
Eletrobras
October 2011
eima 8
Encuentro Iberoamericano
sobre Desarrollo Sostenible
Cooperación para un futuro sostenible

# Who we are ?

## Major utility in Latin America

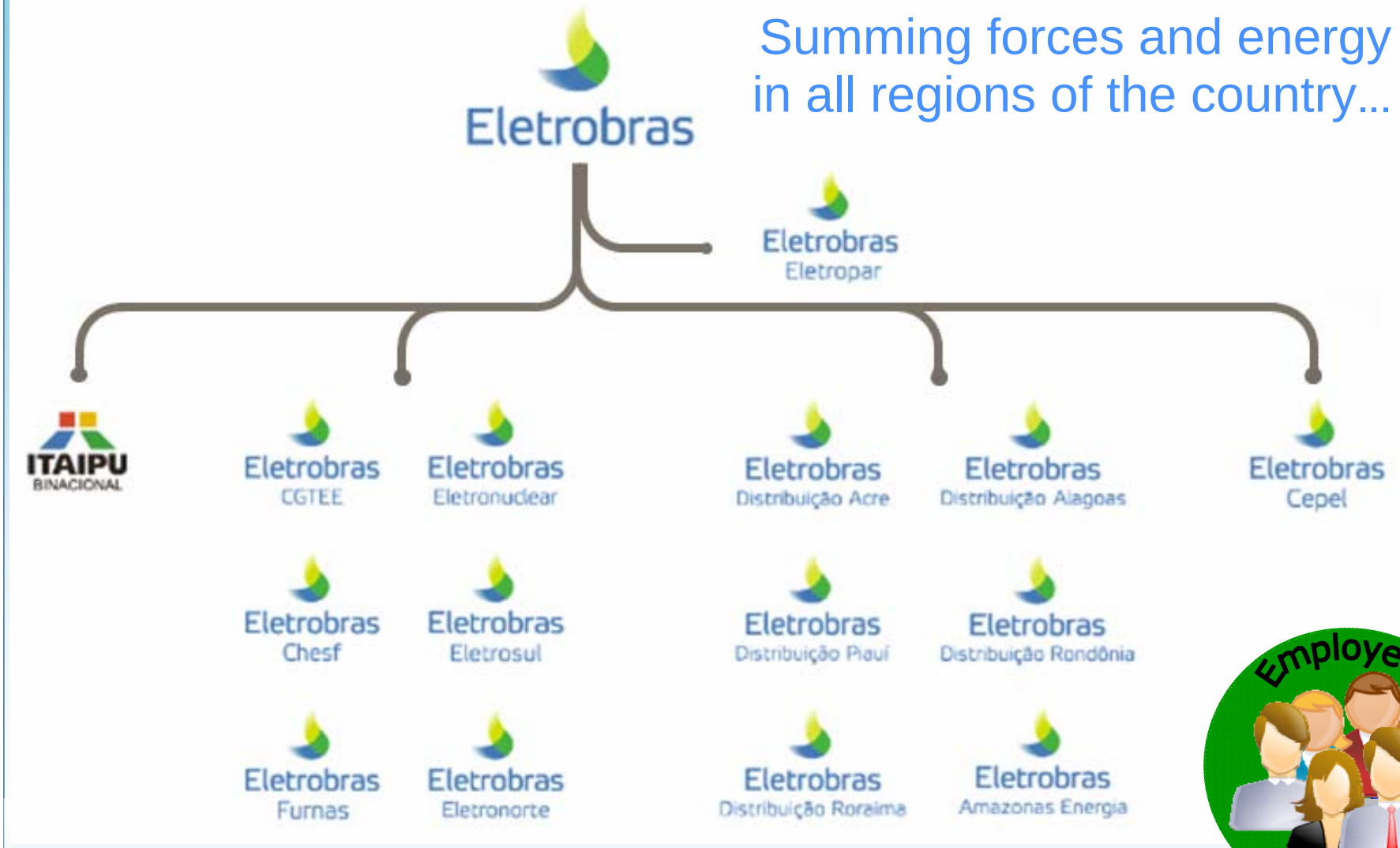
- Generation
- Transmission
- Distribuition
- Free market electricity trading

## Managing and implementing Social and Sector Programs

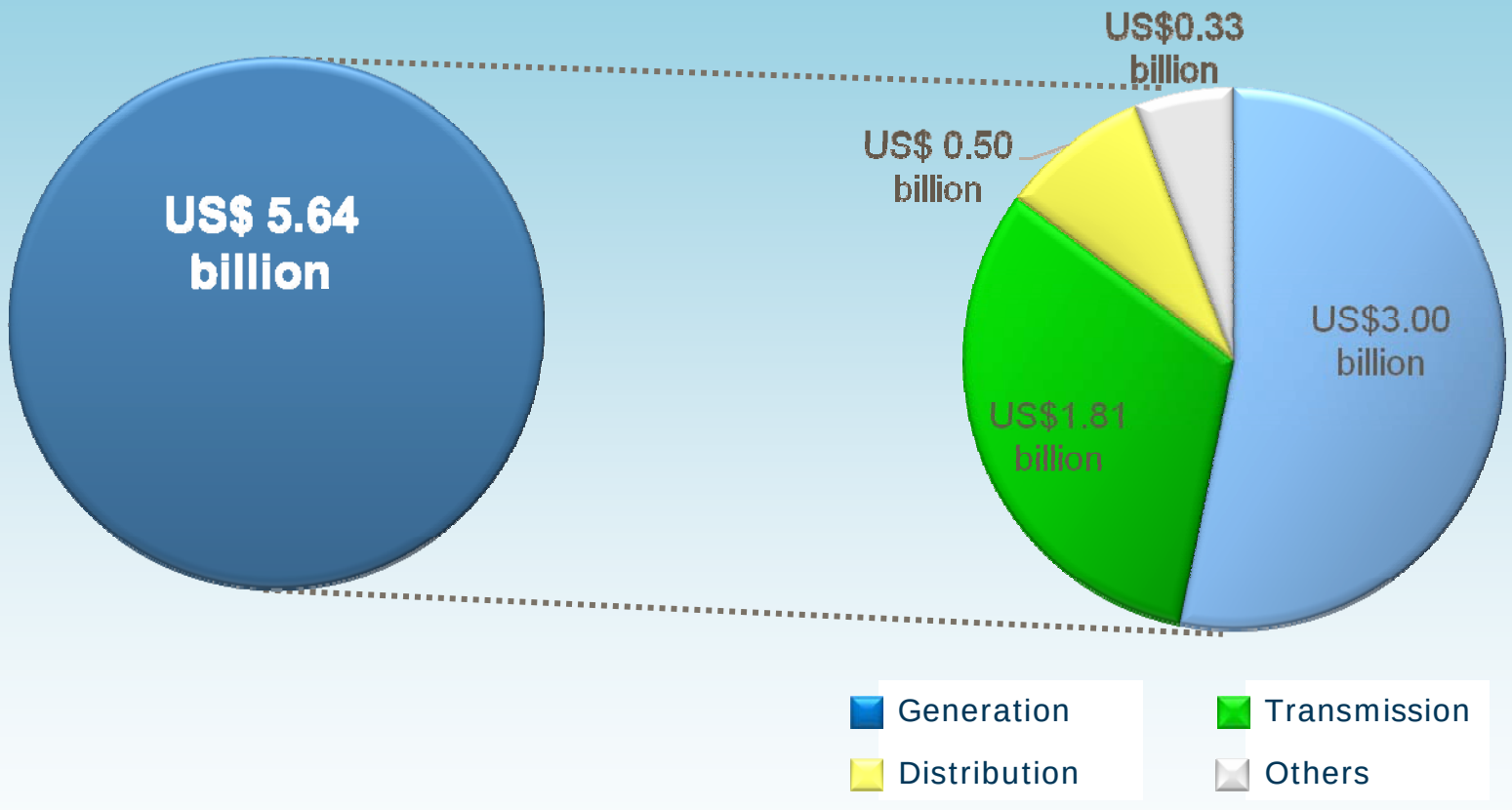
- Universalization of electricity access and use
  Luz para Todos Program (light for all)
- Electricity efficiency and conservation implementer and adviser
  Procel (Energy Efficiency National Program)
- Renewable sources
  Proinfa (National Program for Renewable Sources)

# Eletrobras Companies

Summing forces and energy in all regions of the country...



