

The Brazilian Energy Sector: An Overview

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Main Figures and Facts about Brazil

BRAZIL

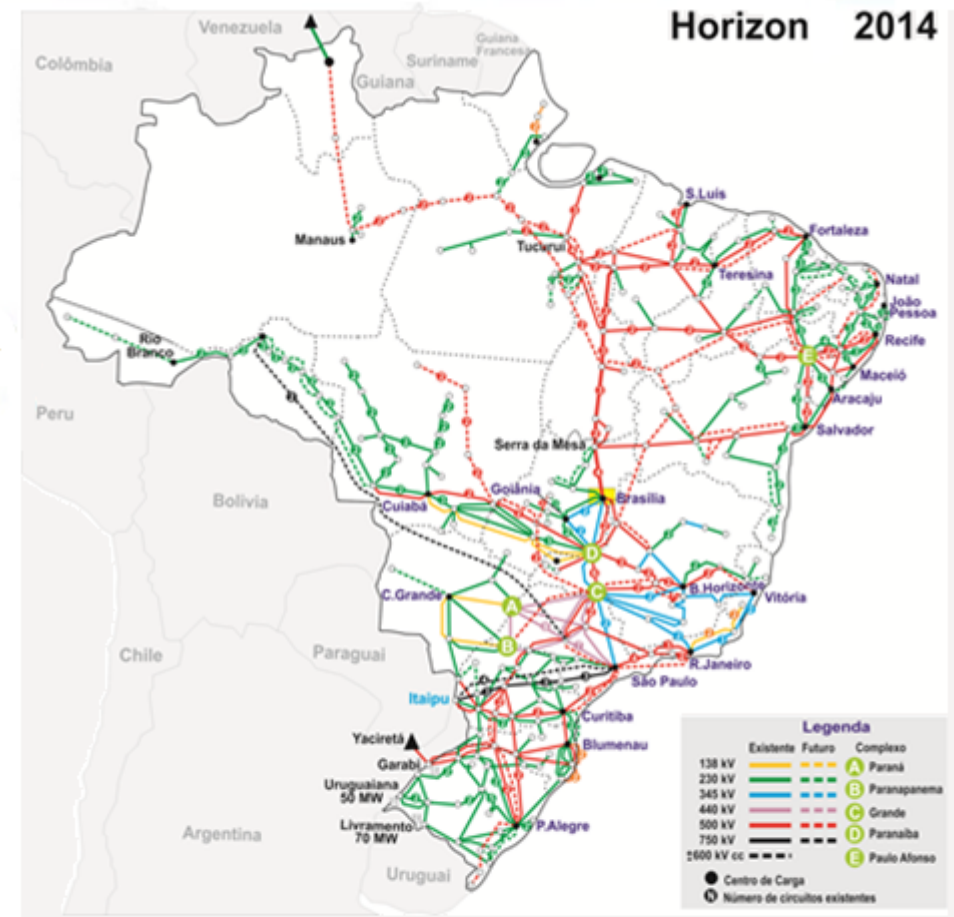
□ Territorial Extension	8,514,876 km ²
□ Population (SEPT 2014)	203.146 million
□ GDP (2013)	US\$ 2,246 trillion

ELECTRICITY SECTOR

□ Installed capacity (Dec 2012)	127 GW
Hydro	66%
Thermal	27%
□ Transmission lines	103,362 km
□ Consumption (Nov 2012)	59,187 average GW
Captive Market:	73.8 %
Free Market:	26.2 %

NUMBER OF MARKET PARTICIPANTS

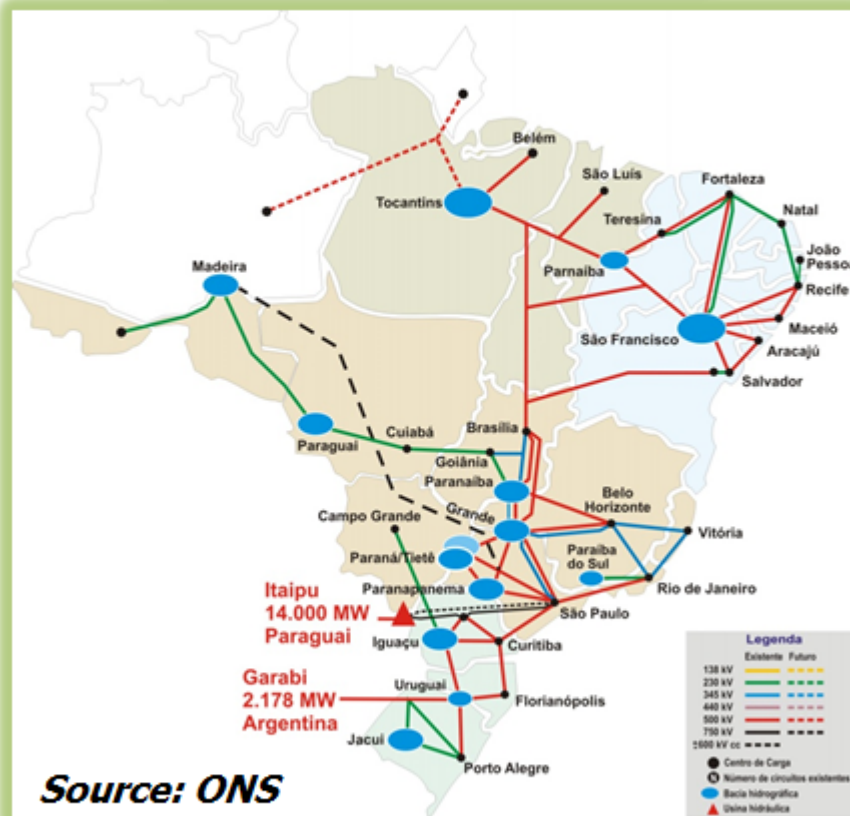
Generators:	514	Distributors:	47
Traders:	149	Free Consumers:	1,654
Total (Jan 2013): 2,364			



