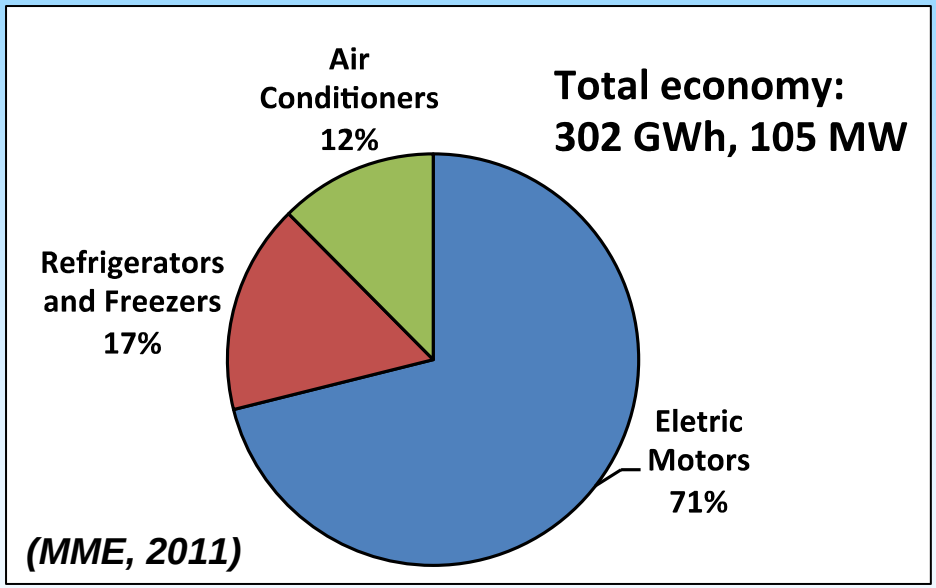
MEPS CGIEE Program

Initial results (2001/2010)



Forthcoming results (2030)

Mainly due efficient lamps mandatory introduction, it is forecasted a total energy economy of 11,864 GWh e 8.30 GW

Final comments

- ✓ *Efficiency programs in Brazil, specially Performance Labeling and MEPS, present sizable and relevant energy impacts.*
- ✓ *The current level of detail and consistence of impacts assessment of efficiency programs recommend to include fostering energy savings in national energy plans.*
- ✓ *A challenge to face in the Brazilian context is to promote efficiency in the current abundance of primary energy supply. Energy should be always used with rationality.*

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Thanks for your attention.

Thanks for FAPEMIG support.

