Empresa de Pesquisa Energética
Uma Empresa do Ministério de Minas e Energia

BRAZIL POWER SECTOR EXPANSION PLANNING

Mesa V: Planeamiento energético ¿ Como se resuelve en el mundo ?

IV SEMINARIO ESTRATEGICO

LA ARGENTINA Y EL PLANEAMIENTO ENERGETICO

Mauricio T. Tolmasquim
CEO
Energy Research Office - EPE

Buenos Aires, September 5th, 2008

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SUMMARY

- Highlights of the Brazilian Electric Sector
- The New Regulatory Framework for the Electric Sector
- Brazilian Power Sector Planning
- About EPE
- Next Steps

HIGHLIGHTS OF THE BRAZILIAN ELECTRIC SECTOR

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GENERAL CHARACTERISTICS

• Installed Capacity	100.5 GW	
• Hydraulic	77.7 GW	77.3%
• Thermal	20.8 GW	20.7%
• Nuclear	2.0 GW	2.0%

• Users	61.2 million (dec/07)
• Energy Production	447 TWh/year (*)
	(equal to 58% of South America)
• Peak Load	62,894 MWh/h (apr/07) (**)
	(equal to United Kingdom or Italy)

• Generation	85% state-owned
	15% private-owned
• Transmission	26 utilities (15 private)
• Distribution	64 utilities (80% private)

Surface area: 8.5 million km²
(= continental USA + 1/2 Alaska)

(*) National Interconnected System + Stand-alone Systems

(**) National Interconnected System only

Sources: EPE (PNE 2030) & ONS

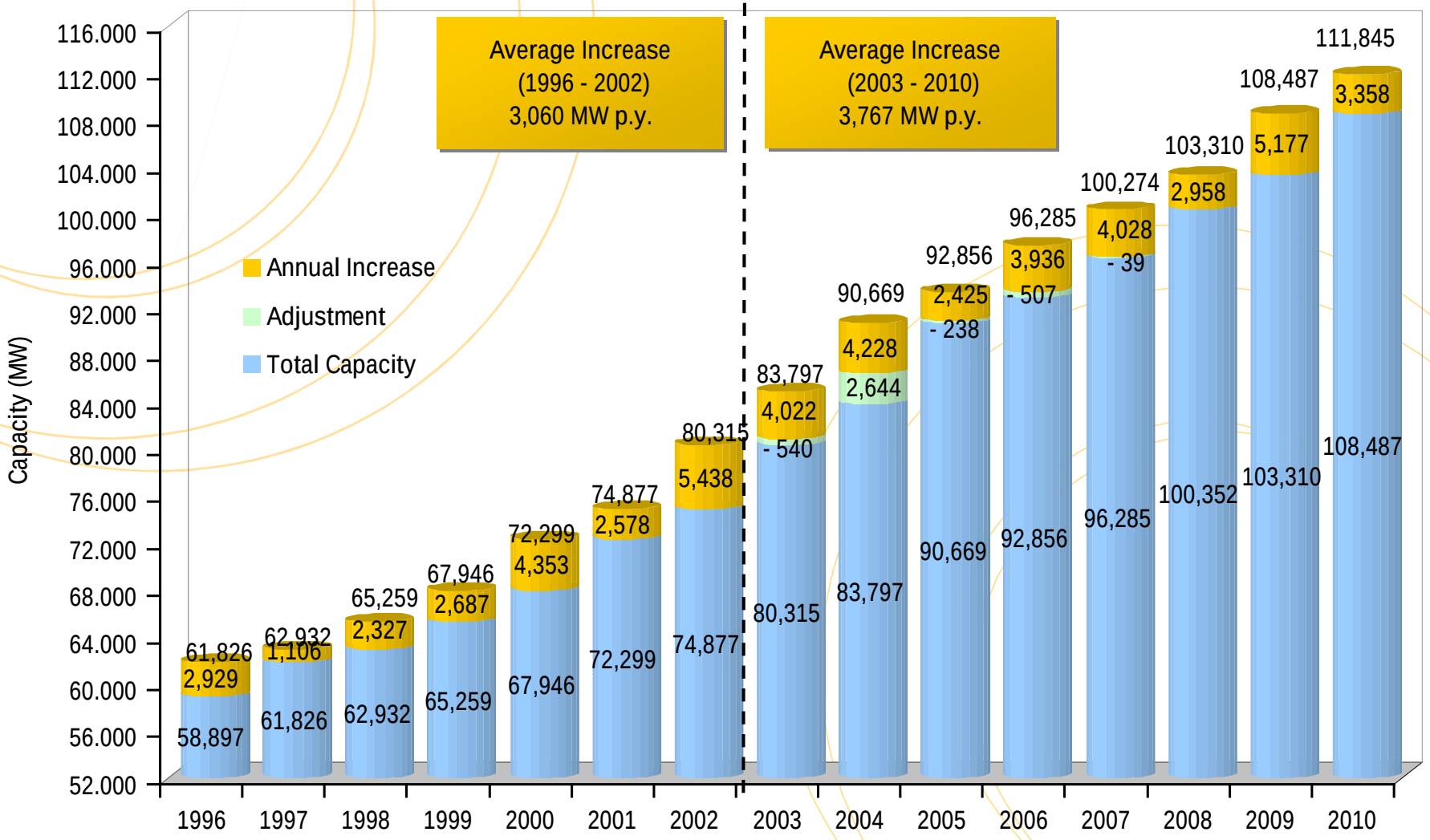
ENERGY CONSUMPTION PROSPECTS (TWh)

in TWh

Year	Consumption Supplied by Discos	Self Production	Total
2007	377.2	35.4	412.6
2012	480.4	63.8	544.2
2017	604.2	102.3	706.4
Growth (% p.y.)			
2007-2017	4.8	11.2	5.5
		GDP (% p.y.)	5.0
		Elasticity (e)	1.10

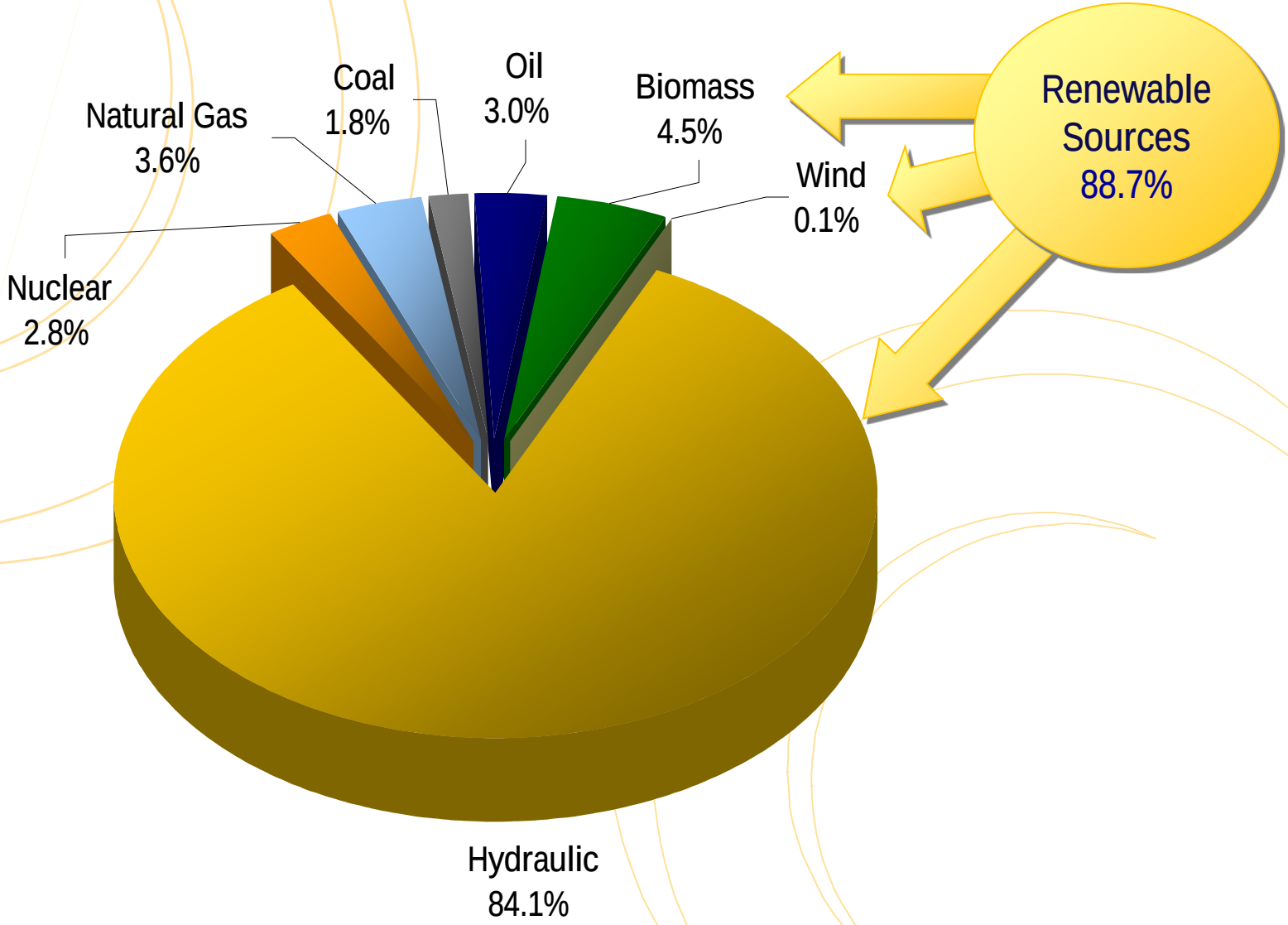
Source: EPE (PDE)