Brazilian Power Sector Overview

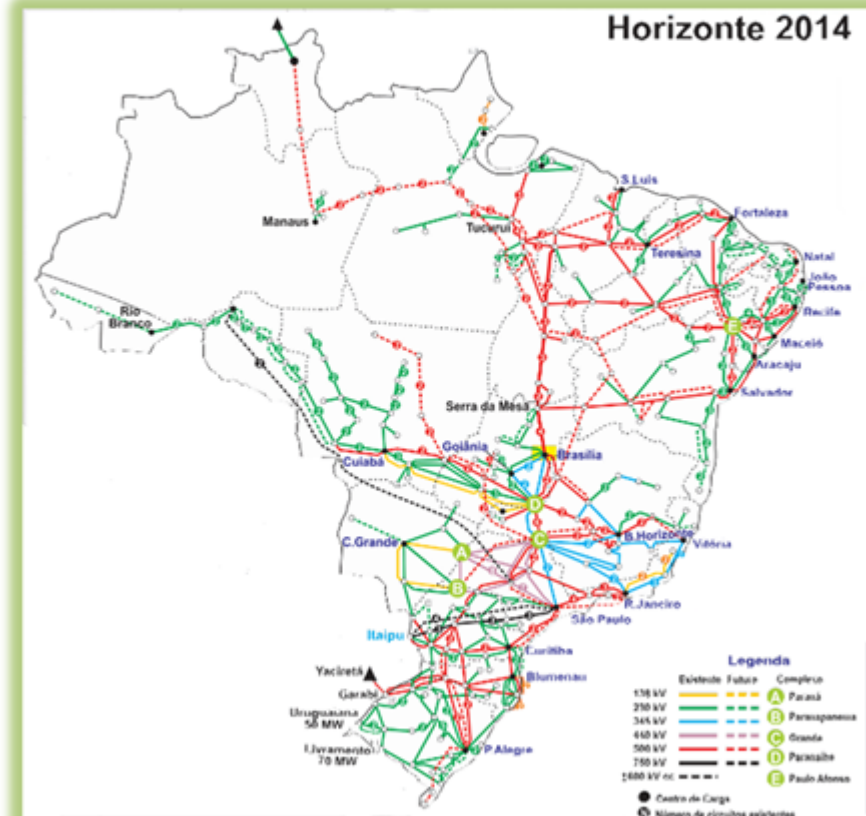
Grid of Continental Size

Hydrographic Basins



**14 Hydrographic Basins
with a Complementary Water Regime**

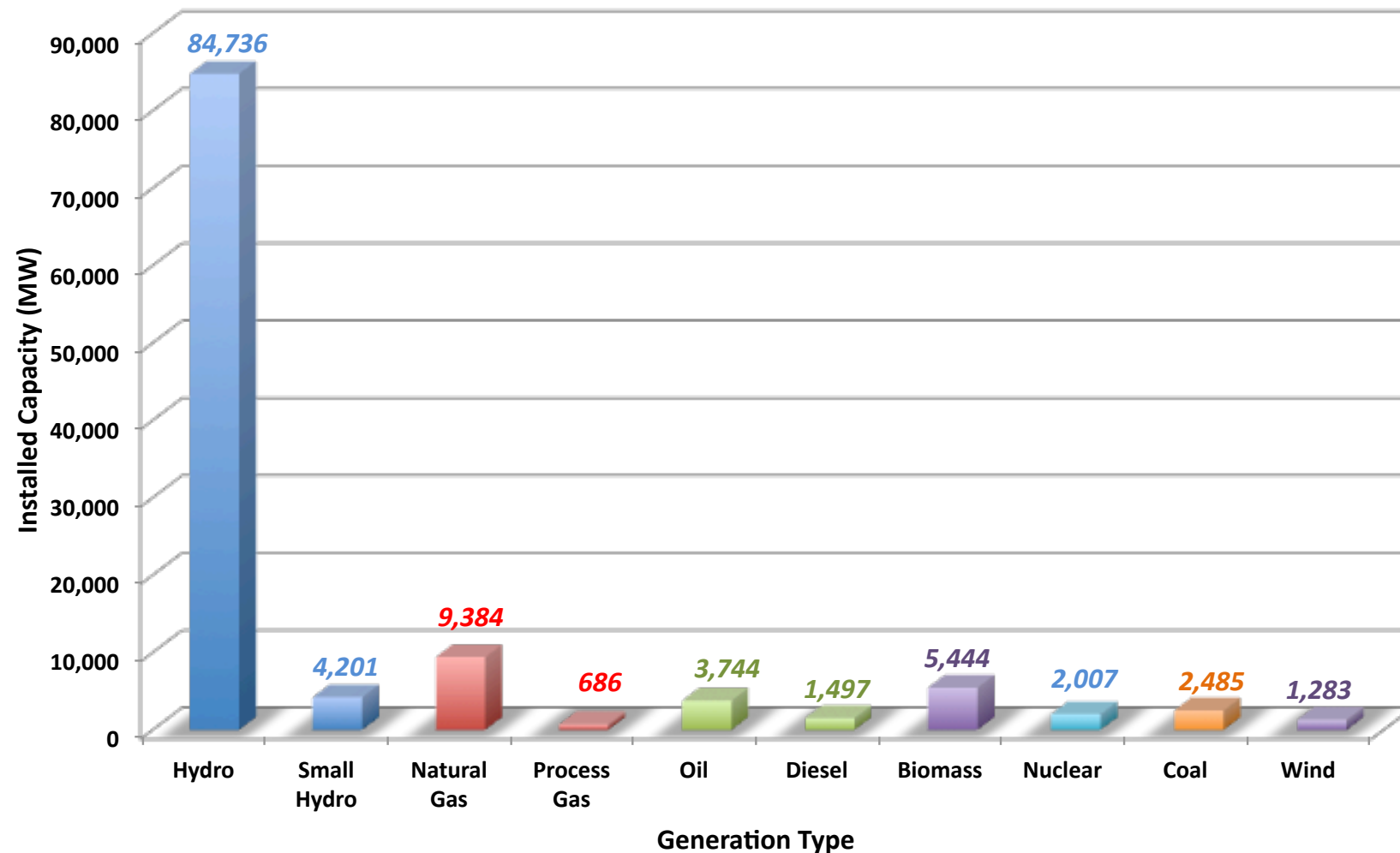
National Interconnected System



**Circa of 104 000 km of Transmission
Lines at the Basic Grid**

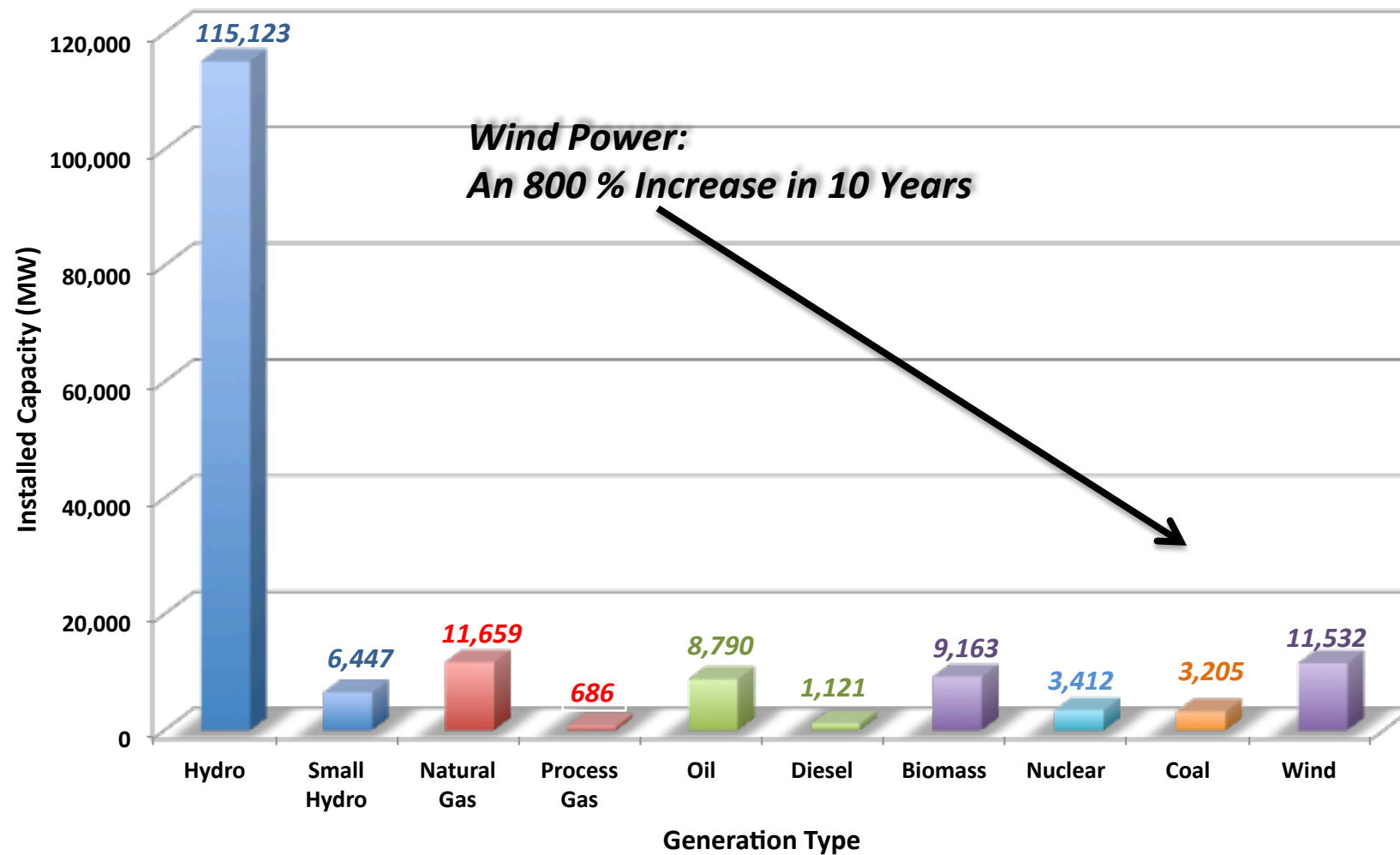
Brazilian Power Sector Overview

Generation by Source Type: December 2011

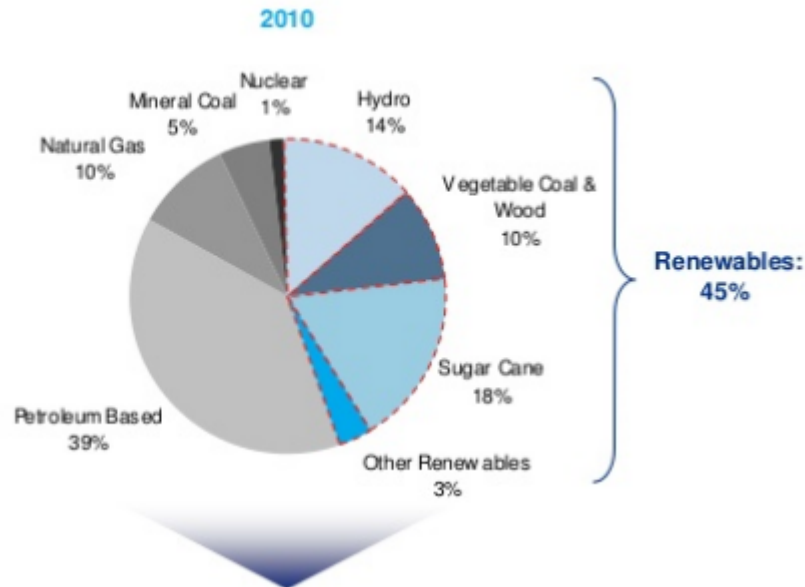