Excellence Centre on Energy Efficiency

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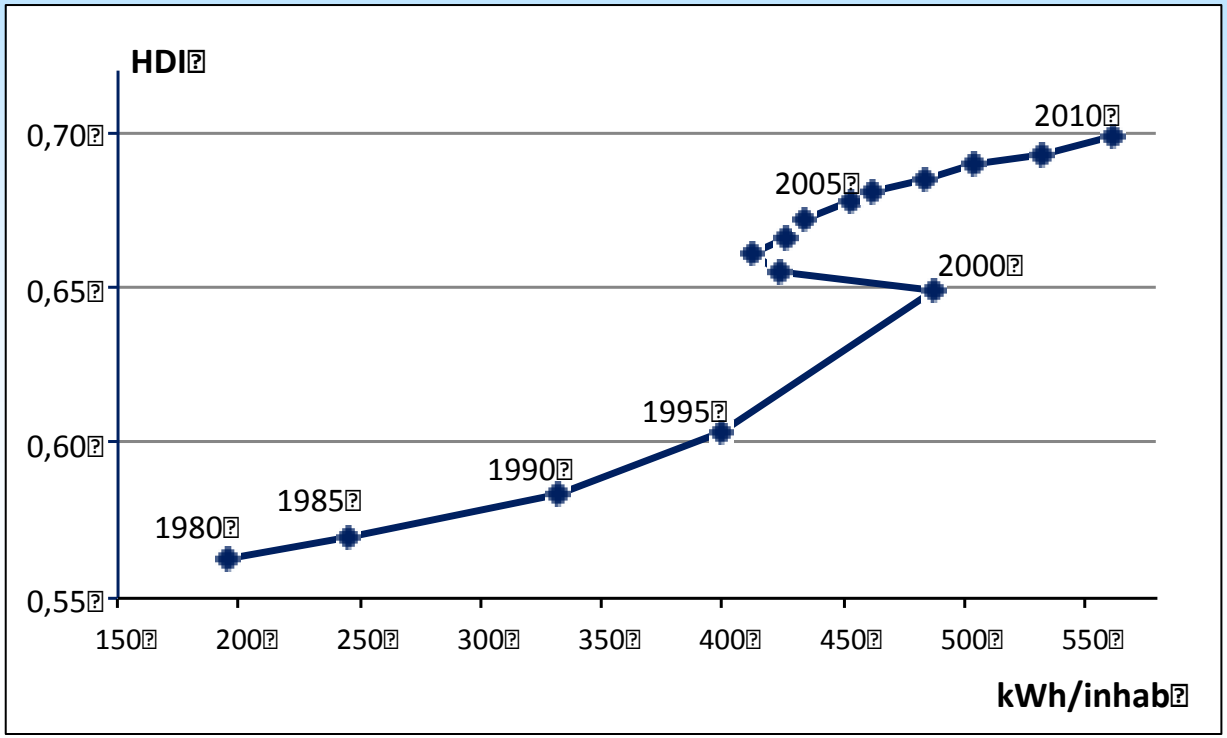
Electricity economy and social impact

Mandatory introduction of efficient appliances due to energy crisis in 2001 promoted energy savings without sensible social effects.



Human Development Index (HDI) and Residential Electricity Use per capita

(EXCEN-UNIFEI, 2010)

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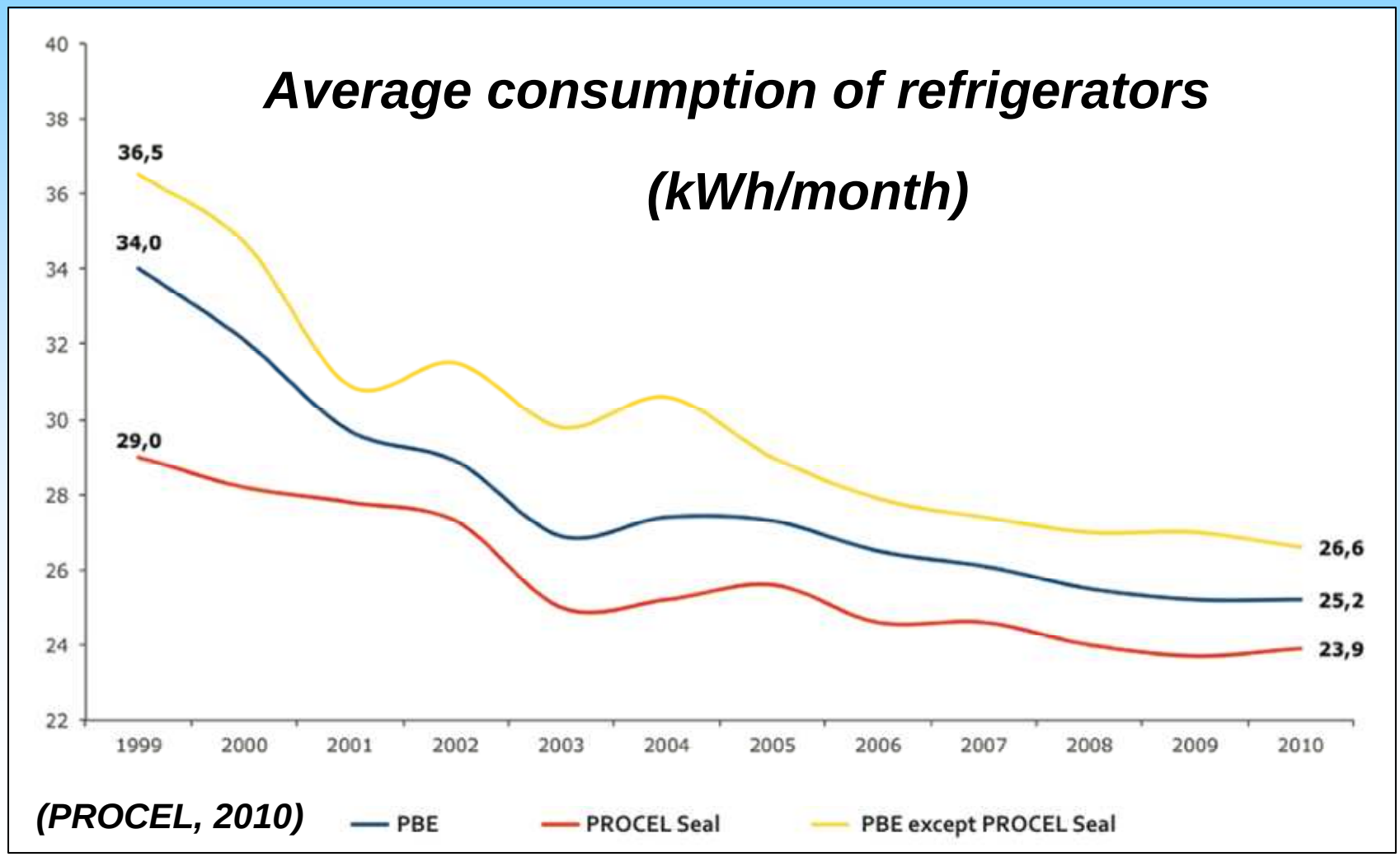