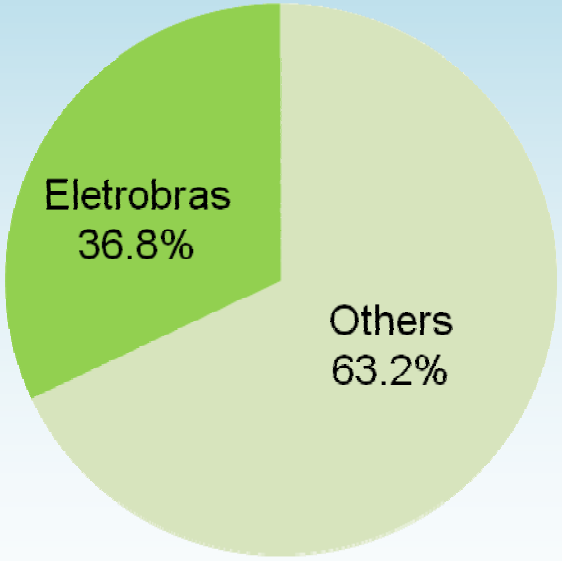
# Investments – 2011



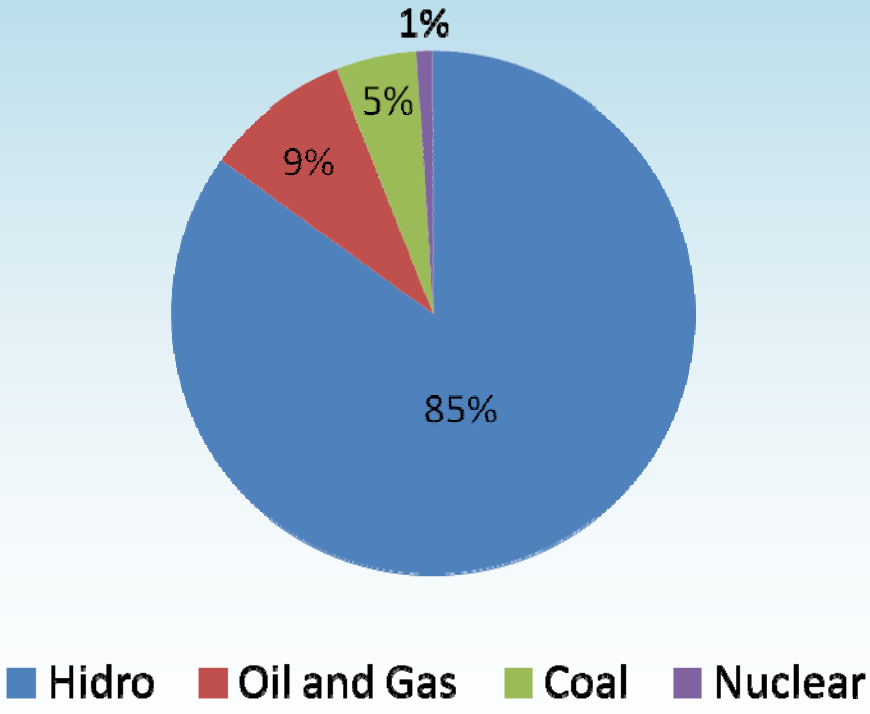

(*)including partnership.

# Eletrobras Installed Capacity

Eletrobras is the the largest contributor to ensure the security of the energy supply (41.7 GW in operation)



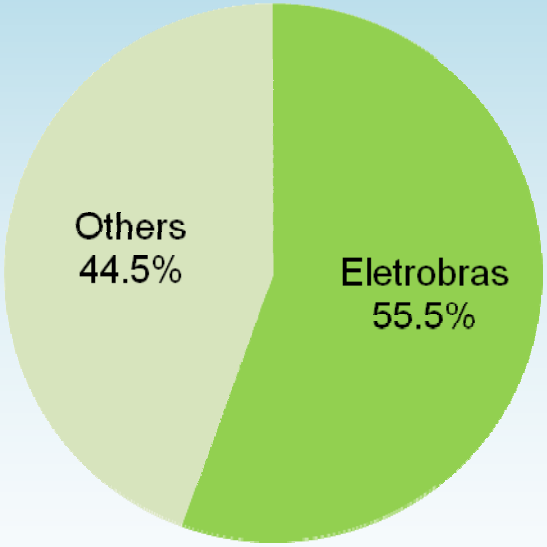

We have a diversified energy matrix... More than 85% of our matrix is from clean and renewable sources (low GHG emissions)