Brazilian Power Sector Overview

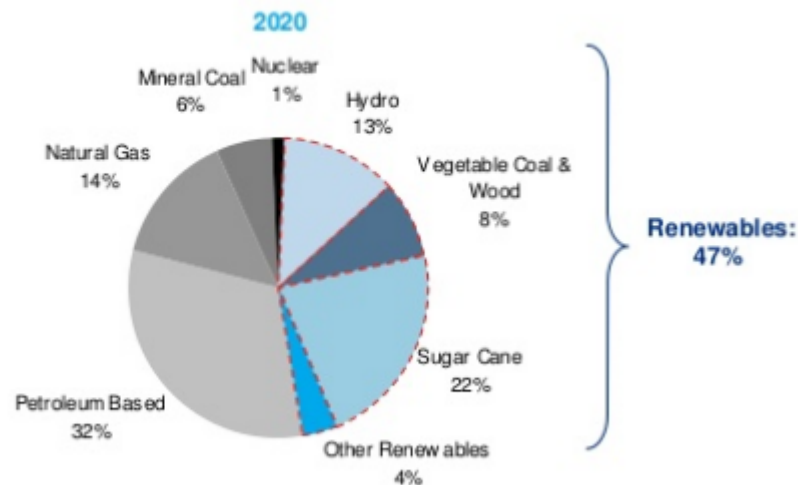
Projected Numbers for 2020



The Brazilian Energy Matrix



✓ Over 45% of all energy consumed in Brazil comes from renewable sources, versus an average of 13% in developed countries



✓ Renewable sources account for over 80% of electricity generation, while global average is under 20%

Brazilian Power Sector Overview

Multi-Owned Generating Units at the SIN (National Interconnected System)

