Energy Use in Selected Industries in Brazil: Overview and Opportunities

American Steel Experts’ Dialogue
Session 1: “State-of-play of the iron & steel industry from an energy perspective”

São Paulo, August 22th 2018

Jeferson Borghetti Soares
Head
Energy and Economic Department
SUMMARY

• About EPE

• Brazilian Industry in the Energy Sector: Status and Prospects

• Meeting the energy demand growth

• Next steps

• Final Remarks
Institutional Structure of Brazilian Energy Sector

**High Level Policy Guidelines and Major Government Decisions**

- **CNPE**
  National Energy Policy Council

**Policy Design and Energy Planning**

- **MME**
  Ministry of Mines and Energy

**Supply Monitoring**

- **CMSE**
  Power Sector Monitoring Committee

**Regulation and Supervising**

- **ANEEL**
  National Electricity Agency
- **ANP**
  National Petroleum Agency
- **ANA**
  National Water Agency

**System Operation**

- **ONS**
  National System Operator

**Commercialization**

- **CCEE**
  Electricity Energy Commercialization Chamber

**Planning**

- **EPE**
  Energy Research Office

EPE is a Brazilian state-owned company responsible for studies in order to support governmental policies for the energy sector, in charge of MME.
BRAZILIAN INDUSTRY IN THE ENERGY SECTOR: Status and Prospects
Energy Consumption in Brazil -2017

Industrial and transportation demand accounts for about 60% of all energy consumption in Brazil (all sources: electricity and fuels)

| Source: Brazilian Energy Balance, 2018 |
Energy Consumption in Brazilian Industry - 2017

- **2017**: 86.5 Mtoe
- **2016**: 84.3 Mtoe
  - **Increase**: 2.6%

### Energy Sources and Consumption

- **Coal**: 8.4% (Steel production)
- **Sugarcane bagasse**: 5.7% (Sugar production)
- **Black Liquor**: +3.6% (Pulp & paper production)
- **Charcoal**: -4.1% (Steel production)

### Renewable Energy
- **Renewable** = 58%

### Sectoral Energy Consumption

- **Other industries**: 10%
- **Pulp & Paper**: 15%
- **Food & Beverages**: 29%
- **Chemicals**: 8%
- **Non Ferrous**: 7%
- **Iron & Steel**: 23%
- **Non Metallic**: 10%

### Notes

- **¹** Includes: diesel oil, LPG, nafta, querosene, coke gas, refinery gas, petroleum coke, as well as other renewables and non renewables.

**Source**: Brazilian Energy Balance, 2018
Energy Consumption in Brazil - Perspectives

% in total energy consumption

- Industry: 33% (2026) vs. 31% (2016)
- Transportation: 30% (2026) vs. 32% (2016)
- Agriculture: 4% (2026) vs. 4% (2016)
- Commercial/Public: 6% (2026) vs. 5% (2016)
- Household: 10% (2026) vs. 10% (2016)
- Energy production: 12% (2026) vs. 10% (2016)
- Non energy use: 7% (2026) vs. 7% (2016)

Other industries:
- Other industries: 9% (2026) vs. 10% (2016)
- Pulp & Paper: 17% (2026) vs. 15% (2016)
- Food & Beverages: 29% (2026) vs. 28% (2016)
- Chemicals: 7% (2026) vs. 7% (2016)
- Non metallic: 10% (2026) vs. 11% (2016)
- Non Ferrous: 7% (2026) vs. 7% (2016)
- Iron & Steel: 22% (2026) vs. 23% (2016)

Source: Ten year Expansion Plan 2026
MEETING THE ENERGY DEMAND GROWTH
Meeting Energy Consumption: Approaches and Choices

- Minimum CAPEX and OPEX
- Reduction of uncertainties supply
- Reduction and avoiding environmental impacts

Renewable
- Hydro
- Biomass
- Wind
- Solar

Non renewable
- Nuclear
- Coal
- Natural Gas

Energy Efficiency
Distributed Generation/Storage
Energy Efficiency: important option to meet demand

% the total energy efficiency by sector – 2026

% Energy efficiency in industrial sector (2026): 5%

% Industry
% Transportation
% Services
% Household
% Agriculture

%  Energy efficiency in industrial sector (2026): 5%

ODEX (baseyear 100 = 2005)

Total Energy  Electricity

94,8  94,2
Energy Efficiency: understanding how to better promote

**National Survey on Energy Industrial Use**

- Improve data quality on energy use in industry
- Understand energy efficiency choices (amount, costs) and their role to meet energy demand in this sector
- Input for policies development to deploy untapped energy efficiency potential
- Update Useful Energy Balance (BEU)
- Focused on most energy intensive industries in Brazil
- Funding by World Bank Resources – META Project
- 12-Month project
- Contracted via Competitive Procurement
- Consultancy: Applus-Qualitec
- Currently under development
<table>
<thead>
<tr>
<th>Industry</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALUMINUM</strong></td>
<td>• Bauxite • Alumina • Primary and Secondary Aluminum</td>
</tr>
<tr>
<td><strong>PULP AND PAPER</strong></td>
<td>• Pulp • Paper • Recycled Paper</td>
</tr>
<tr>
<td><strong>IRON AND STEEL</strong></td>
<td>• Pelletizing/sintering • Pig Iron • Steel (coal and charcoal routes)</td>
</tr>
<tr>
<td><strong>CERAMIC</strong></td>
<td>• White ceramics • Structural ceramics • Glass</td>
</tr>
<tr>
<td><strong>FOOD AND BEVERAGES</strong></td>
<td>• Sugar • Floor, Pasta and Bakery • Oil &amp; Fats • Meat • Milk/Dairy • Beverages and Juices</td>
</tr>
<tr>
<td><strong>CHEMICALS</strong></td>
<td>• Petrochemical • Gas and Chemical • Alcohol-chemical • Fertilizers • Soda-Chlorine</td>
</tr>
</tbody>
</table>
National Survey on Energy Industrial Use: Overview