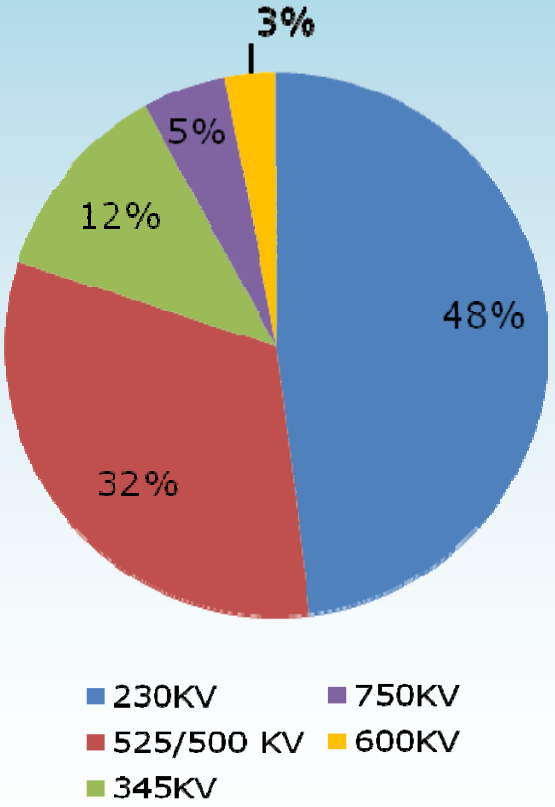



Source : Eletrobras mar/2011

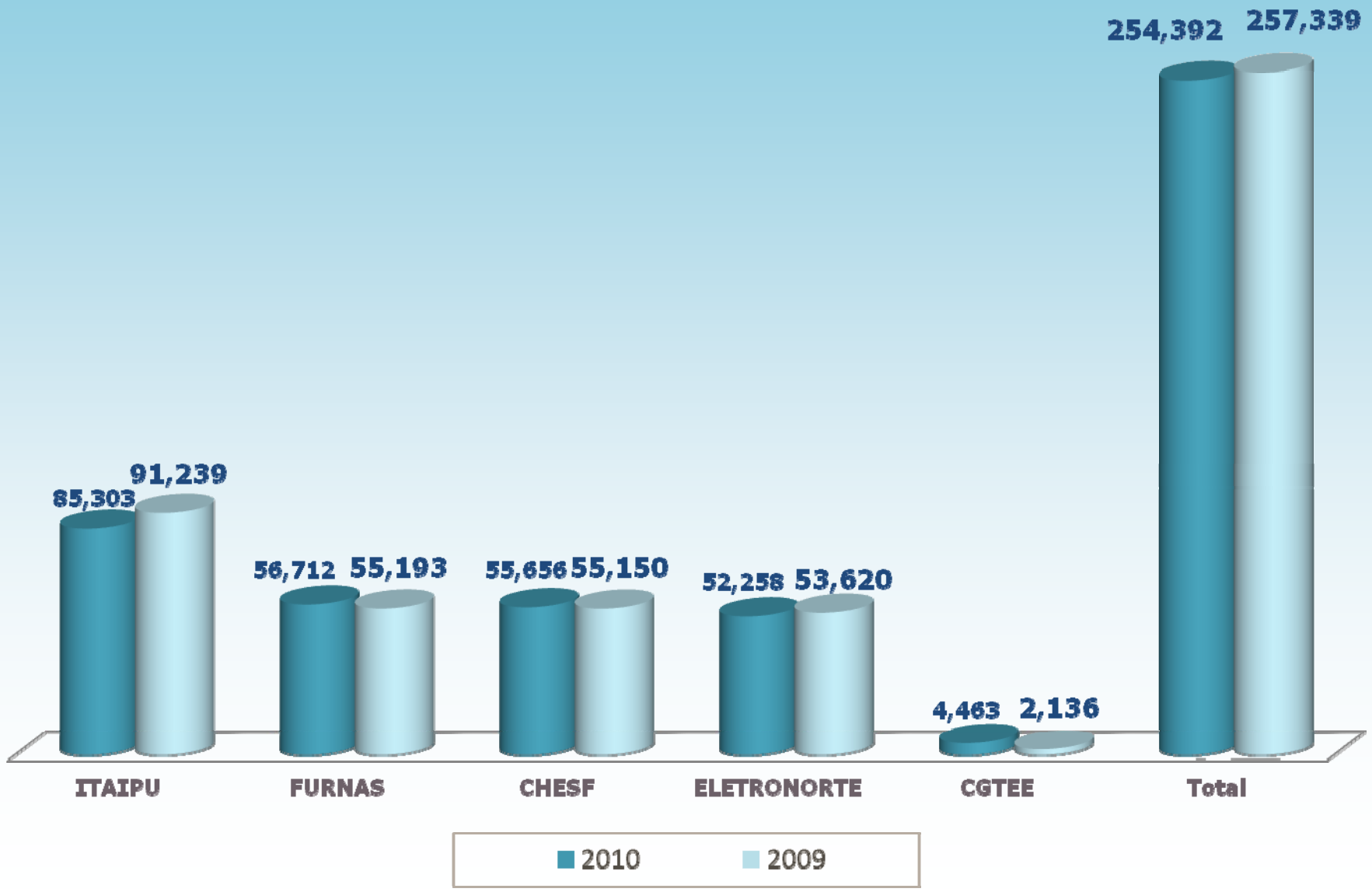
# Eletrobras Transmission lines

One of the greatest national transmission grids in the world, spread over most of the country's territory
53,789 km