- ▶ **35 Public & Private Companies**

own 141 Hydro Power Plants

(>30MW) in 14 Large Basins

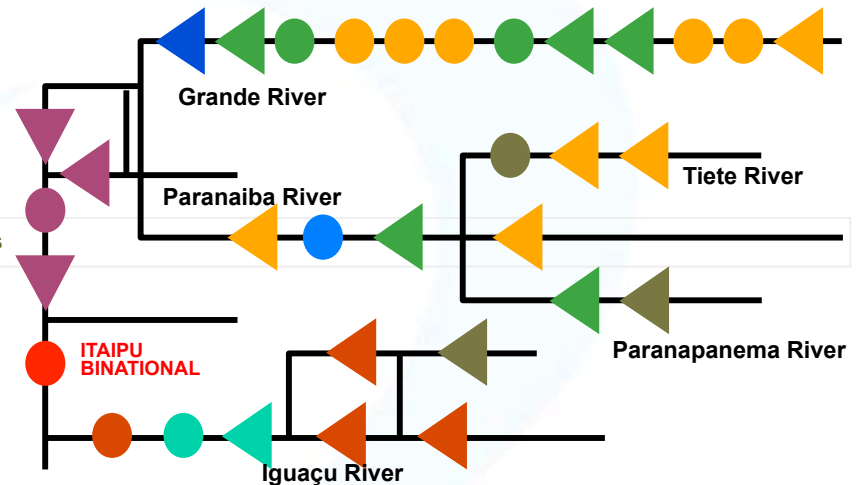
- ▶ **69 Hydro Plants with**

Reservoirs, 68 Run-of-River

Plants and 4 Pumping Storage

Power Stations are in Operation

Today



Altogether, the Brazilian Hydrothermal System has 200 Power Plants above 30 MW, and over 1000 Generation Units

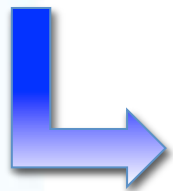
The ONS: Cost of Water & Dispatch Policies

Optimal Dispatch of the Brazilian Power System

ONS Minimizes the Total Operation Cost
Horizon: 05 Years

Controlling Dispatch of:

- *Thermal Generation;*
- *Hydro Generation;*
- *National & International Interconnections; and*
- *Load Curtailment*



Mathematical Models

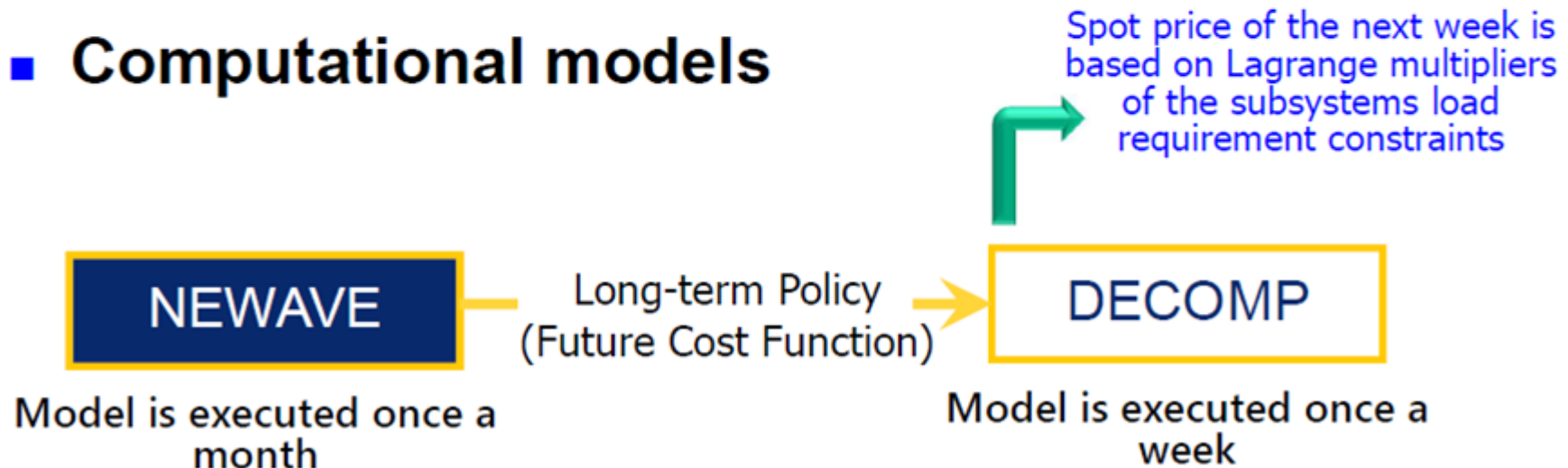
- *NEWAVE - 05 Years- Monthly Basis;*
- *DECOMP - 01-06 Months- Weekly Basis*
- *DESSEM - 01 Week- 1/2 Hour Basis*