EXPANSION OF GENERATION (MW)



Source: MME

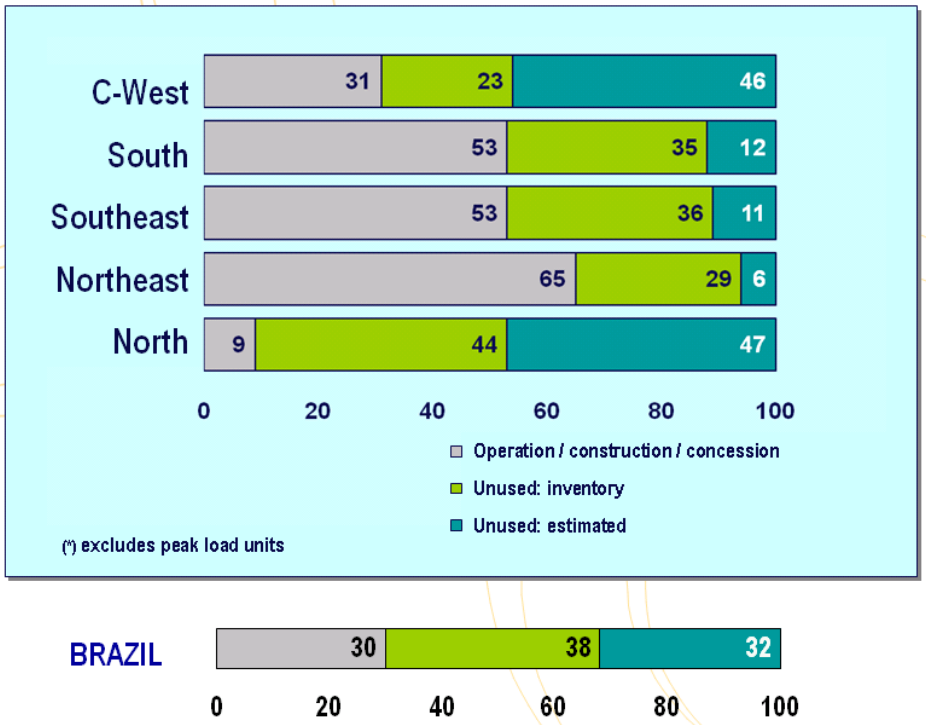
ELECTRICITY SUPPLY STRUCTURE

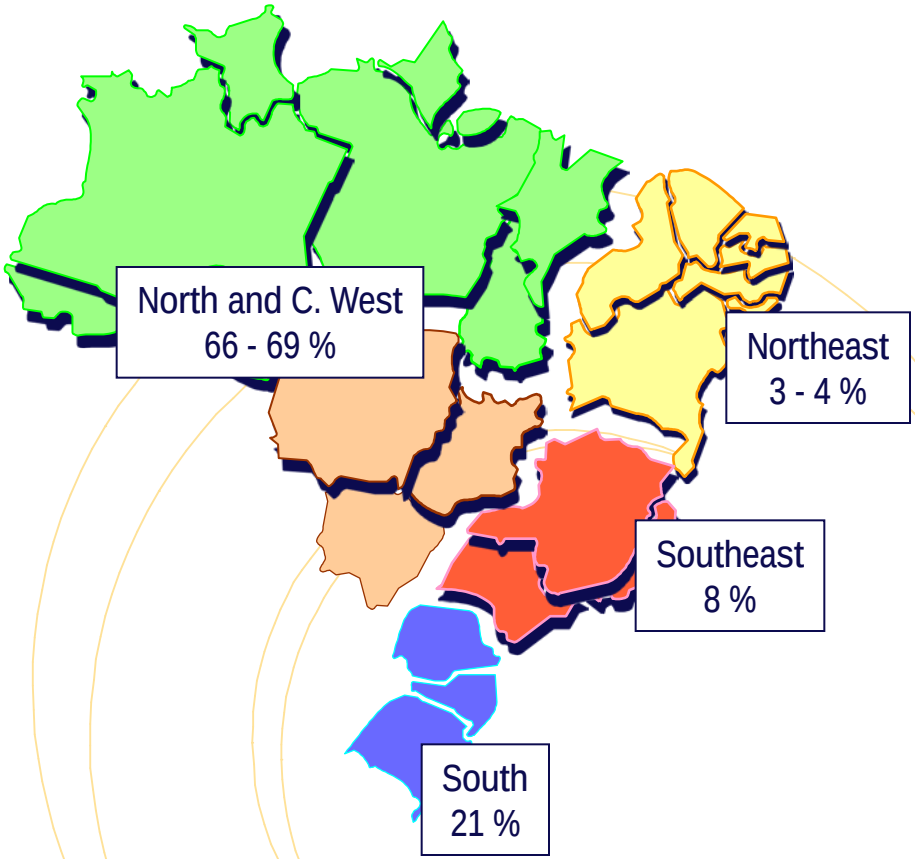


Source: EPE - BEN 2008 (preliminary results)

REMAINING POTENTIAL OF HYDRO IN BRAZIL

BRAZIL : 135 GW

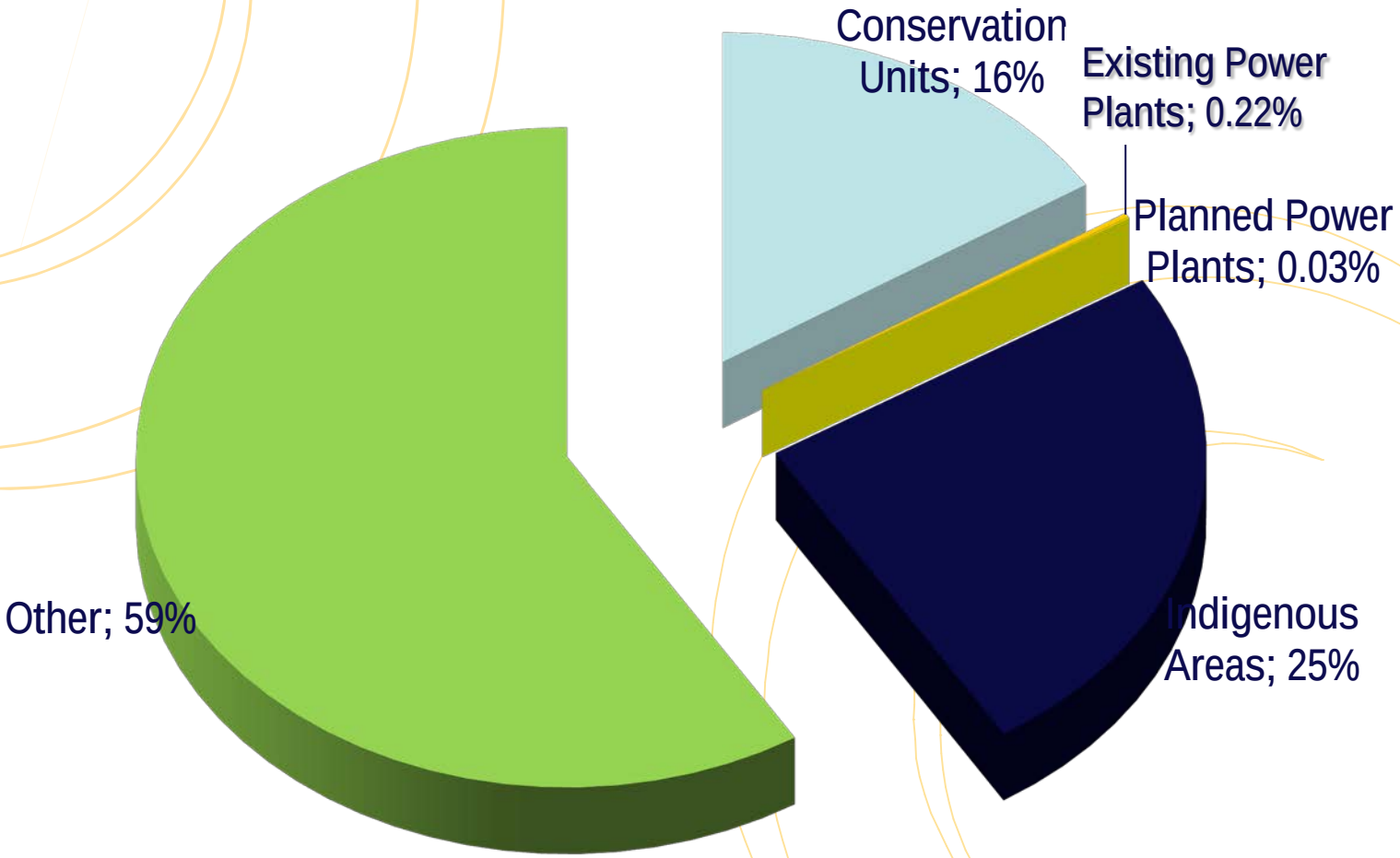




Source: EPE (PNE 2030)