(PROCEL, 2010)

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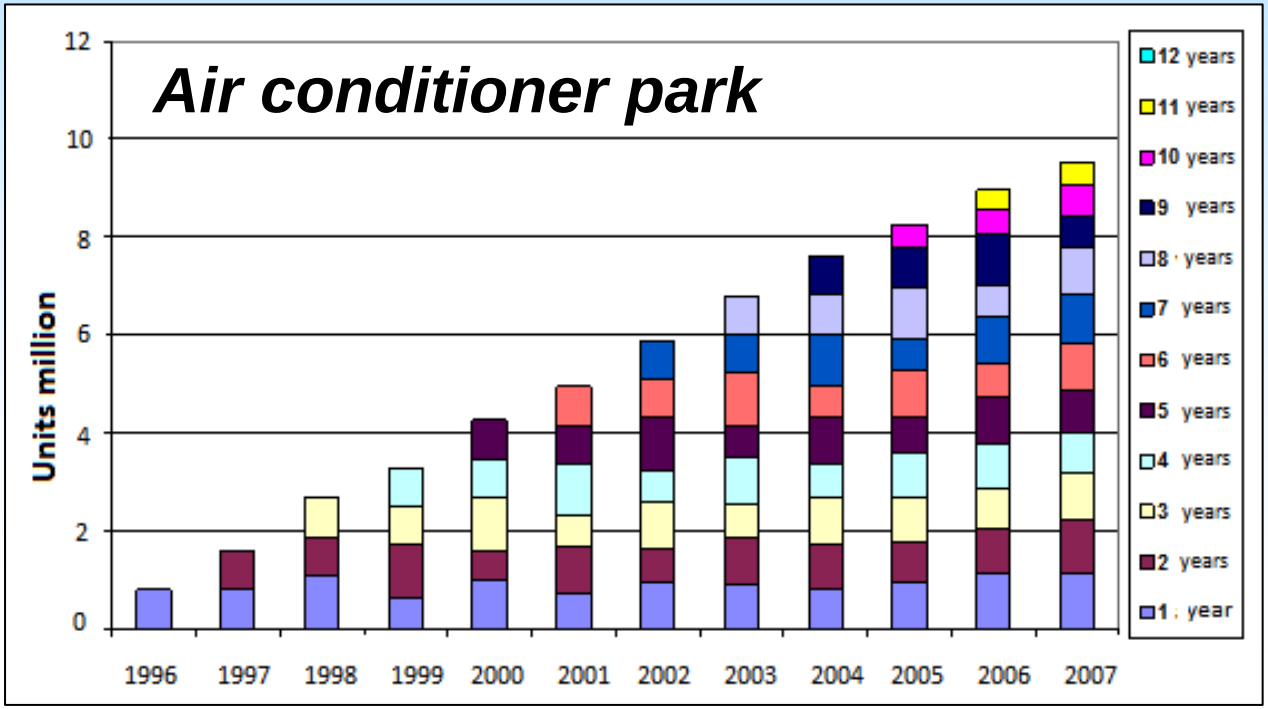
PROCEL/INMETRO Labeling Program