Spot Price

■ Methodology

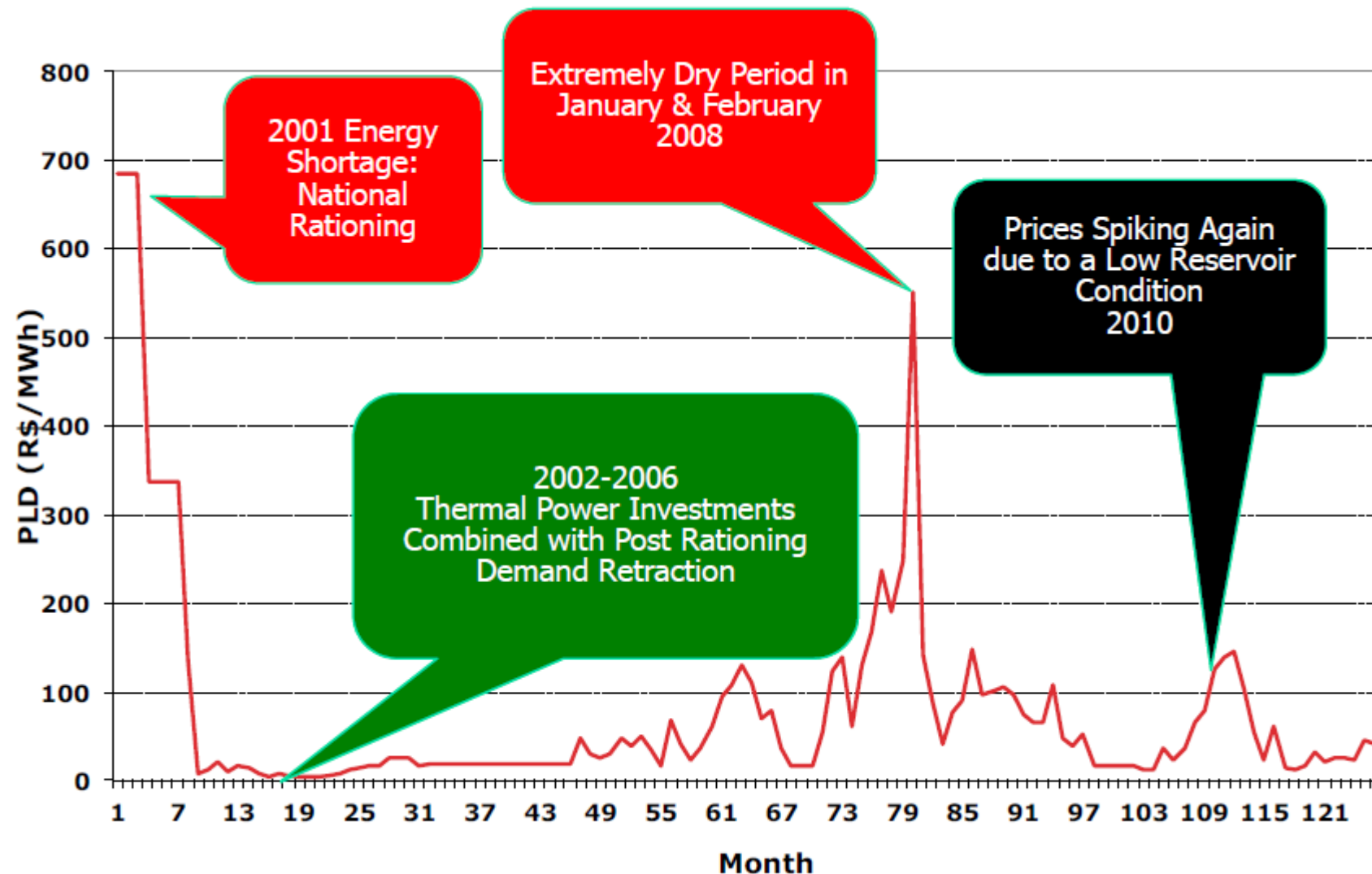
- Ex-ante (information about generator availability, inflows and loads forecasts etc.)
- Weekly price for each load level and subsystem
- Based on marginal operation costs