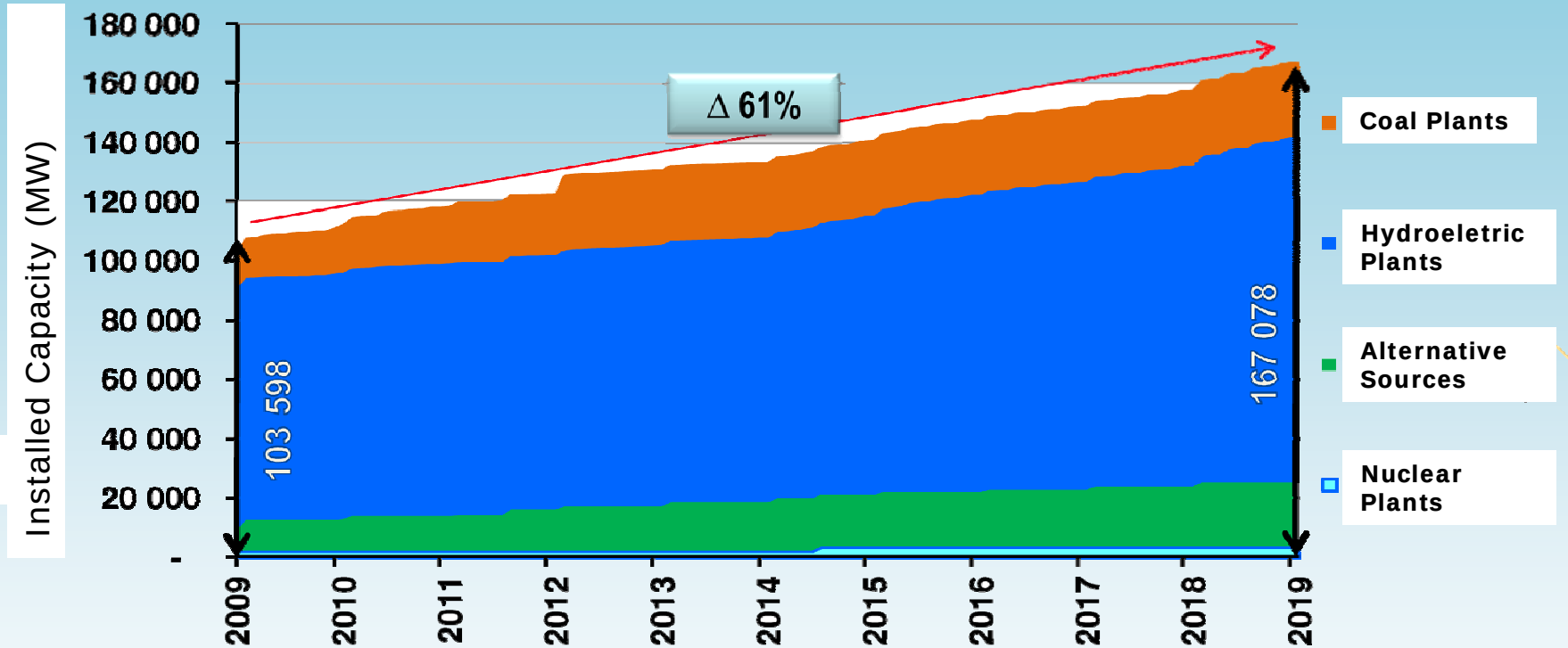



# Energy Commercialization – GWh



# Intalled Capacity Evolution at SIN – Brazil

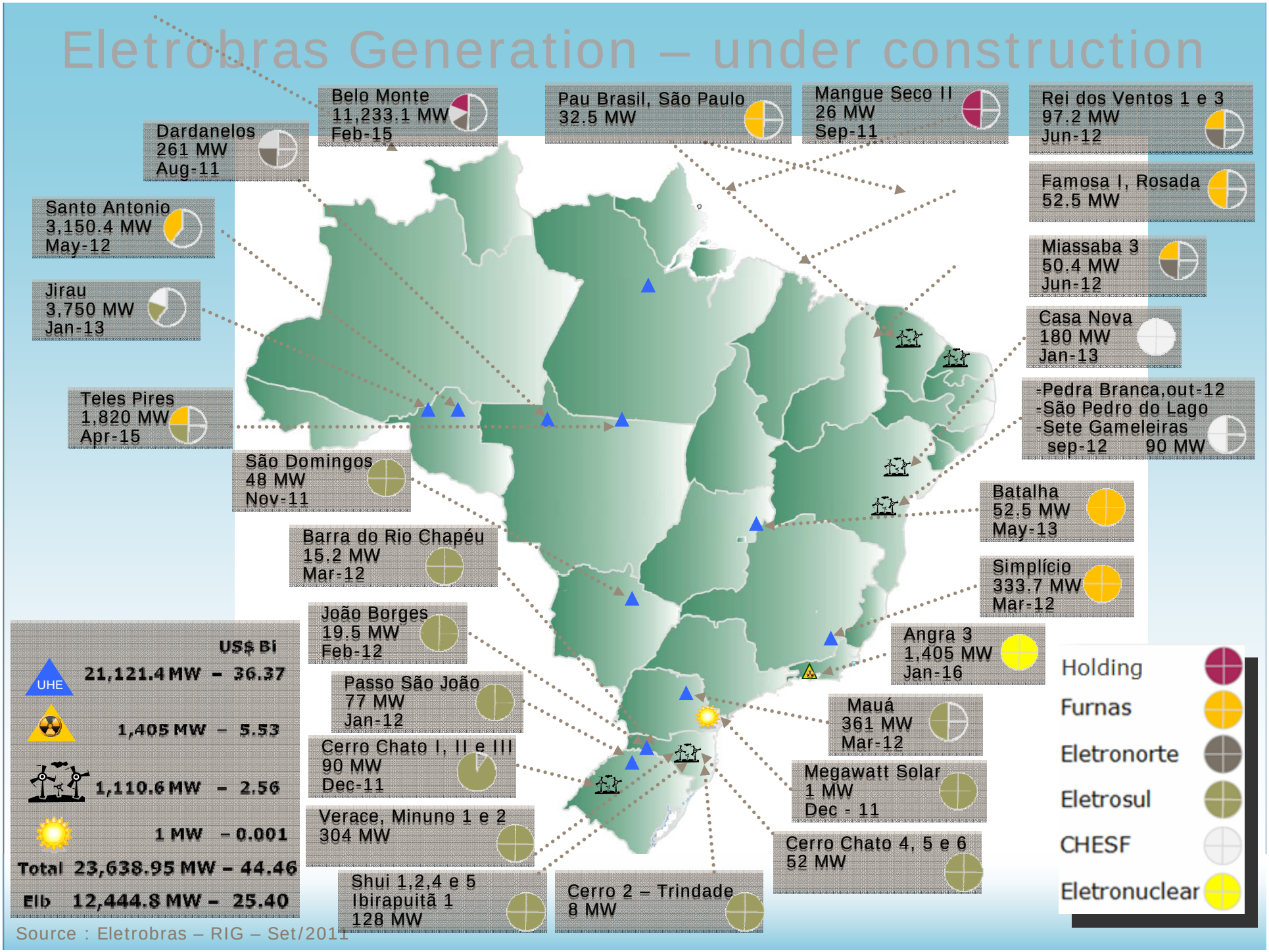
SIN = National Interconnected System




Belo Monte, Santo Antonio and Jirau, will together be responsible for about 10% of the installed capacity in 2019 of the SIN. Considering the new units of the Teles Pires, Tapajós and Jamanxim rivers, this participation will increase to 15% of the total.

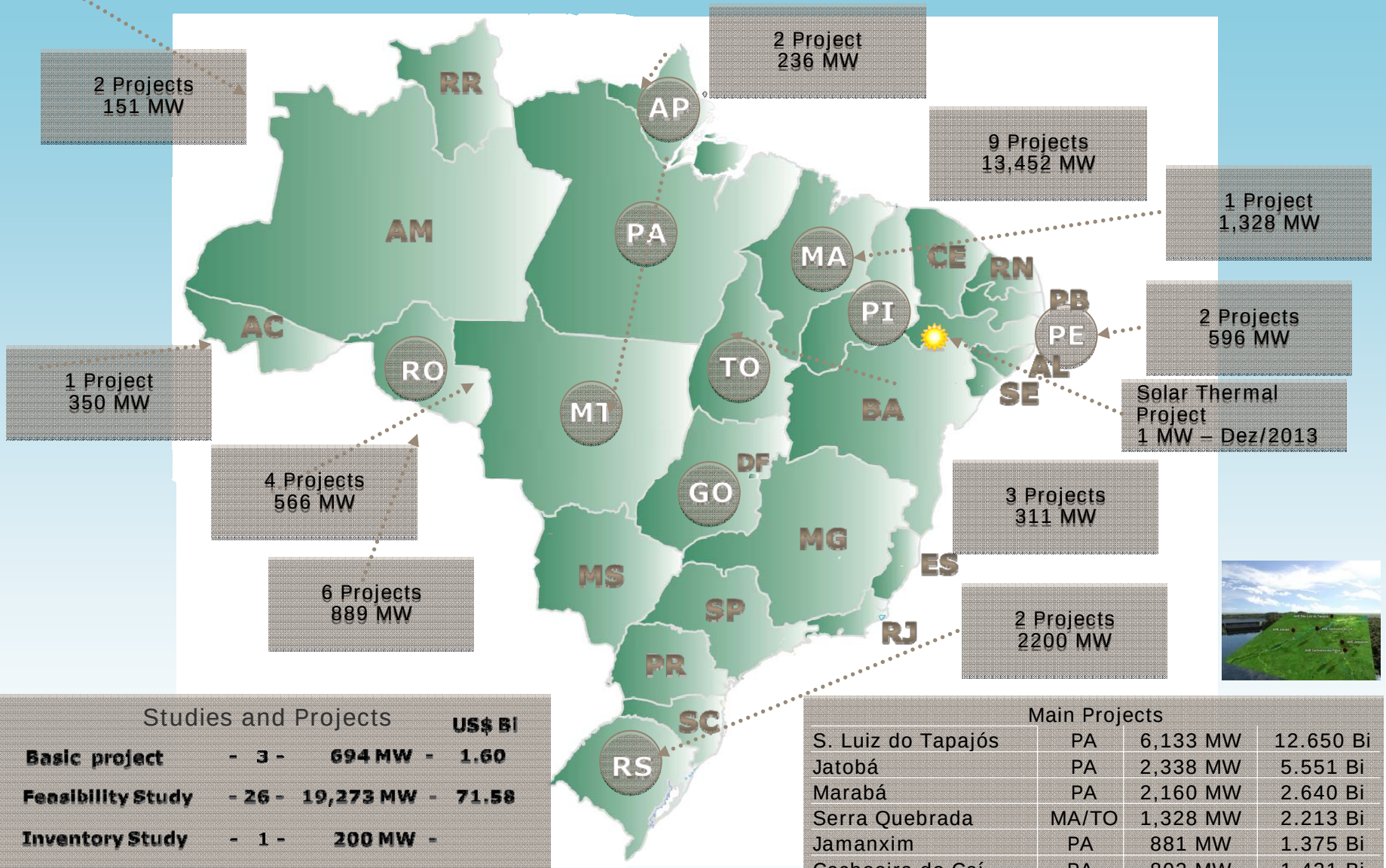
Fonte : EPE (PDE 2019)