AMAZON BIOME OCCUPATION

EXISTING AND PROSPECTIVE POWER SYSTEMS



Source: EPE (PNE 2030)

BRAZILIAN POWER GRID

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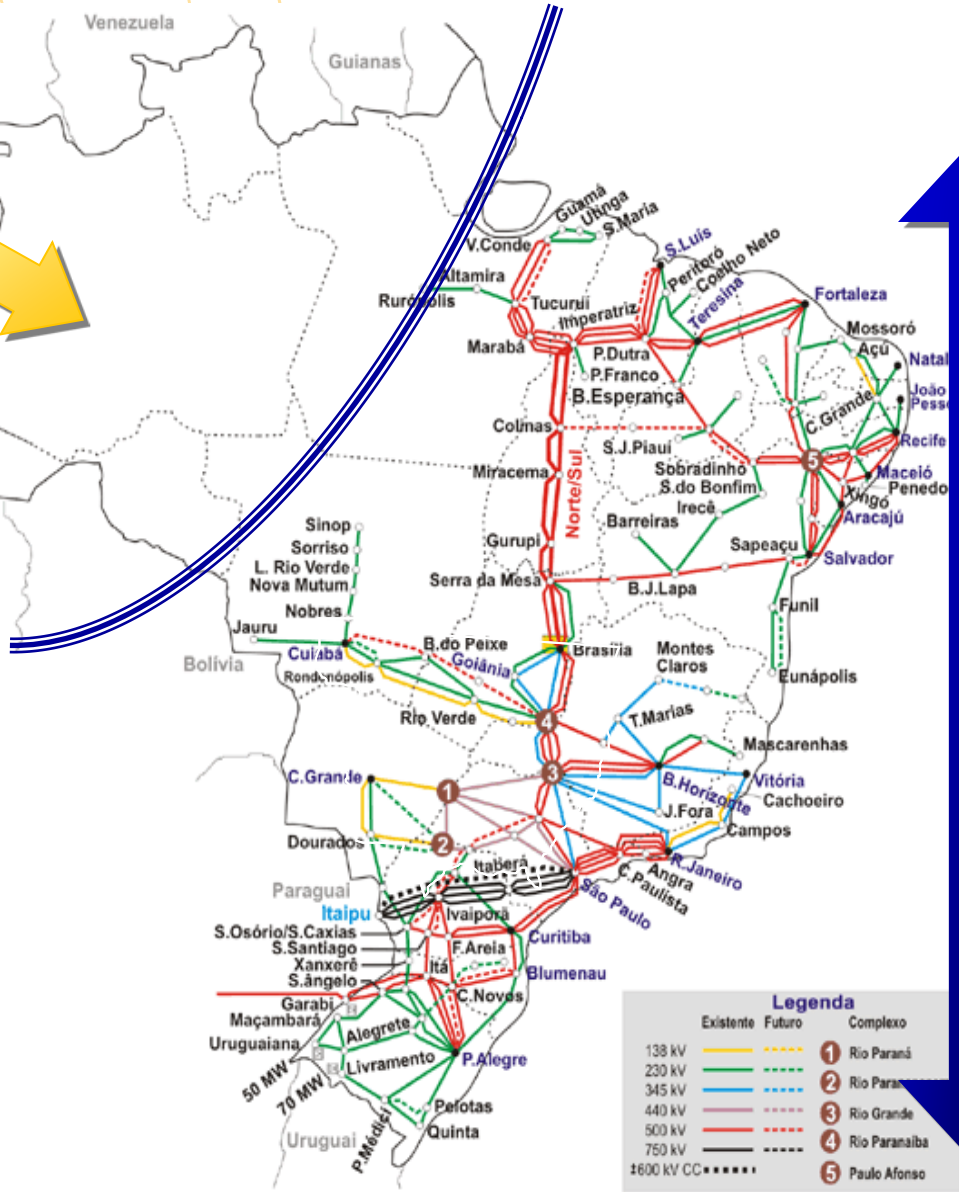
Stand-alone Systems



4,000 km

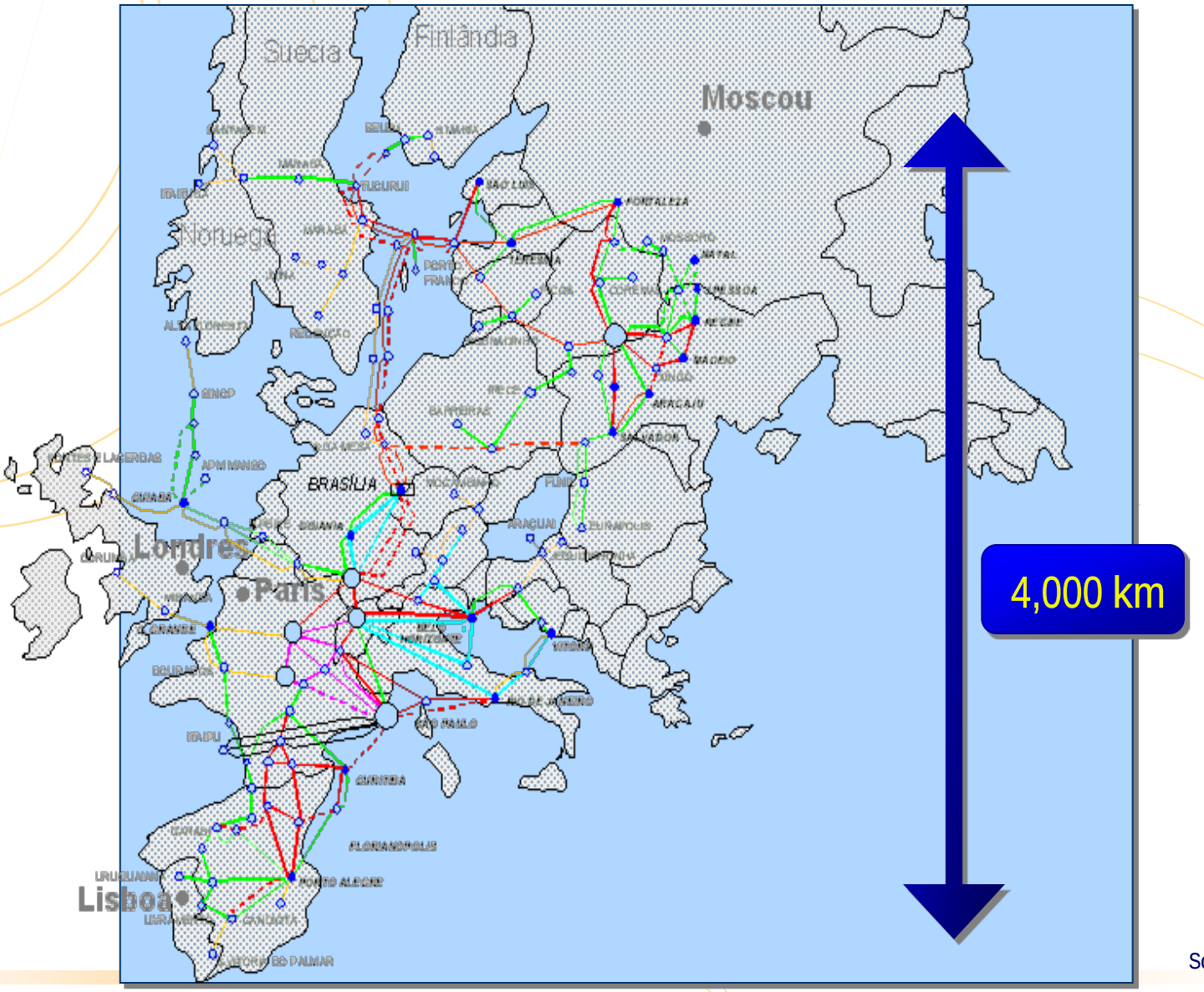
National Interconnected System

Existing System

Voltage	Length
TL 230 kV	: 36,814 km
TL 345 kV	: 9,218 km
TL 440 kV	: 6,791 km
TL 500 kV	: 29,262 km
TL 600 kV	: 1,612 km
TL 750 kV	: 2,698 km
Total	: 86,395 km