■ Computational models



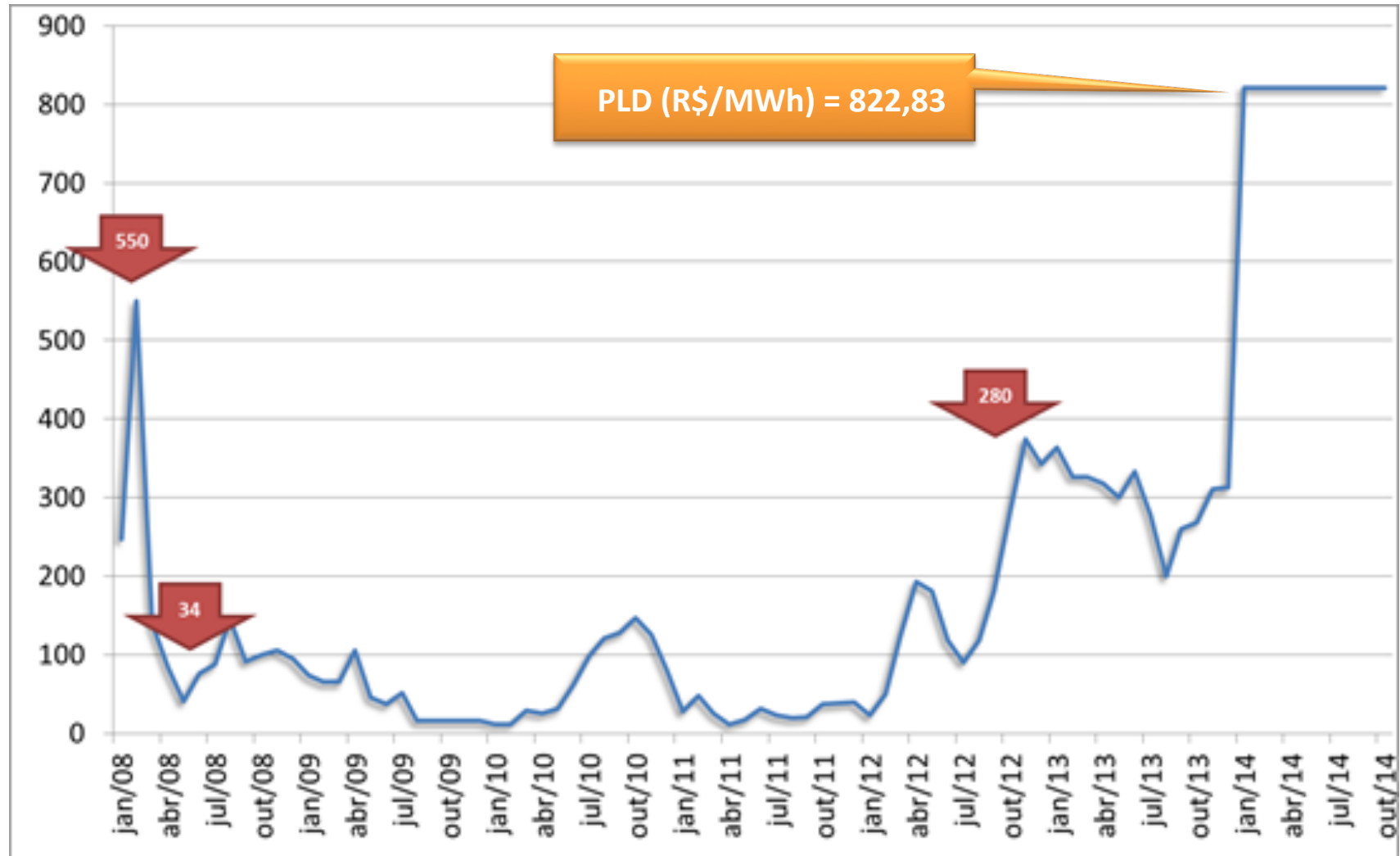
Spot Prices

High Volatility

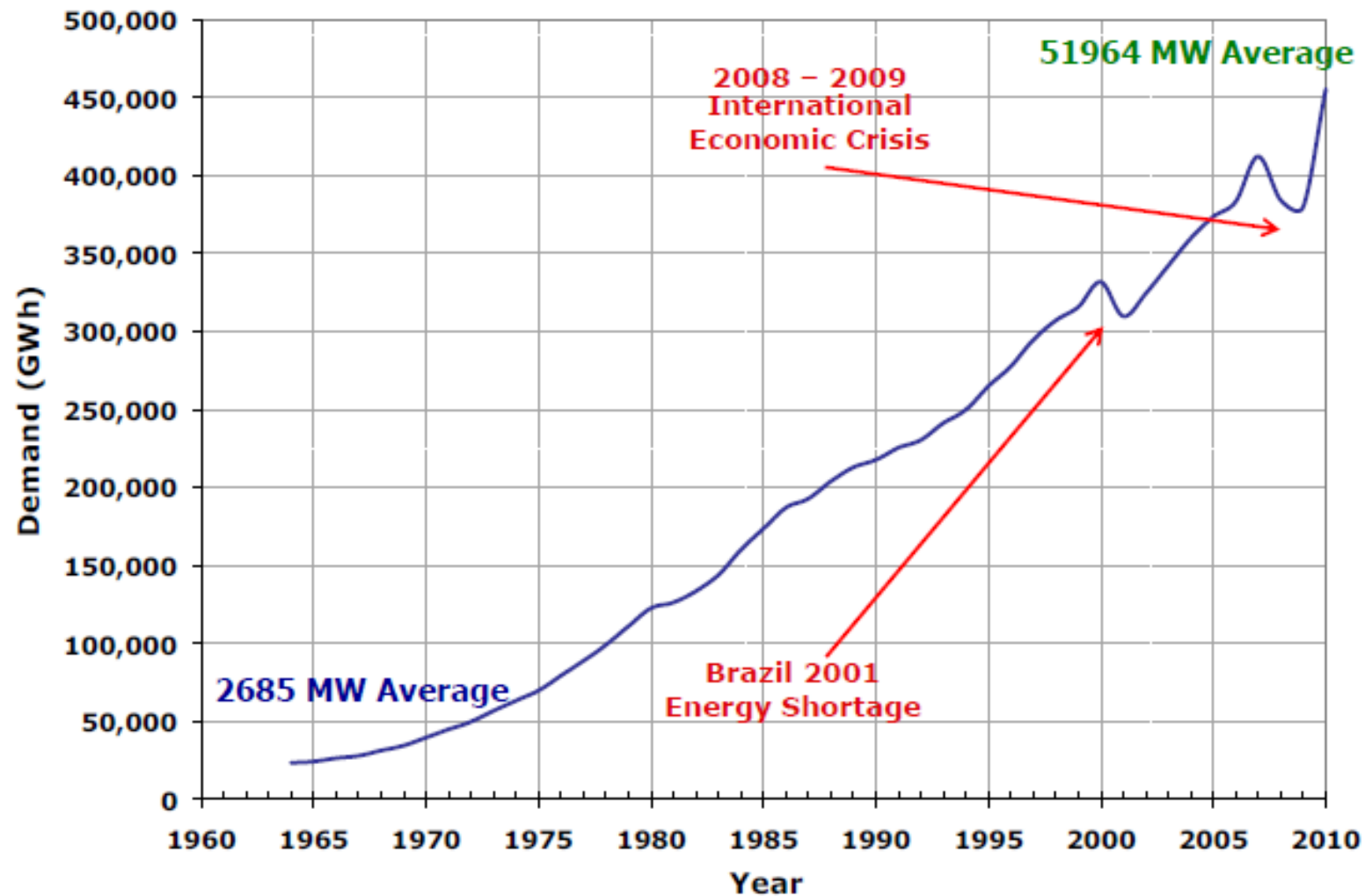


Spot Prices

High Volatility

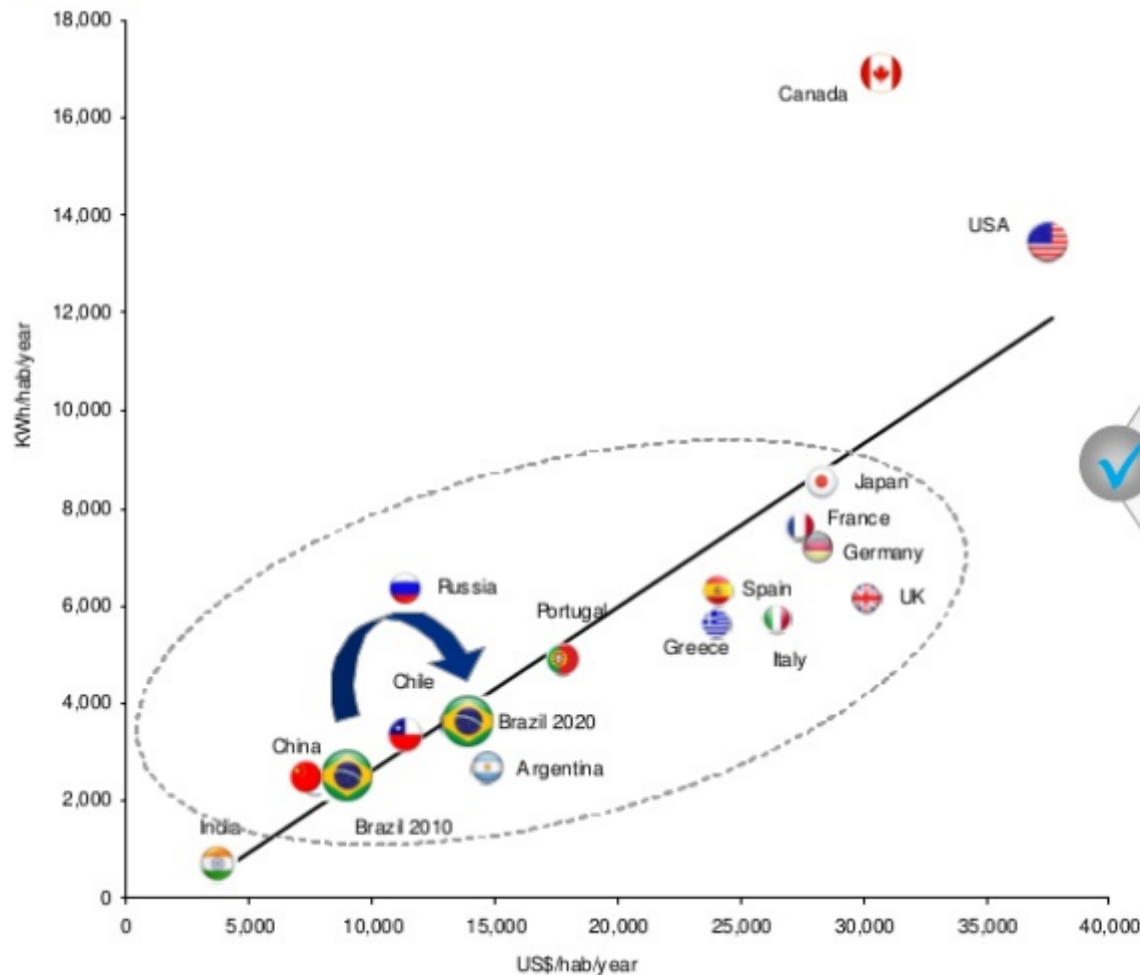


Brazilian Demand Growth Over the Last 50 Years