Evaluation of results:

To estimate the park of equipment can be used surveys or marketing and economic life information.

$$P_j = \sum_{i=j-VU}^{j} S_i - D_j$$



(Horta Nogueira et al., 2011)

PROCEL/INMETRO Labeling Program

Evaluation of results:

The average unit consumption (baseline and after labeling) can be obtained weighing and adjusting results from laboratory tests, considering ambient temperature, age and operating time.

Average Unit Annual Energy Consumption	=	Weighed Standard Consumption	X	Adjusting Factors: Temperature, Age and Operating Time

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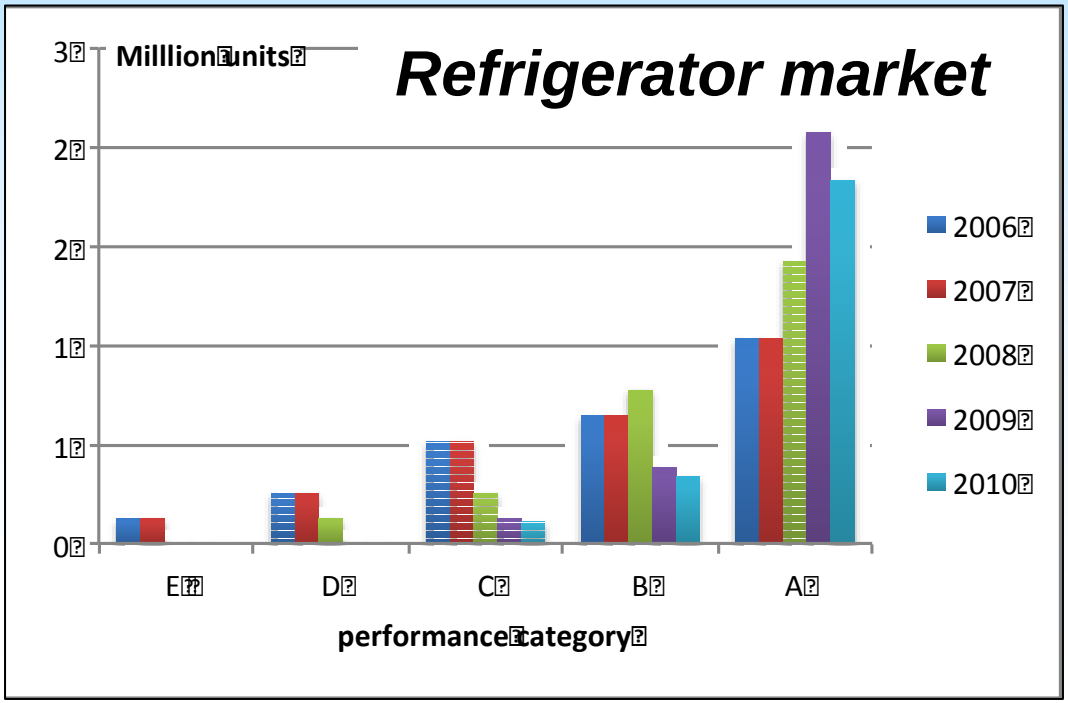
PROCEL/INMETRO Labeling Program