# Eletrobras Generation – under construction




Source : Eletrobras – RIG – Set/2011

# Eletrobras Generation – Studies and Projects




| Studies and Projects | | | US$ Bi |
|---|---|---|---|
| Basic project | - 3 - | 694 MW - | 1.60 |
| Feasibility Study | - 26 - | 19,273 MW - | 71.58 |
| Inventory Study | - 1 - | 200 MW - | |
| Total | - 30 - | 20,167 MW - | 73.17 |

| Main Projects | | | |
|---|---|---|---|
| S. Luiz do Tapajós | PA | 6,133 MW | 12.650 Bi |
| Jatobá | PA | 2,338 MW | 5.551 Bi |
| Marabá | PA | 2,160 MW | 2.640 Bi |
| Serra Quebrada | MA/TO | 1,328 MW | 2.213 Bi |
| Jamanxim | PA | 881 MW | 1.375 Bi |
| Cachoeira do Caí | PA | 802 MW | 1.431 Bi |
| Total | - | 13,642 MW | 25.860 Bi |



Source : Eletrobras – RIG – Set/2011

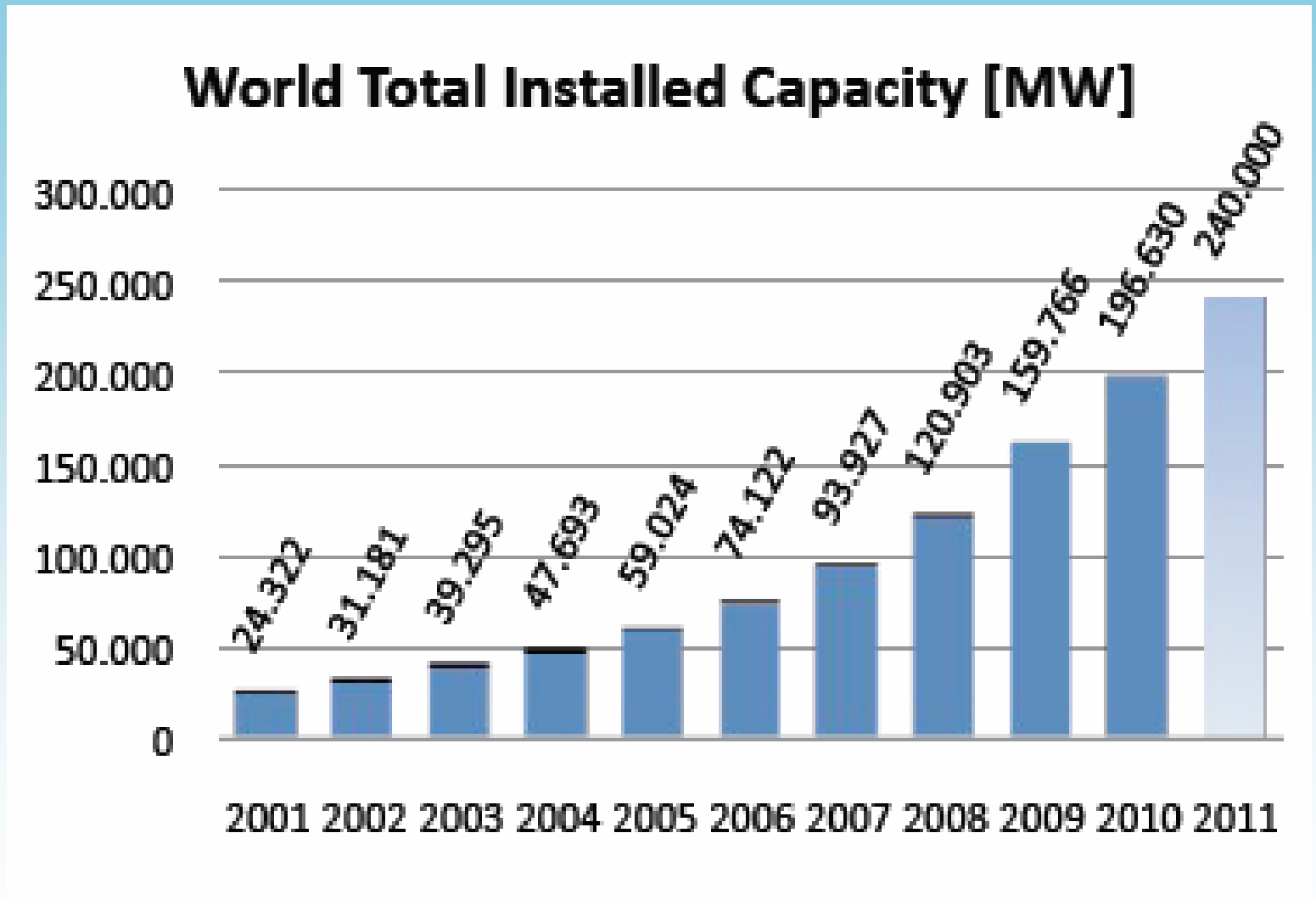
# Installed Capacity in Brazil – Oct 2011