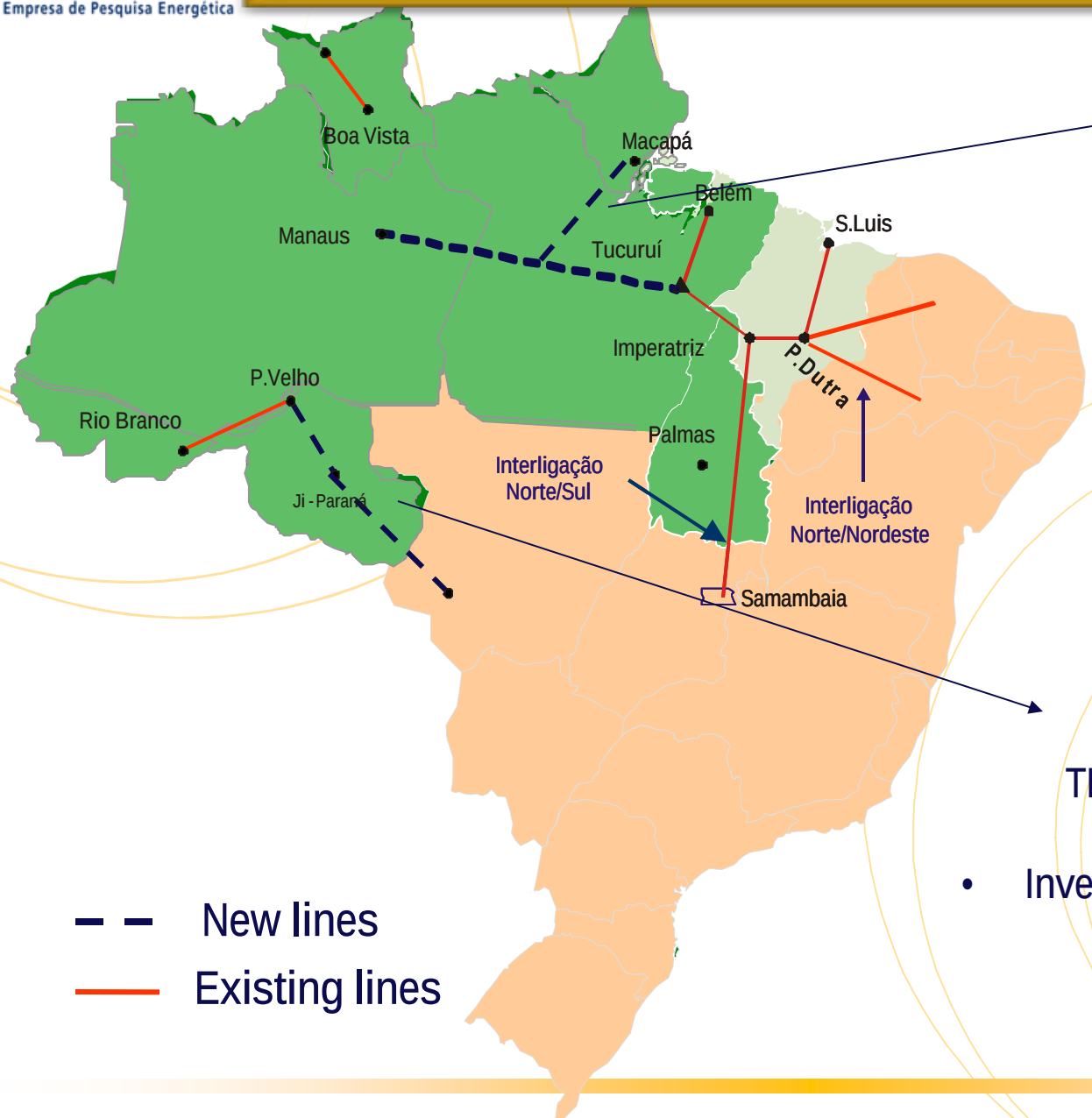
Source: EPE (PDE 2008 /2017)

BRAZILIAN POWER GRID AT PERSPECTIVE



Source: EPE

STAND-ALONE SYSTEMS CONNECTIONS



TUCURUÍ-MACAPÁ-MANAUS TRANSMISSION LINE

- May assist up to 1730 MW
- Expansible to 2530 MW
- Investments: US$ 2 billion

MADEIRA RIVER'S TRANSMISSION LINES

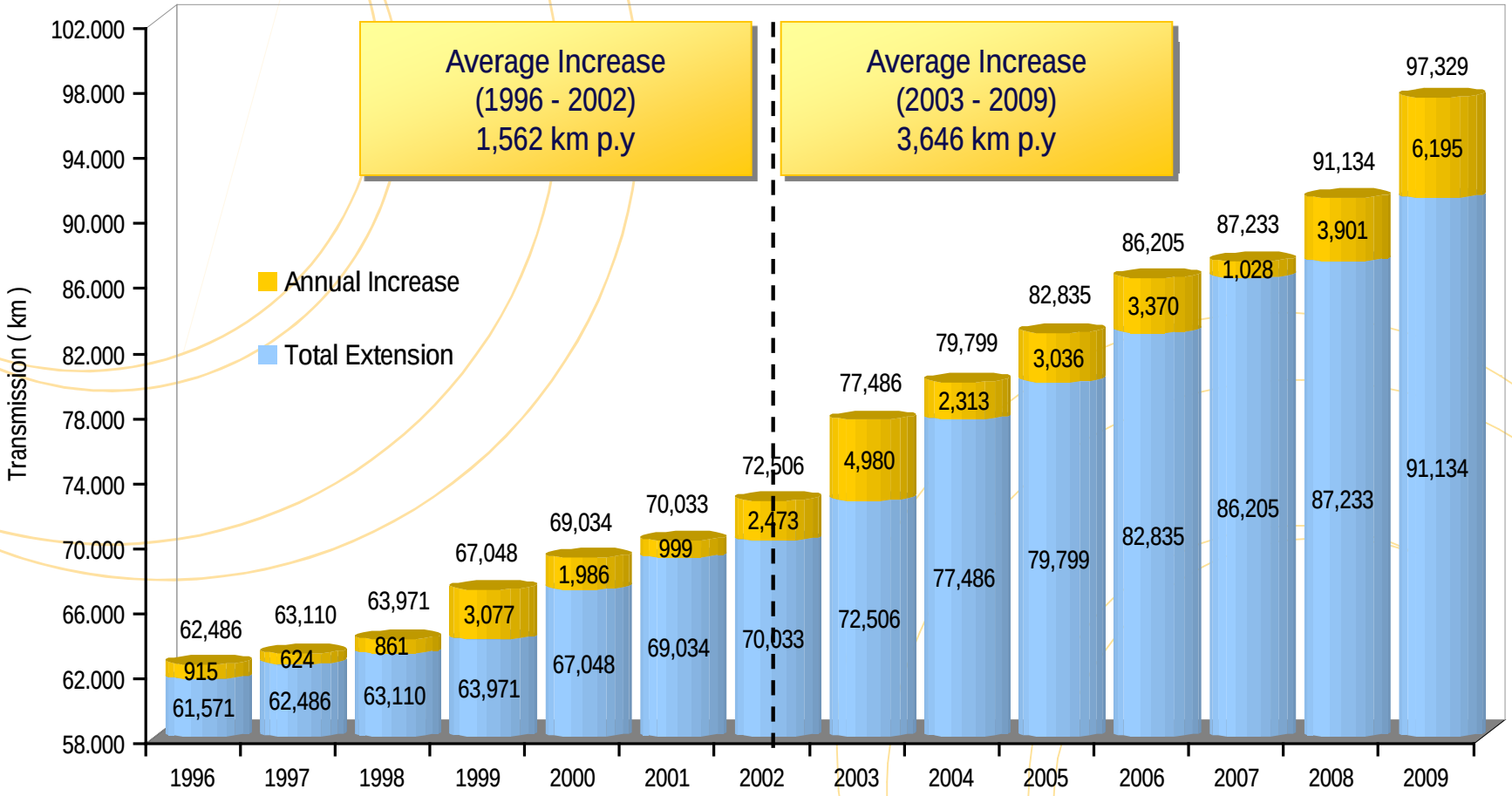
- Investments: US$ 59 - 72 billion

New lines

Existing lines

EXPANSION OF TRANSMISSION (KM)

BASE NETWORK



Year	2003	2004	2005	2006	2007	2008	2009	TOTAL
Investments (US$ million)	1,473.8	637.1	1,411.8	1,730.0	294.3	1,501.6	1,769.2	8,855.7