Evaluation of results:

The average unit consumption (AC) can be defined based on market share (MS) of different performance categories.

$$AC_{jK} = \frac{\sum_{i=j\text{-}EL}^{j} C_{iK}.MS_i}{\sum_{i=j\text{-}EL}^{j} MS_i}$$



(MME, 2011)

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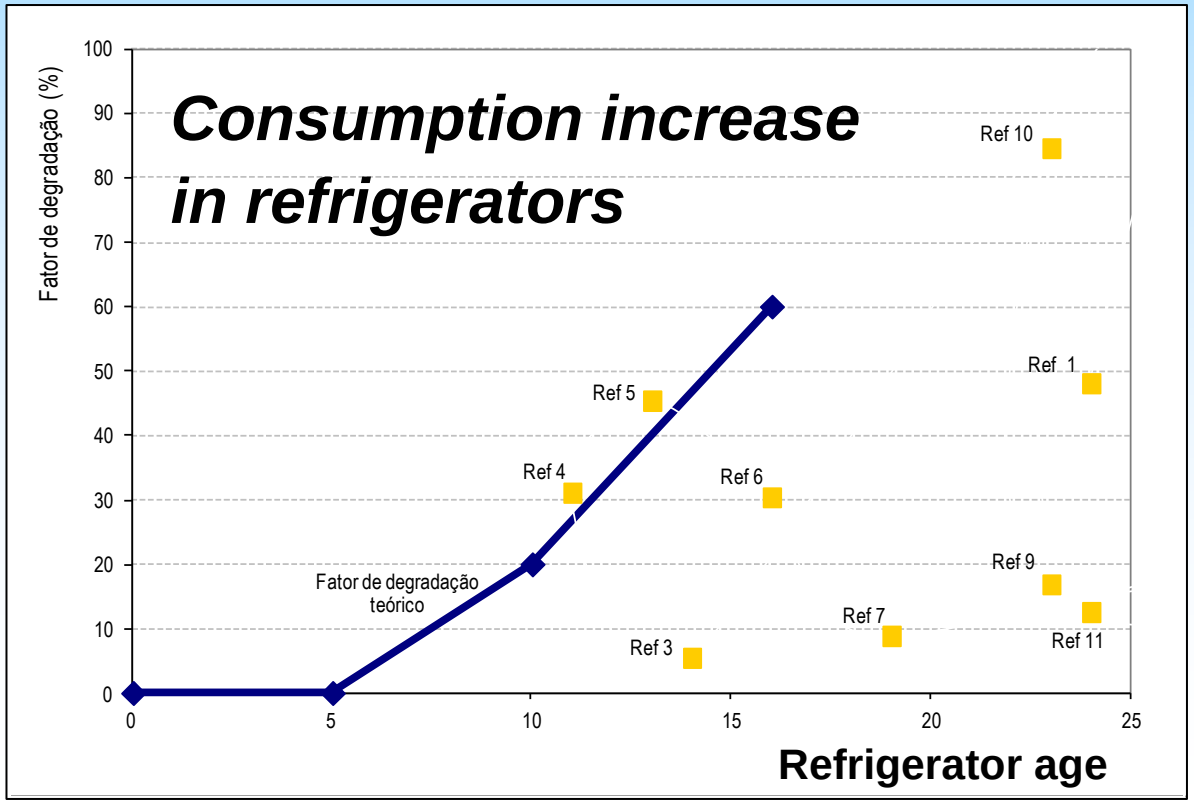
PROCEL/INMETRO Labeling Program

