Brazil’s non-domestic energy and buildings context

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Brazil x World

• Consumption per capita is different
• Emission are different
• End uses are different
• Space cooling is very important and growing rapidly
Renewables represent 13% of global energy consumption...

* In this graph, peat and oil shale are aggregated with coal, when relevant.
By 1970, renewables were 80% of Brazilian energy matrix, today less than 47%...
Energy Matrix

BRAZIL vs. WORLD

Brazil:
- Non-renewable: 53%
- Renewable: 47%

World:
- Non-renewable: 86%
- Renewable: 14%

BEN – 2014 & IEA 2013
CO₂ Emission Factor – SIN (médio mensal)

Fator de emissão (tCO₂/MWh)

BORGSTEIN, 2014
Emissões de CO₂ per capita

- Produzindo e consumindo energia, cada brasileiro emite, em média, 7 vezes menos do que um americano e 3 vezes menos do que um europeu ou um chinês.

Emissões de CO₂ per capita (2014), em t CO₂/hab

<table>
<thead>
<tr>
<th>País</th>
<th>Emissão (t CO₂/hab)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUA</td>
<td>16,2</td>
</tr>
<tr>
<td>China</td>
<td>6,7</td>
</tr>
<tr>
<td>União Européia</td>
<td>6,2</td>
</tr>
<tr>
<td>Brasil</td>
<td>2,3</td>
</tr>
</tbody>
</table>

Emissões per capita brasileiras em 2016: 2,1 t CO₂/hab

Fonte: EPE

Fonte: Agência Internacional de Energia.
Elaboração: EPE
Em 2016, o total de emissões antrópicas associadas à matriz energética brasileira atingiu 428,95 MtCO₂-eq.

Emissões totais (2016), em Mt CO₂

- **Transportes**: 194,3 MtCO₂-eq (45,3%)
- **Indústrias**: 81,9 MtCO₂-eq (19,1%)
- **Residências**: 18,6 MtCO₂-eq (4,3%)
- **Outros setores**: 134,1 MtCO₂-eq (31,3%)

Δ 16/15

-7,2%
CONSUMPTION BY SETOR - BRAZIL

TOTAL 243,911 tep

ELETRICIDADE 18%
INDUSTRIAL 36%
TRANSPORTES 34%
ENERGÉTICO 11%
AGROPECUÁRIO 4%
RESIDENCIAL 10%
COMERCIAL 10%
PÚBLICO 2%

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Electric Energy Consumption - Brazil

- Consumption of electricity (TWh)
  - Setor Público
  - Setor Comercial
  - Setor Residencial

- HVAC 20%
- HVAC 50%
- HVAC 50%
Space cooling in Brazil

• In 1997 space cooling was 3% of the residential sector electric energy consumption and in 2007 went up to 20%
• In 2007 it was 47 to 50% of commercial and public buildings electric energy consumption
• We miss more recent and in depth end-use studies
End-use - WORLD

Residencial:
- Cooking: 29%
- Space Heating: 32%
- Appliances: 9%
- Lighting: 4%
- Cooling: 2%
- Water Heating: 24%

Total = 24.3 PWh

Comercial:
- Space Heating: 33%
- Other (IT...): 16%
- Cooling: 12%
- Lighting: 7%
- Water Heating: 32%

Total = 8.42 PWh

IEA – 2013
Space cooling Globally

Key point

Space cooling has been and will continue to be the fastest growing building end-use to 2050.

Key point

The global building sector has enormous potential to reduce energy-related GHG emissions, especially through energy efficiency measures that will support decarbonisation of the power sector.
• Quatro datas por ano em intervalos trimestrais. (FEV, MAI, AGO, NOV)
• Terças-feiras e não são feriados.
• O horário de pico em MAI e AGO permaneceu constante de 2005 a 2014.
• O horário de pico em NOV e FEV era cerca de 20:30 até nov 2009, e migrou para cerca de 15:30 a partir de fev 2010.
• Infere-se que houve antecipação do horário de pico no verão mas não houve alteração do horário de pico no inverno.
HVAC MARKET IN BRAZIL

MERCADO EM TR
Ar Condicionado Brasil – 2017*

Split (HW)+Inverter 72%
Others 4%
Self(Pakage) 3%
VRF 3%
FC 3%
Chillers 5%
WRAC 10%

* = Projeção DEE ABRAVA
HVAC market in Brazil

– 80% splits (and WRAC)
  ➢ INMETRO label is compulsory (A a E)
  ➢ PROCEL Seal (for the most efficient, A)
  ➢ Minimum Energy Performance Standards CGIEE
  ➢ 7 million splits + WRAC per year (2014), 0.9 m inverter

– 20% larger systems (Chiller, VRF, Self)
  ➢ No measurement of COP, IPLV and no MEPS
Latin America EE

LATAM Energy Efficiency standards Overview

Region/Country
- México
  - Inverter: EER 2.7
  - Non Inverter: EER 3.35
- Puerto Rico
  - EER 2.7
- Ecuador
- Colombia
  - COP 2.6
  - New: 2016 Aug
- Brazil
  - COP 2.6
  - New: 2016 Aug
- Argentina
  - COP 3.2
  - New: 2016 May
- Uruguay
  - COP 2.3
- Chile
  - COP 2.2
- Others (30 Countries)
- Central América
- Caribbean countries

Possible harmonization of Energy Efficiency Standards in LATAM under SEER, using AHRI testing method.

No Regulations

REF- Shu Kawasaki - Daikin
Superefficiency

➢ Increase 30% in EE of RAC with R410A (Base case, COP=2.9) >>> Class “C” INMETRO 2015)

➢ Brazil 2030: reduction in demand from 14 to 32 GW
➢ Brazil 2050: reduction in demand from 41.3 to 96.4 GW
Recomendations (ABRAVA to MME)

SPLIT and window (Labelled by INMETRO)

➢ Include SCOP to show the value of the inverter technology
➢ Increase substantially the MEPS – align with the best international references

Larger systems (Not labelled yet)

➢ Follow ASHRAE 90.1-2016 for MEPS
➢ Implement compulsory COP and IPLV measurements
➢ Align with US proposals for 2018 and 2023
Building Standards, Labels and certifications

• Construction industry is 10% of GDP – 50% formal
• No minimum thermal performance standard for envelope of commercial buildings
• Building codes – municipalities do not control
• High level of informality in the building industry
• EPC is voluntary – only compulsory for Federal Public buildings
• Some green buildings – 152 NC Leed
• Some EPCs (124 design and 90 built)
New EPC Asset rating Label

Escala com base em consumo de energia primária (kWh/ano)

Os valores de referência relativos à classe D são fixo por tipologia ao longo do tempo.

Avaliação da edificação

consumo final de energia térmica e elétrica

Classificação considerando eficiência energética da edificação e geração local.

Uso racional de água e emissões de dióxido de carbono incluídos e de caráter informativo
When building start to operate ...
Operational rating DEO from CBCS

www.cbcbs.org.br/deo
Operational rating DEO from CBCS

- Operational rating is very important to help establish retrofit priorities
- We started with bank branches
- Corporate offices
- Public buildings
- New project from Procel 15 typologies
Concluding

• Brazil is different
• Building codes are basic and not really followed
• We do not have building standards for energy efficiency in buildings
• We have voluntary EPC
• We have some green buildings
• We have the basis for operational rating