Sources: ANEEL, ONS & MME

THE NEW REGULATORY FRAMEWORK FOR THE ELECTRIC SECTOR

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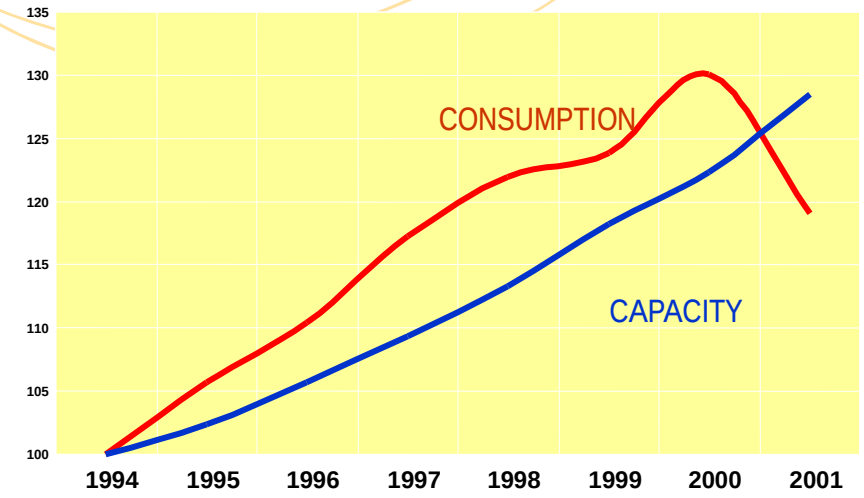
WHY REVIEW THE ELECTRIC SECTOR MODEL IN BRAZIL?

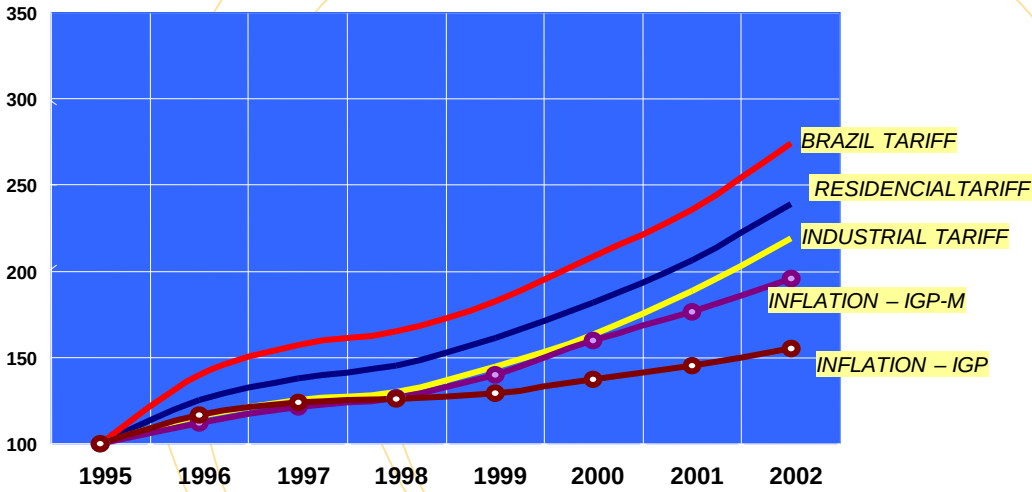
- Electricity rationing in 2001-2002
- Sector companies undergoing financial and economic crisis in 2001-2002, recovering during 2003
- Lack of electricity for 12 million Brazilians

SCENARIO BEFORE 2003

- Difficulties for investments and no competition: absence of cost of expansion references and "self-dealing" (incentives for contracting within the same economic group)
- Rising prices for final consumer
- Generators have no PPA guarantees
- High environmental risk
- High risk in the short-term market



Consumption grows faster then capacity



Tariffs grow faster then Inflation

PURCHASE OF POWER THROUGH AUCTION PLUS SURCHARGE

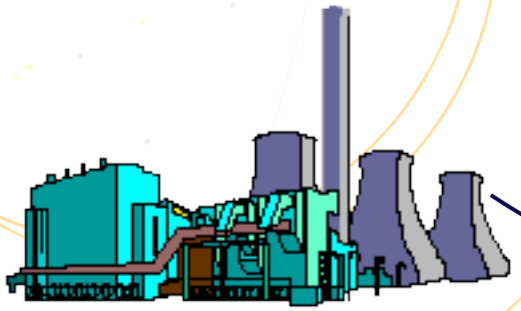
Auction Based on Payment of Highest Surcharge:
3,090% !!!! US$ 2.1 billion

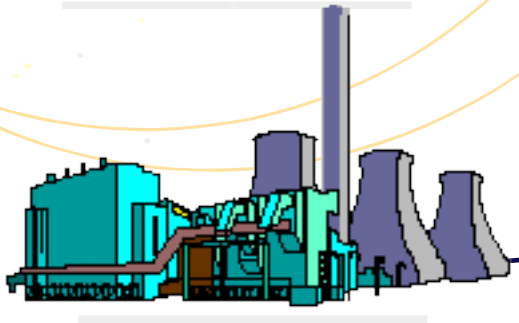
HIGH TARIFFS

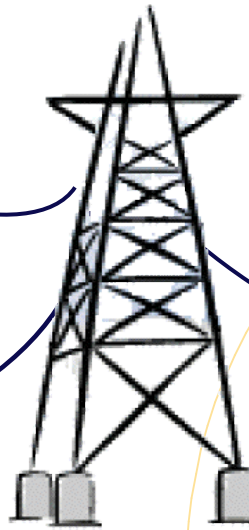
REAL INCREASE OF 40% BETWEEN 1995 AND 2002

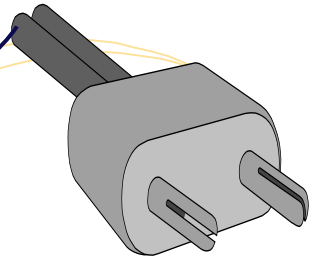
CRISIS

GENERATION	TRANSMISSION	DISTRIBUTION
RATIONING	BLACK-OUT	MARKET CONTRACTION + HIGH DEBT
Delays in New and Ongoing Construction and Under-investment	Delays in New and Ongoing Construction and Under-investment	Financial Crisis









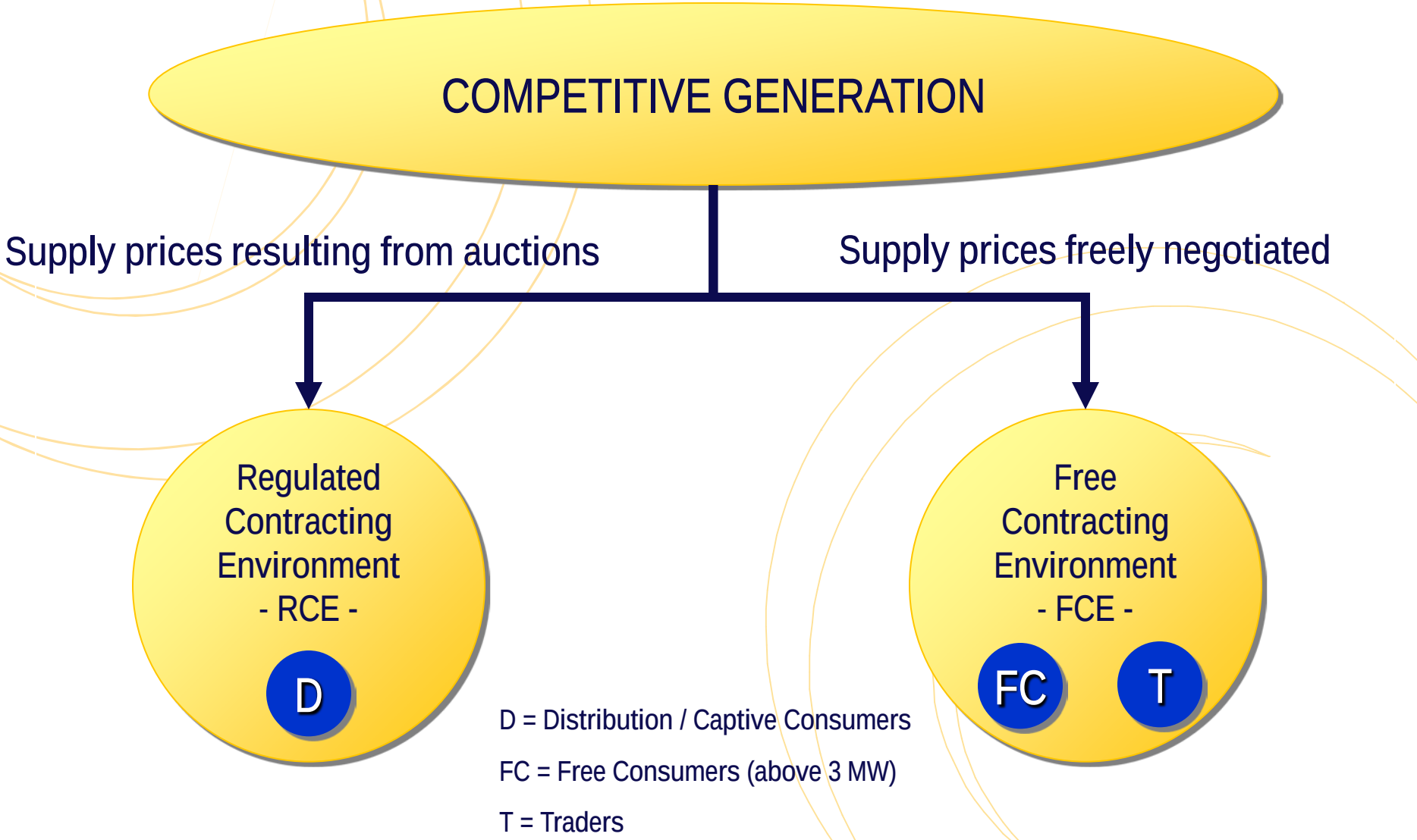
ABSENCE OF PLANNING AND CLEAR MARKET RULES