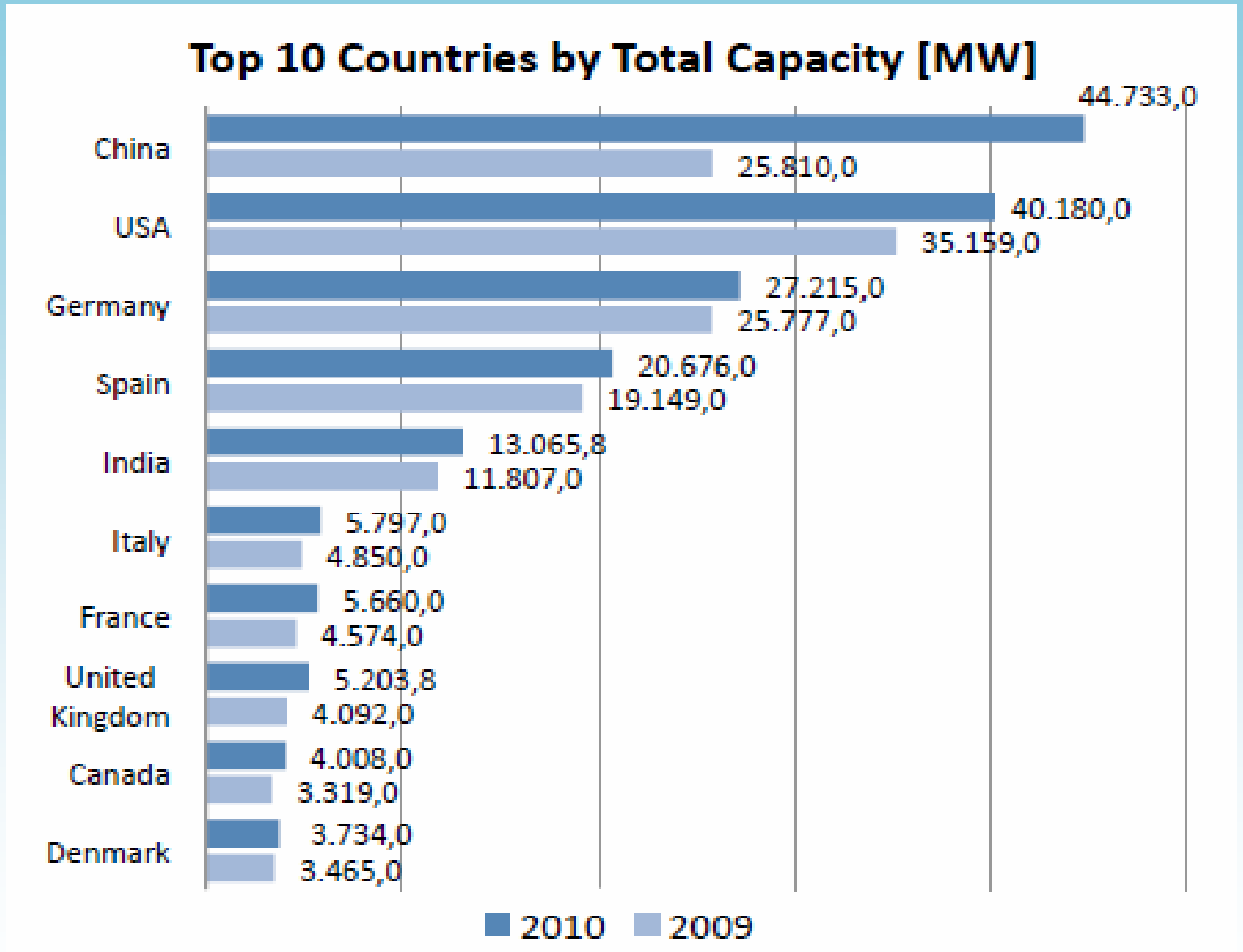
| Power Plants in Operação | | | |
|---|---|---|---|
| Source | Number of Power Plants | Installed Power (MW) | Participation (%) |
| Hydro | 951 | 82,075 | 66.1 |
| Gas | 139 | 13,210 | 10.6 |
| Oil | 918 | 7,009 | 5.6 |
| Biomass | 419 | 8,571 | 6.9 |
| Nuclear | 2 | 2,007 | 1.6 |
| Coal | 10 | 1,944 | 1.6 |
| Wind | 60 | 1,178 | 1 |
| | | | |
| Imports | | 8,170 | 6.6 |
| | | | |
| Total | 2,499 | 124,164 | 100 |

Source: ANEEL – Oct/2011

# Wind Energy in Brazil

## A History of Success

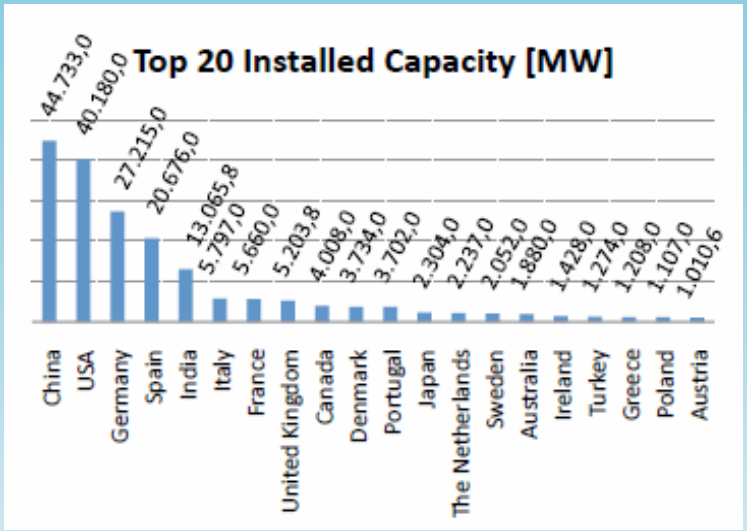

World Total Installed Capacity [MW]
300.000
250.000
200.000
150.000
100.000
50.000
0
24.322
31.181
39.295
47.693
59.024
74.122
93.927
120.903
159.766
196.630
240.000
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

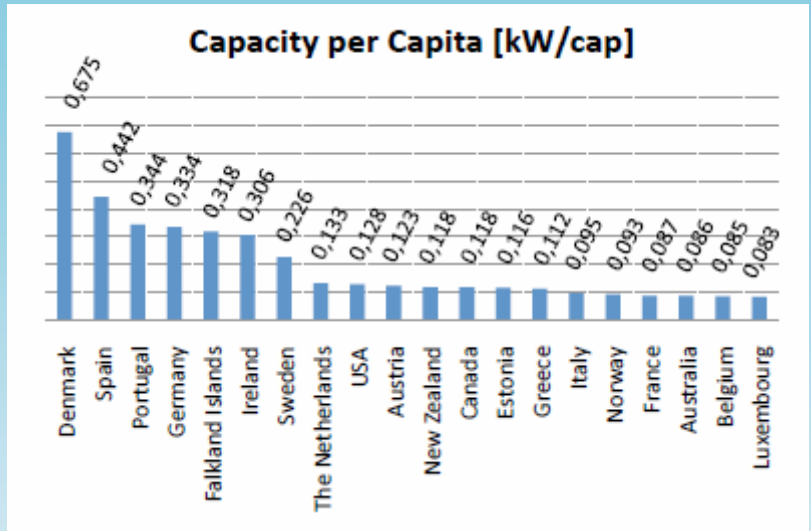

Top 10 Countries by Total Capacity [MW]
China
44.733,0
25.810,0
USA
40.180,0
35.159,0
Germany
27.215,0
25.777,0
Spain
20.676,0
19.149,0
India
13.065,8
11.807,0
Italy
5.797,0
4.850,0
France
5.660,0
4.574,0
United Kingdom
5.203,8
4.092,0
Canada
4.008,0
3.319,0
Denmark
3.734,0
3.465,0
2010
2009

