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DEPARTMENT OF ENERGY OPTIMIZATION AND ENVIRONMENT ELECTRIC ENERGY RESEARCH CENTER Principles and Objectives of the Brazilian Energy Policy



Security of Supply Tariff moderateness Universal Access Respect to Existent Contracts Strengthening of the Planning Matrix Diversification: Renewable Energy National Integration National Technological Development Compromise with Socioenvironmental Issues









Growth of Domestic Supply of Energy and Gross Domestic Product(%)





Events 1999-2009 (reduction of the energy intensity):

- Electricity Supply Crises 2000/2002 (more rationality and efficiency)
- Global Crises 2008 (strong reduction in the production of energy intensity products)
- Relatively more exportation of products with less electric energy
- (more alumina and less aluminum; more iron ore and less steel; etc)
- Lighter weight and more efficient vehicles

Events 2009-2019 (increase of the energy intensity):

- World Cup 2014, Olympic Games 2016, exploration of the pre-salt
- Strong increase in the production of steel, cellulose, cement and energy sectors

Sources: IBGE, 2008 and PDE 2019

Final Energy Consumption: International Comparison



Source: IEA Database (2010)

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Parameter	2009	2019	% per year
GDP (10 ⁹ R\$)	3.143	4.966	4,7
Population (10 ⁶)	191	207	0,8
GDP per capita (R\$/inhab)	16.416	24.042	3,9
Domestic Supply of Energy per capita (toe/inhab)	1,274	2,081	5,0
Domestic Supply of Energy per GDP (toe/10 ³ R\$)	0,078	0,087	1,1
Final Electricity Consumption per capita (kWh/inhab)	2.231	3.441	4,4

Source: PDE 2019

Domestic Supply and Consumption of Energy (10⁶ tep)



Workshop Promoting Flexible Use of Hydropower | Tokyo, JAPAN - FEB/2013

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Energy Domestic Supply Matrix (%)





HYDROPOWER in **BRAZIL**



- Hydroelectric energy is the main energy source in Brazil for electricity
- The Total Potential to be explored is estimated as 260 GW,
- ✤ only 30% is in operation



BRAZILIAN WIND POTENTIAL





Height 100m – Turbines of 2 MW

Source: CRESESB/CEPEL, 2001

Other Options for the Electrical Matrix







- Sixtieth uranium reserve of the world. (309,000 tons proved and 800,000 ton probable)
- Nuclear Energy promises a strong expansion after 2030 (55 GW up to 2050).
- Low emission and secure supply



- ✤ A large bioenergy program
- Biomass in the range of 500 MW / year, which means more than 6.000 MW up to 2016



- A large potential of energy savings: 10%
- PROCEL
- PNEf National Program of Energetic Efficiency

ELECTRICAL MATRIX (%)





Hydropower Inventory Studies



MAIN STUDIES

Approved by	1 Tapajós/Jamanxim: 14.245 MW (7 projects)					
ANEEL	2 Teles Pires/ Apiacás:	Teles Pires/ Apiacás: 3.697 MW (5 projects)				
	Hydrograph Bas	in MW	UF			
Concluded	3 Araguaia	3.100	GO / MT / PA / TO			
	4 Jari	1.100	AP / PA			
	5 Juruena	5.000	AM / MT			
	6 Branco	2.000	RR			
	7 Tibagi	1.291,5	PR			
	Hydrograph Basi	in MW	UF			
Running	8 Aripuanã	3.000	AM / MT / RO			
Studies (PAC)	9 Sucunduri	650	AM			
	10 Trombetas	3.000	PA			
	Total	19.141,5				



Source: ANEEL and PAC 2011

Hydroelectric Expansion



	Project	River	MW	UF	Operatipm	
Operation between 2014 and 2019						
a f	Belo Monte Teles Pires Outras (10 UHEs) Subtotal	Xingu Teles Pires vários	11,233 1,820 1,716 14,769	PA MT vários	2015 2015 2014/19	
Future auctions: Operation between 2015 and						
2 2 2	Foz do Apiacás São Manoel Sinop	Apiacás Teles Pires Teles Pires	275 746 461	MT MT / PA MT	2015 2015 2015	
1	São Luiz do Tapajós	Tapajós	6,133	PA	2016	
b c d e 3 1	São Roque Marabá Itapiranga Serra Quebrada Torixoréu Jatobá Jardim do Ouro	Canoas Tocantins Uruguai Tocantins Araguaia Tapajós Jamanxim	214 2,160 725 1,328 408 2,336 227	RS PA RS / SC TO PA PA PA	2017 2018 2018 2018 2019 2019 2019	
1	Cachoeira dos Patos	Jamanxim	528	PA	2019	
1 1	Jamanxim Cachoeira do Caí Others Subtotal of future a	Jamanxim Jamanxim vários J ctions	881 802 1,391 18,615	PA PA vários	2019 2019 2015/19	
	Total		33,384		2014/19	

Transmission Lines Expansion





(a) Manaus, (b) Belo Monte, (c) AC/RO, (d) Tapajós, (e) Teles Pires, (f) Itaipu, (g) Boa Vista

Source: PDE 2020

"Platform" Hydropower Plants"







- Implemented in areas with low or no anthropogenic activity
- Reconciliation between electricity generation and environment
- Keep the impact restricted to the plant site
- Recuperation of the affected area during the construction phase
- Operation with small number of staff in turnover labor periods



"Platform" Hydropower Plants"



Hydrograph Basin	HPs	Installed Capacity[MW]
Tapajós River	7	14.245
Araguaia River (Mortes River)	2	396
Madeira River (Ji- Paraná River)	1	350
Juruena River	3	5.162*
TOTAL	13	20.153



For each km² of intervention, 101 km² preserved



Inundation Index: Tapajos Complex– 0,21 km²/MW Actual Index – 0,49 km²/MW

* Feasibility

Source: Eletrobras (2009), PAC 2

AND AFTER 2030



By 2030 the Brazilian Hydropower Potential will be almost completely developed

Long term studies indicate that the country will nedd thermal plants (conventional and nuclear) supplying the base load



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