NEW REGULATORY FRAMEWORK FOR THE ELECTRIC SECTOR

NEW REGULATORY FRAMEWORK

- Restructuring of the planning sector (Creation of Energy Research Office - EPE)
- Effective monitoring of conditions of service (creation of the Committee for System Monitoring)
- End of self dealing and promotion of efficient pricing mechanism (auction)
- Promoting social integration (universalization of the energy service for 12 million people)
- Prior Environmental License required
- All consumers must be totally covered by electricity contracts
- All contracts must be backed up by physical production capacity (security of supply)
- Reliance on long-term contracts (up to 30 years), but there is a spot market

TWO CONTRACTING ENVIRONMENTS



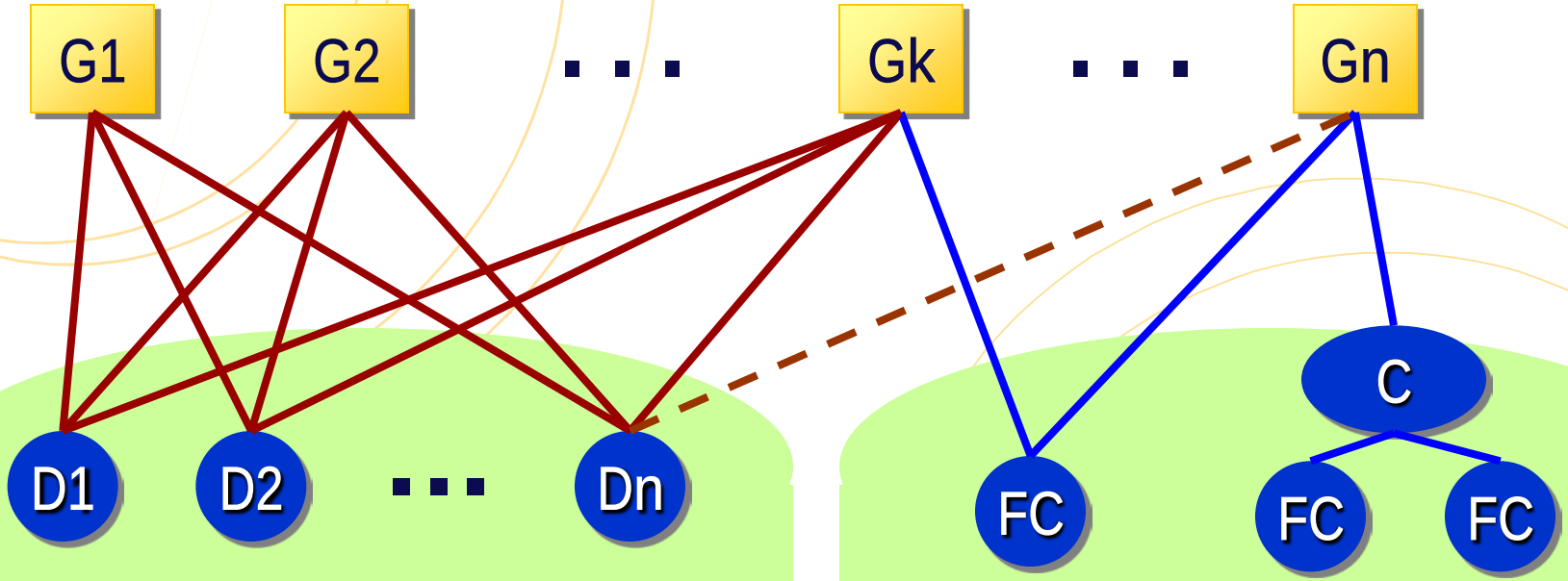
D = Distribution / Captive Consumers

FC = Free Consumers (above 3 MW)

T = Traders

WHOLESALE COMPETITION

Generators must contract with all distributors, in proportion to their energy needs



Regulated Contracting Environment (RCE)

- Normal bilateral contracts auctions through CCEE contracting mechanism for long term
- Additional contracts for market adjustment auctions through CCEE Contracting up to 2 years

Free Contracting Environment (LCE)

- Contracting at free contracting rule

REGULATED CONTRACTING ENVIRONMENT - POOL

POWER AUCTIONS PPA

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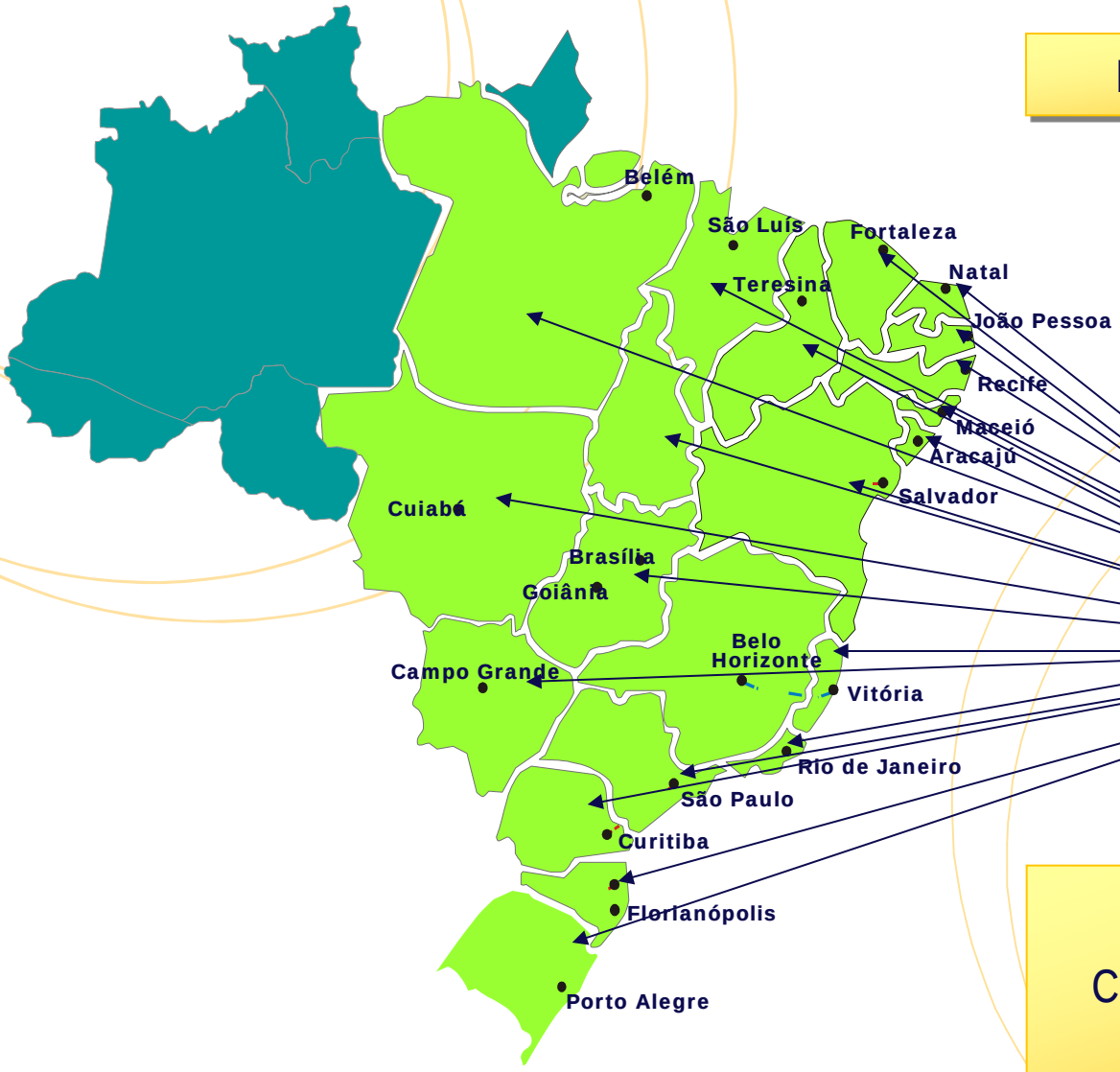
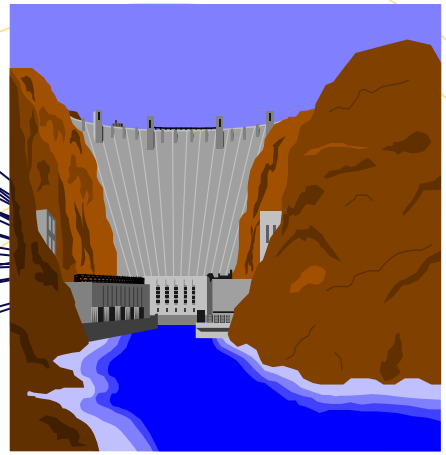
D's signs PPA's with G's