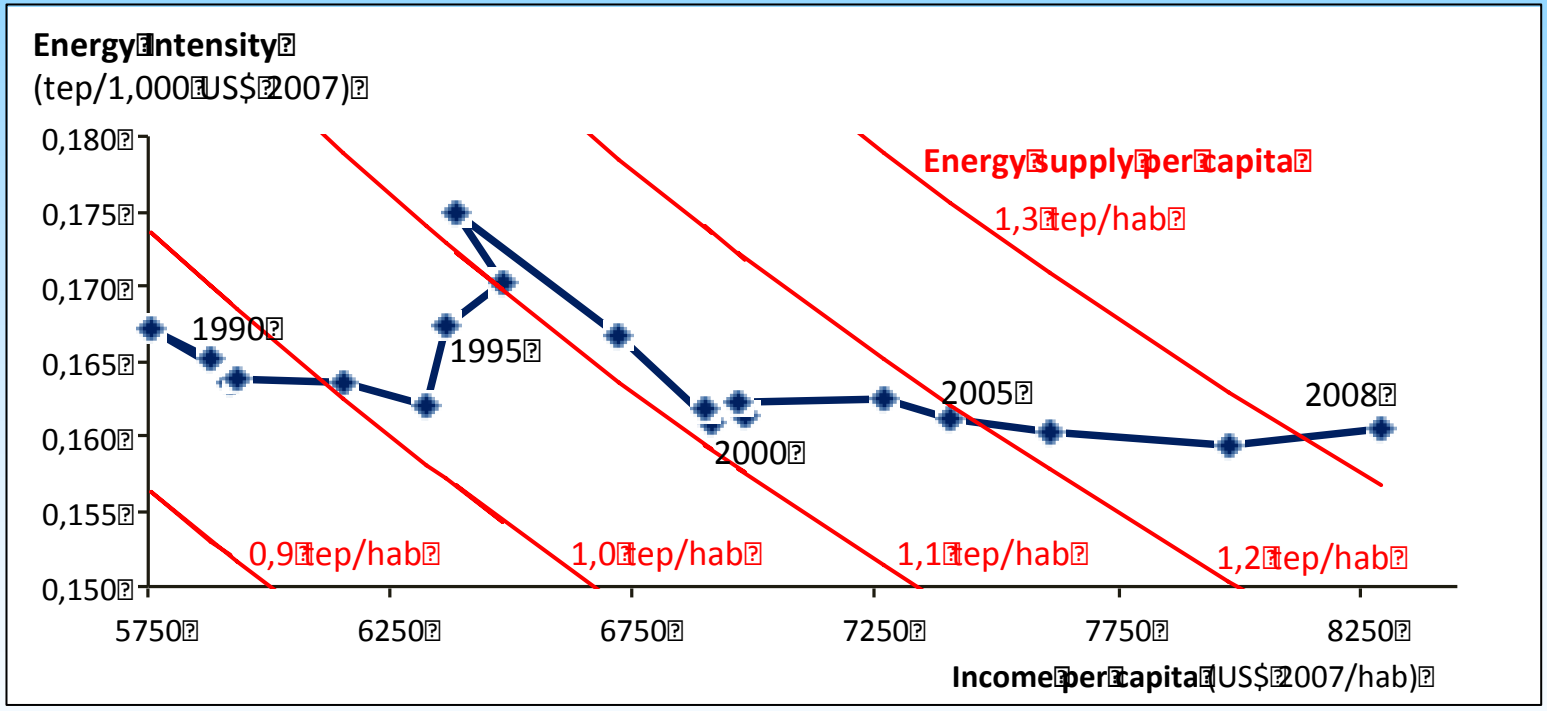
Evaluation of results:

Aging effect in refrigerators.



(Salvador, 2012, unpublished)

How can we take the efficient path?



(prepared with data from ECLAC and OLADE, 2009)