Significant Potential for Electricity Demand

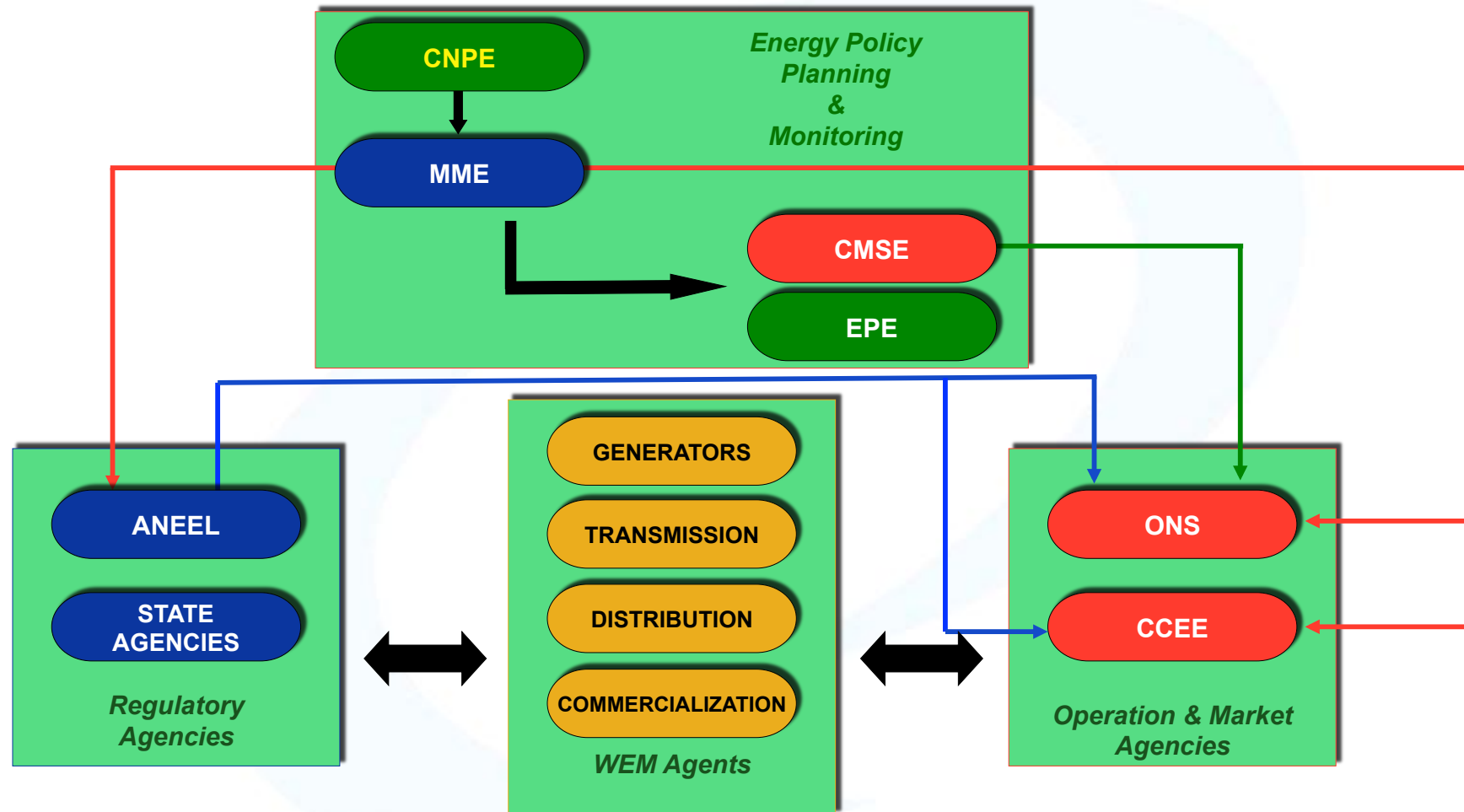
Electrical Consumption p/ Capita vs. GDP p/ Capita
(KWh, US)



✓ Brazil's per capita electricity consumption is expected to reach 3.5MWh by 2020 from 2.4MWh today