REGULATED BILATERAL CONTRACTS FOR BUYING AND SELLING OF POWER

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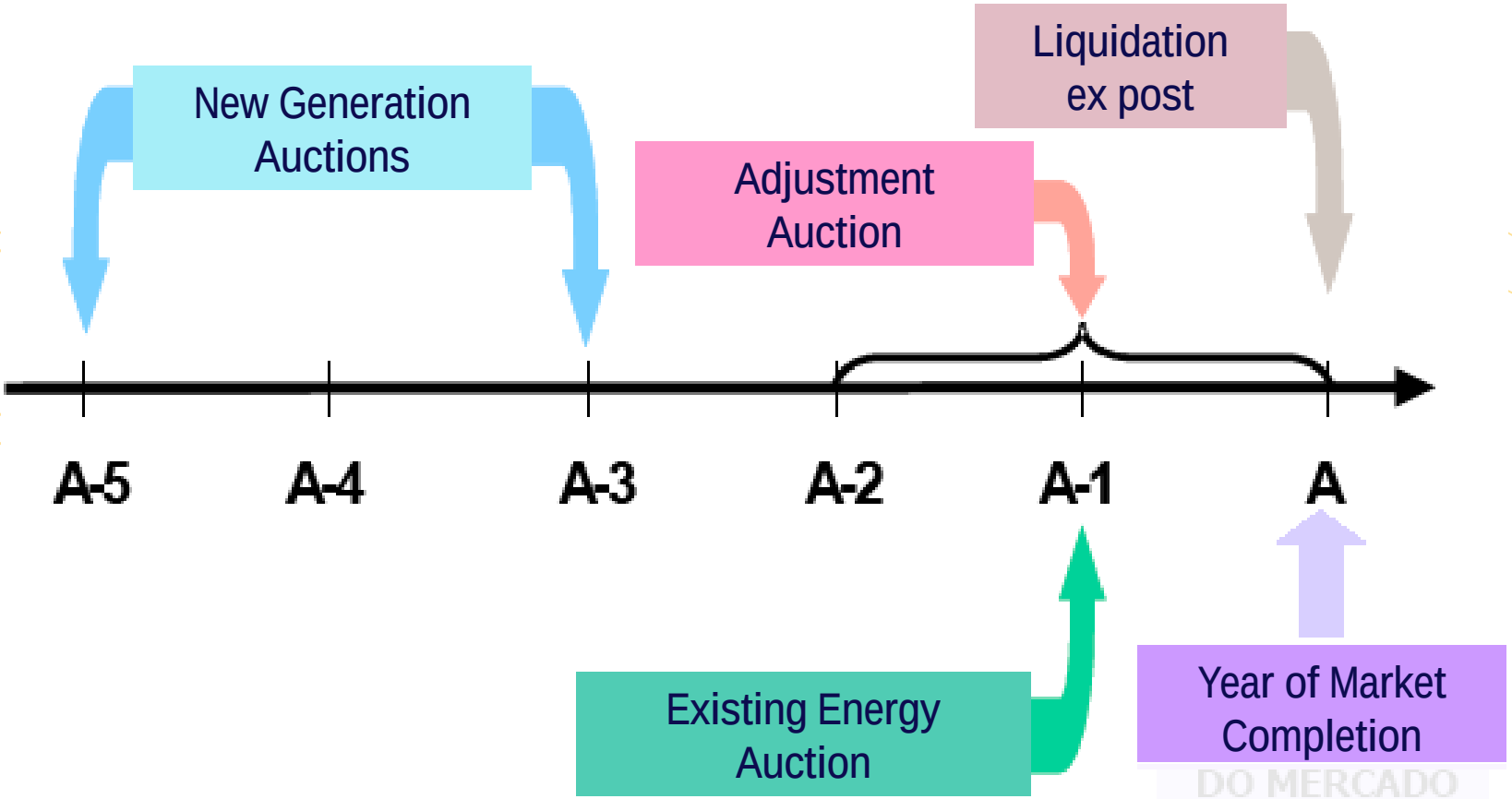
POWER AUCTIONS

- TYPES
  - Separate auctions for existing energy and new energy
  - 3 years- and 5 years-ahead of start of supply
  - Dutch Auction (the lower price wins)
- BUYERS
  - Discos are responsible for load forecast
  - They can pass through the contract costs to customers
- BIDDERS
  - Private or state-owned companies
  - Brazilian or Foreign Companies
- ENERGY SOURCES
  - All energy sources
- WINNERS
  - Winners of new energy auctions will award long-term PPA's and hydro concessions
- MITIGATION OF ENVIRONMENTAL RISKS
  - Only projects with pre-approved environmental license are auctioned off

RESTRUCTURING OF THE BRAZILIAN ELECTRIC SECTOR

COMMERCIALIZATION MODEL



BRAZILIAN POWER SECTOR PLANNING

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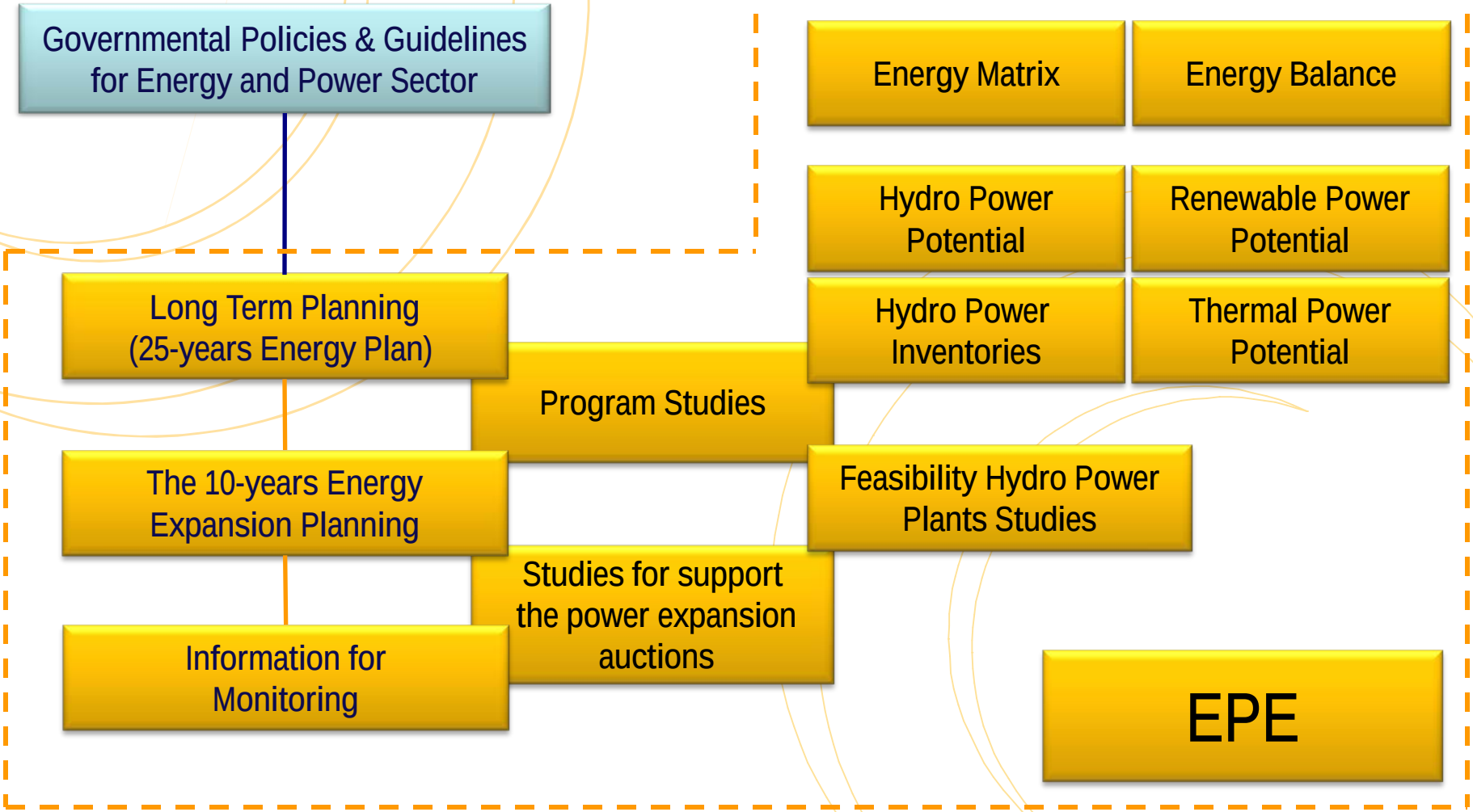
INSTITUTIONAL ORGANIZATION