Scope

• Surveys in Brazilian industrial plants (face-to-face)
• Energy consumption by technology and process by segment
• Identifying energy potential and costs for Brazilian Industry

Requests

• Industry collaboration in order to allow data access
• Expert team on energy use analysis from consultancy side
• EPE team in order to provide and guide for adjustments

Products

• Database about specific industrial segments: energy use
• Specific reports for each study
• Internal technical workshops to present results (capacity building)
INDUSTRIAL ENERGY DEMAND FORECASTING: GENERAL OVERVIEW

- Sectoral economic scenario (Physical output/Added value)
- Technical coefficients (Energy service)
- Useful Energy by energy service
- Yield by energy service
- Useful Energy by energy service and by energy source
- Energy sources competitiveness
- Final Energy by energy service and by energy source

Industrial segments:
- Iron & Steel
- Food & Beverages
- Non Ferrous
- Mining/pelotizing
- Cement
- Ceramic
- Chemical
- Pulp & paper
- Textile
- Other

Energy Services:
- Direct heating
- Steam
- Mechanical power
- Lightening
- Cooling
- Electrochemical
- Other uses
National Survey on Energy Industrial Use: Usage

Updating of technical parameters for energy consumption in industry

- For each energy service identify in which amount some energy source is consumed
- For each energy service identify energy efficiency average potential

<table>
<thead>
<tr>
<th>ENERGY SOURCE</th>
<th>Mechanical Power</th>
<th>Steam</th>
<th>Direct Heating</th>
<th>Cooling</th>
<th>Lightning</th>
<th>Electrochemical</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Coal</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Firewood</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Sugar cane bagasse</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Other primary sources</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Diesel Oil</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Gasoline</td>
<td>0.01</td>
<td>0.94</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>LPG</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Kerosene</td>
<td>0.99</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Coke gas</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Coke</td>
<td>0.00</td>
<td>0.03</td>
<td>0.92</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Electricity</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Charcoal</td>
<td>0.99</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Other oil sources</td>
<td>0.00</td>
<td>0.20</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Tar</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENERGY SOURCE</th>
<th>Mechanical Power</th>
<th>Steam</th>
<th>Direct Heating</th>
<th>Cooling</th>
<th>Lighting</th>
<th>Electrochemical</th>
<th>Other</th>
<th>Mechanical Power</th>
<th>Steam</th>
<th>Direct Heating</th>
<th>Cooling</th>
<th>Lightning</th>
<th>Electrochemical</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Coal</td>
<td>0.77</td>
<td>0.32</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Firewood</td>
<td>0.01</td>
<td>0.94</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Sugar cane bagasse</td>
<td>0.77</td>
<td>0.32</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Other primary sources</td>
<td>0.77</td>
<td>0.32</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Diesel Oil</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>LPG</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Kerosene</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Coke gas</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Coke</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Electricity</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Charcoal</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Other oil sources</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Tar</td>
<td>0.48</td>
<td>0.89</td>
<td>0.52</td>
<td>0.10</td>
<td>0.95</td>
<td>0.55</td>
<td>0.05</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
<td>0.55</td>
<td>0.59</td>
<td>0.90</td>
<td>0.95</td>
</tr>
</tbody>
</table>

INPUTS FOR:
- Improvement of energy demand method
- Competitiveness of energy sources studies (e.g. oil vs natural gas)
- Energy efficiency potential and subsidies to promote designing policies
NEXT STEPS
Next Steps

✓ Data gathering are under development by consultancy and fine tune consistency analysis is required

✓ Development status to be presented in 29th August in MME

✓ Products from this Project will be available:
  ✓ Reports for each industrial segment: available at EPE website
  ✓ Updating of Useful Energy Balance (BEU) for Brazilian Industry: to be developed
  ✓ Technical Note about energy use in Brazilian industry consumption and energy efficiency deployment: to be developed
Untapped Energy Efficiency Potential: How accelerate deployment?

Cross Sector
- Education, Communication, Financing, Standards and Labeling, Regulation, EE Auctions

Sectors
- Industry
- Building
- Transport
- Public

Policy
Untapped Energy Efficiency Potential: How accelerate deployment?

- Energy audits
- Voluntary Agreements
- Information Campaigns
- Mandatory targets
- CHP and thermal waste deployment
- Fiscal and economic incentives
- Equipment replacement
- EE networks

Financing schemes, energy efficiency auctions, taxes and incentives
FINAL REMARKS
Final Remarks: Lessons Learnt

✓ Data availability: critical issue and access strategies are needed

✓ Communication Strategy with industry stakeholders is fundamental: helps to establish confidence

✓ Conduct a previous survey with industrial consumers in order to identify critical issues to overcome

✓ Continuous adaptation capacity required
THANK YOU FOR YOUR ATTENTION!

Jeferson Borghetti Soares

Head - Energy and Economic Department

E-mail: jeferson.soares@epe.gov.br

Phone number: + 55 (21) 3512 – 3194

+ 55 (21) 3512 – 3334

Avenida Rio Branco, 1 – 11th Floor
20090-003 – Downtown - Rio de Janeiro/RJ - Brazil

http://www.epe.gov.br/

Twitter: @EPE_Brasil
Facebook: EPE.Brasil