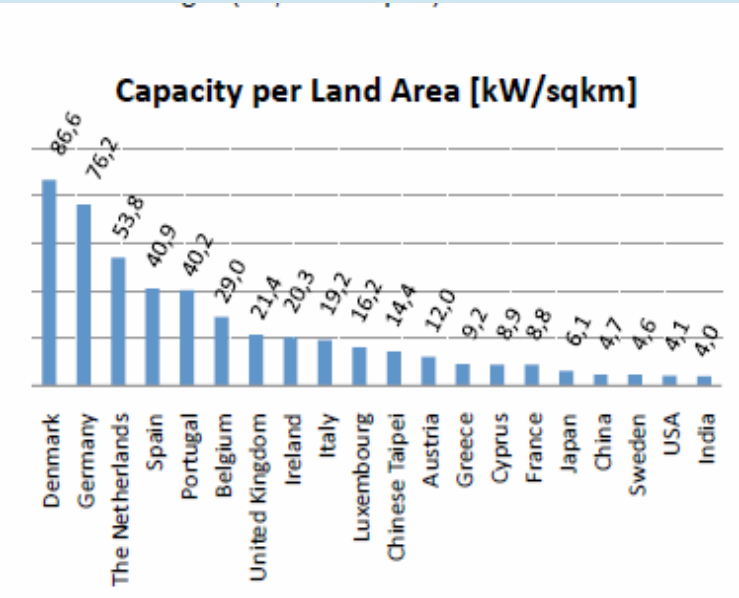
# Installed Capacity Rank - Dec2010

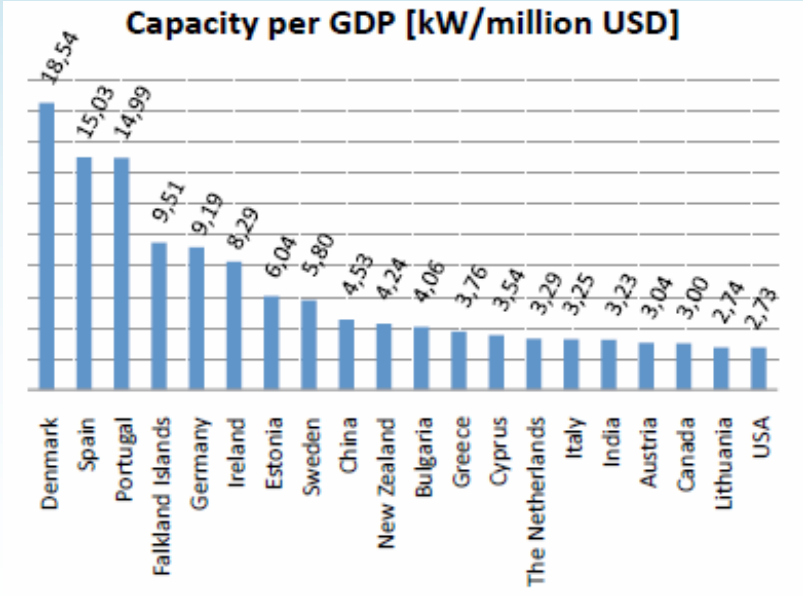
| Position 2010 | Country / Region | Total capacity end 2010 [MW] | Added capacity 2010 [MW] | Growth rate 2010 [%] | Position 2009 | Total capacity end 2009 [MW] | Total Capacity end 2008 [MW] | Total Capacity end 2007 [MW] | Total Capacity end 2006 [MW] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | China | 44.733,0 | 18.928,0 | 73,3 | 2 | 25.810,0 | 12.210,0 | 5.912,0 | 2.599,0 |
| 2 | USA | 40.180,0 | 5.600,0 | 15,9 | 1 | 35.159,0 | 25.237,0 | 16.823,0 | 11.575,0 |
| 3 | Germany | 27.215,0 | 1.551,0 | 6,0 | 3 | 25.777,0 | 23.897,0 | 22.247,4 | 20.622,0 |
| 4 | Spain | 20.676,0 | 1.527,2 | 8,0 | 4 | 19.149,0 | 16.689,0 | 15.145,1 | 11.630,0 |
| 5 | India | 13.065,8 | 1.258,8 | 10,7 | 5 | 11.807,0 | 9.587,0 | 7.850,0 | 6.270,0 |
| 6 | Italy | 5.797,0 | 950,0 | 19,6 | 6 | 4.850,0 | 3.736,0 | 2.726,1 | 2.123,4 |
| 7 | France | 5.660,0 | 1.086,0 | 23,7 | 7 | 4.574,0 | 3.404,0 | 2.455,0 | 1.567,0 |
| 8 | United Kingdom | 5.203,8 | 1.111,8 | 27,2 | 8 | 4.092,0 | 3.195,0 | 2.389,0 | 1.962,9 |
| 9 | Canada | 4.008,0 | 690,0 | 20,8 | 11 | 3.319,0 | 2.369,0 | 1.846,0 | 1.460,0 |
| 10 | Denmark | 3.734,0 | 309,0 | 8,9 | 10 | 3.465,0 | 3.163,0 | 3.125,0 | 3.136,0 |
| 11 | Portugal | 3.702,0 | 345,0 | 10,3 | 9 | 3.357,0 | 2.862,0 | 2.130,0 | 1.716,0 |
| 12 | Japan | 2.304,0 | 211,0 | 10,1 | 13 | 2.083,0 | 1.880,0 | 1.528,0 | 1.309,0 |
| 13 | The Netherlands | 2.237,0 | 15,0 | 0,7 | 12 | 2.223,0 | 2.235,0 | 1.747,0 | 1.559,0 |
| 14 | Sweden | 2.052,0 | 603,8 | 41,7 | 15 | 1.448,2 | 1.066,9 | 831,0 | 571,2 |
| 15 | Australia | 1.880,0 | 3,0 | 0,2 | 14 | 1.877,0 | 1.494,0 | 817,3 | 817,3 |
| 16 | Ireland | 1.428,0 | 118,0 | 9,0 | 16 | 1.310,0 | 1.027,0 | 805,0 | 746,0 |
| 17 | Turkey | 1.274,0 | 477,5 | 59,9 | 19 | 796,5 | 333,4 | 206,8 | 64,6 |
| 18 | Greece | 1.208,0 | 123,0 | 11,3 | 17 | 1.086,0 | 989,7 | 873,3 | 757,6 |
| 19 | Poland | 1.107,0 | 382,0 | 52,7 | 20 | 725,0 | 472,0 | 276,0 | 153,0 |
| 20 | Austria | 1.010,6 | 16,0 | 1,6 | 18 | 995,0 | 994,9 | 981,5 | 964,5 |
| 21 | Brazil | 920,0 | 320,0 | 53,3 | 21 | 600,0 | 338,5 | 247,1 | 236,9 |
| 22 | Belgium | 886,0 | 340,0 | 62,0 | 22 | 548,0 | 383,6 | 286,9 | 194,3 |
| 23 | Romania | 591,0 | 577,0 | 4.121,4 | 55 | 14,0 | 7,0 | 7,8 | 2,8 |
| 24 | Egypt | 550,0 | 120,0 | 27,6 | 26 | 435,0 | 390,0 | 310,0 | 230,0 |
| 25 | Mexico | 521,0 | 104,5 | 25,1 | 27 | 416,8 | 85,0 | 85,0 | 84,0 |

# Future Scenario Exploration



# PROINFA's Institutional Marks

**Established by Law, with the following basic guidelines:**

- **Special Tariff per MWh for each source;**
- **Call for tenders, based on availability of environmental licenses.**

# Main Objectives

- **Install 3,300MW of generating capacity from RE – Renewable Energy resources (wind, biomass and small hydro, 1100W each);**
- **Diversify primary sources of electricity improving National System supplying conditions;**
- **Best use of country's regions potentials creating local jobs;**
- **Reduce Greenhouse Gases emissions, according to Kyoto Protocol.**

# General Conditions

- **Encourage small power producers;**
- **The cost of energy is shared among all consumers supplied by the interconnected system;**
- **Technical, judicial, fiscal, economical and financial requirements for bidders;**
- **Compulsory Dispatch;**
- **Mandatory Environmental License, respecting states rules limits.**

# Social Aspects

- **150,000 new jobs are estimated;**
- **US$ 5.7 billion Investments – industry, equipment and materials;**
- **Reduction of $CO_2$ emissions – 2.8 millions tons/year.**

# Contracts

| SOURCE | Power Plants | Contracted Power (MW) | Energy (MWh/year) | Investiment (US$ billion) |
|---|---|---|---|---|
| Small Hydro | 63 | 1,191 | 6,541,338 | 2.0 |
| Wind | 54 | 1,423 | 3,719,799 | 3.1 |
| Biomass | 27 | 685 | 2,275,572 | 0.3 |
| TOTAL | 144 | 3,299 | 12,536,709 | 5.7 |