Brazilian Power Sector Overview

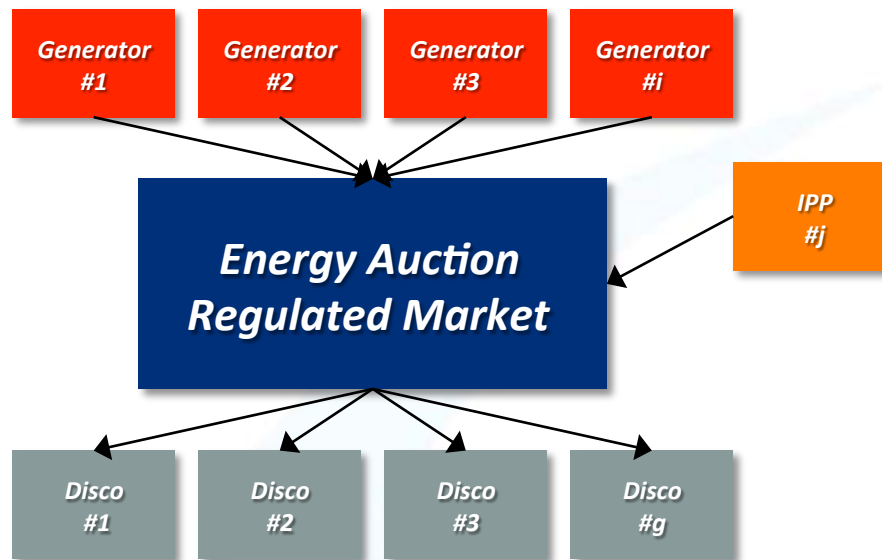
The Regulatory Framework



The CCEE: Brazilian Wholesale Entity Market

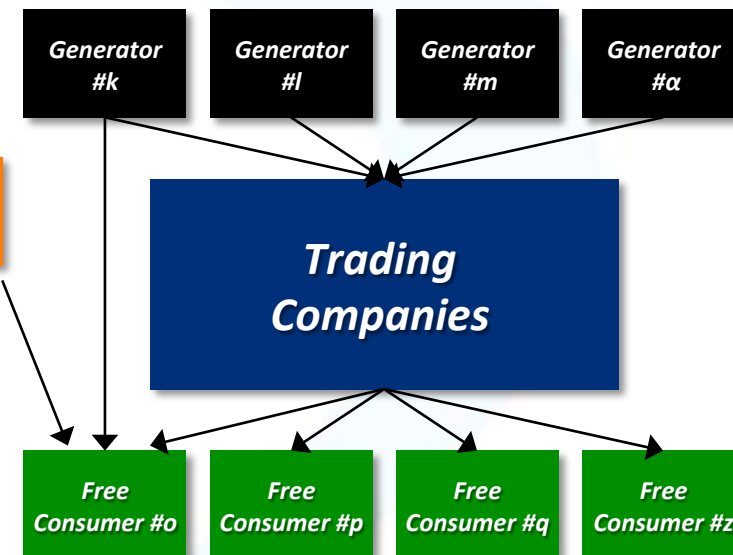
Two Regulated Markets: ACR & ACL

ACR: Captive Market



- **Energy is Negotiated on a Pool Basis**
- **Distribution Companies Buy Energy From:**
 - **Generators**
 - **Independent Power Producers**

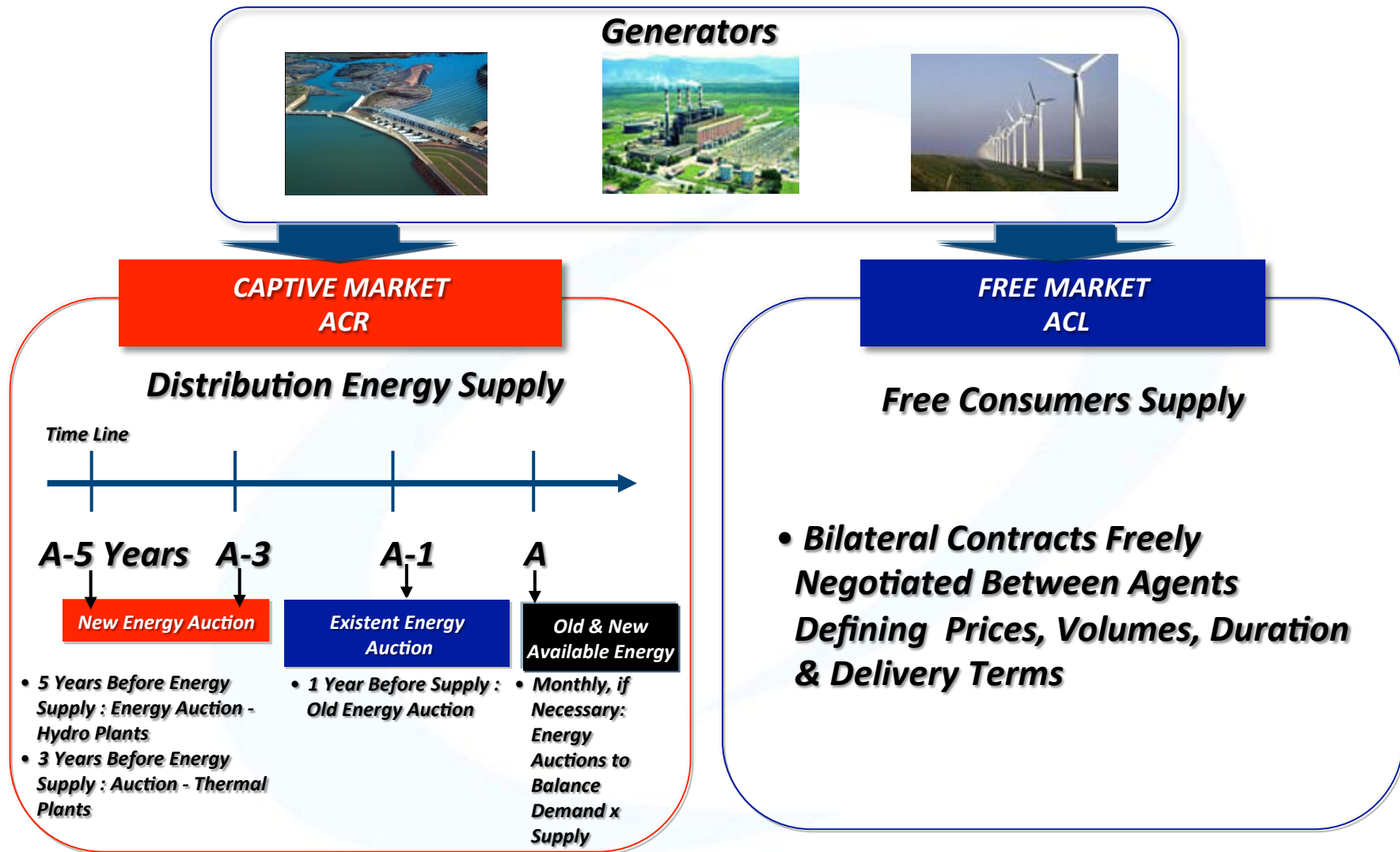
ACL: Free Market



- **Energy is Negotiated on an Individual Basis**
- **Free Consumers Buy Energy From:**
 - **Generators**
 - **Independent Power Producers**
 - **Origination Companies**
 - **Self-Producers**

The CCEE: Brazilian Wholesale Entity Market

Energy Auction Structures: A-5, A-3 & Bilateral



The Brazilian Free Market

Who is Eligible ?

CONSUMERS		DEMAND	VOLTAGE LEVEL
POTENTIALLY FREE	<i>Connected to the Grid before July 8th 1995</i>	<i>Higher or Equal to 3 MW</i>	<i>Higher or Equal to 69 kV</i>
	<i>Connected to the Grid After July 8th 1995</i>	<i>Higher or Equal to 3 MW</i>	<i>Any Level</i>
SPECIAL CONSUMERS	Supplied by Renewable Energy Sources (Biomass, Solar & Wind)	Higher or Equal to 0.5 MW	Any Level

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“Muito Obrigado.”

Thank you very much!