# PROINFA Feed-In Tariff

| Monthly Correction - Value in R$/MWh reffers to March 2004 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Correction Index | Small Hydro | Wind Max. | Wind Min. | Sugarcane Bagasse | Rice Crust | Wood Chips | Biogas |
| Mar/04 | | 117.02 | 204.35 | 180.18 | 93.77 | 103.20 | 101.35 | 169.08 |
| Sep/11 | 1.557916 | 182.31 | 318.36 | 280.71 | 146.09 | 160.78 | 157.89 | 263.41 |
| | | | | | | | | |
| In US$ | Sep/2011 | 101.28 | 176.86 | 155.95 | 81.16 | 89.32 | 87.71 | 146.34 |

**Reference: US$ 1.00 = R$ 1.80**

# Wind Energy Potential


**The Wind Atlas of Brazil (2001) presents an estimated potential of 143 GW, using a reference height of 50 m, and the state of the art equipment of 600kW.**

**Considering technology evolution where 2 to 3 MW equipment is deployed in new projects and a Hub Height of 100 m the new potential is estimated in 300 GW.**

# Winding Energy Competitiveness

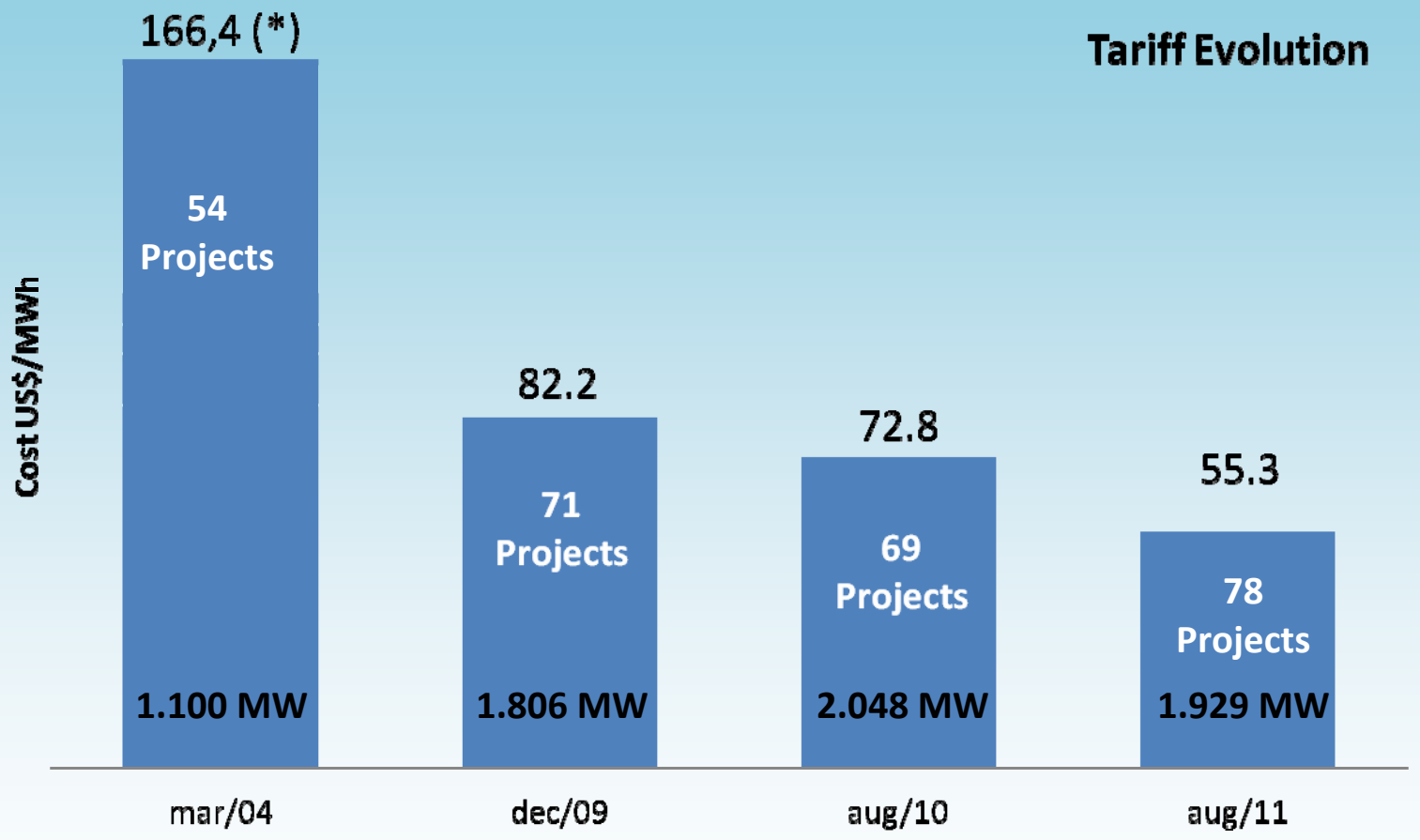
**The current costs are compatible with other new technologies.**

**The energy auctions results show this competitiveness.**

**The deployment of these projects presents an excellent opportunity to get experience and knowledge to consolidate this technology in Brazil.**

**Brazil has good wind resource and industrial capacity.**

# Results of Wind Energy Auctions

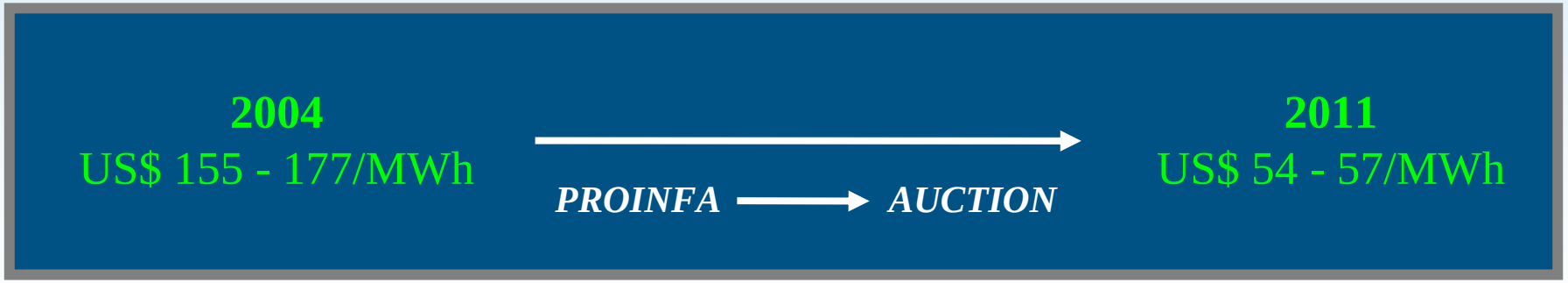



(*) PROINFA average costs

# Wind Energy Cost Evolution

**Strong reduction in the costs of wind energy:**

- **Cost reduction on wind turbines;**
- **Larger turbines and higher towers;**
- **Better technologies and production methods;**
- **Better efficiency and availability;**
- **Accurate sensors and SCADA systems;**
- **Reduction on O&M costs.**




**Ref.: US$1.00 = R$1.80**

# Evolution to Wind Energy Market Competition

Eletrobras

*Energy for new ages*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Thank you!
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