- National Council for Energy Policy (CNPE)
  - High level Council empowered with establishing guidelines for energy policy
- Ministry of Mines and Energy (MME)
  - Responsible for energy policy and energy planning.
- Energy Research Office (EPE)
  - Responsible for the implementation of studies that will assist MME`s planning.
- Electric Energy National Agency (ANEEL)
  - Responsible for regulation, control and mediation.
- Electric System National Operator (ONS)
  - Responsible for the operation of the National Interconnected System.
- Chamber for the Commerce of Electric Energy (CCEE)
  - Responsible for the management of contracts and for short term accounting and short term liquidation.

PLANNING PROCESS AND ROLE OF EPE



HYDRO POWER PLANTS PLANNING PROCESS

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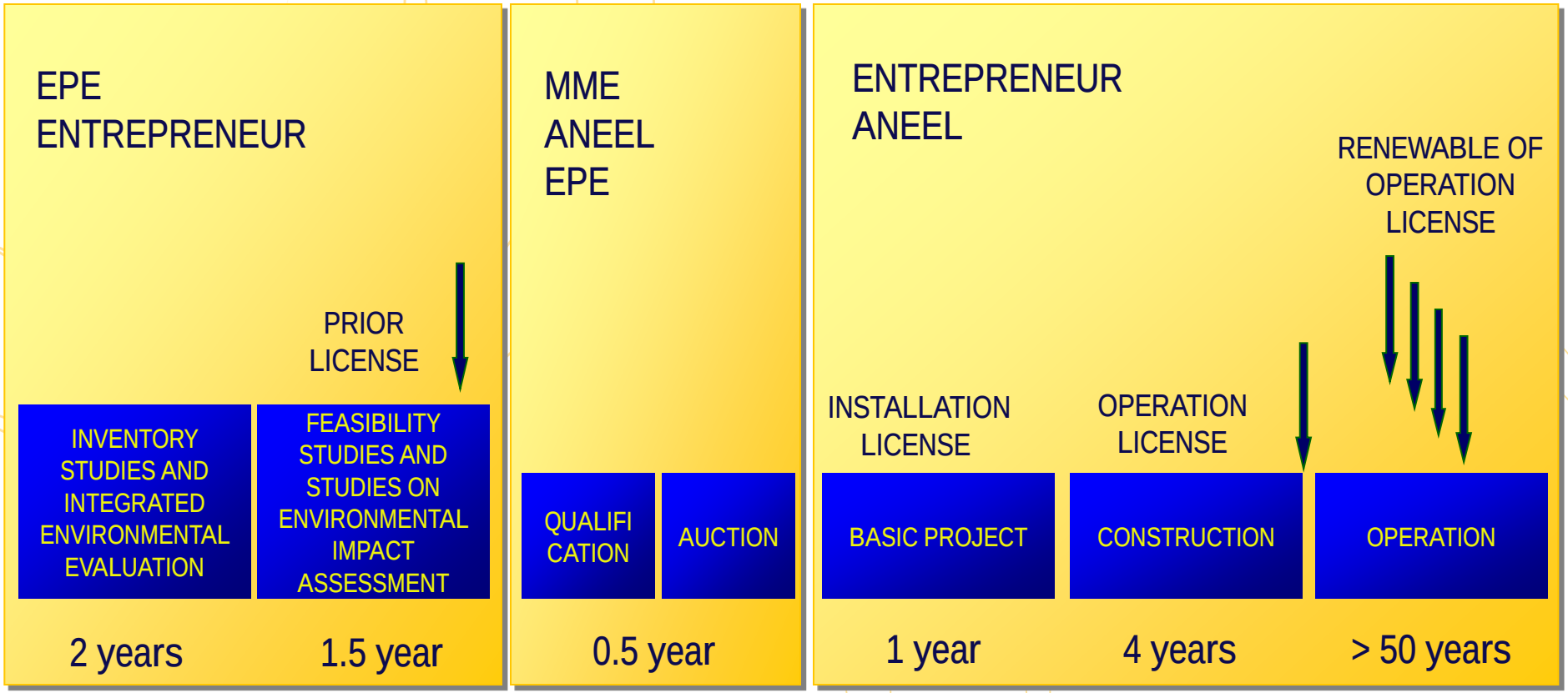
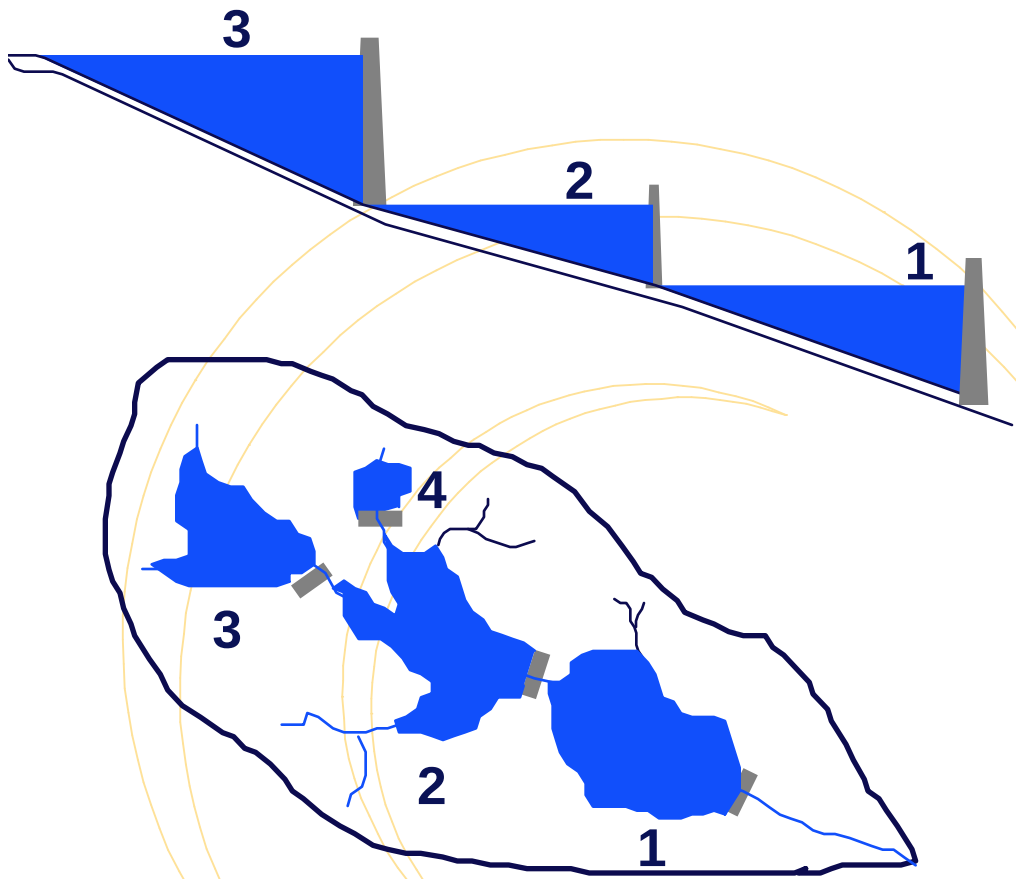


RIVER BASIN INVENTORY

- Valuation of the multiple implications of projects
- Definition of better use of the hydro potential of the basin
- Interaction with the planning of other sectors engaged in the basin



SELECTION OF ALTERNATIVES

FOCUS
MULTIPURPOSE

MAXIMIZE THE ECONOMIC-ENERGY EFFICIENCY
MINIMIZE THE SOCIAL & ENVIRONMENTAL IMPACTS

HYDRO POWER INVENTORIES

WITH A COMPREHENSIVE INTEGRATED ENVIRONMENTAL EVALUATION

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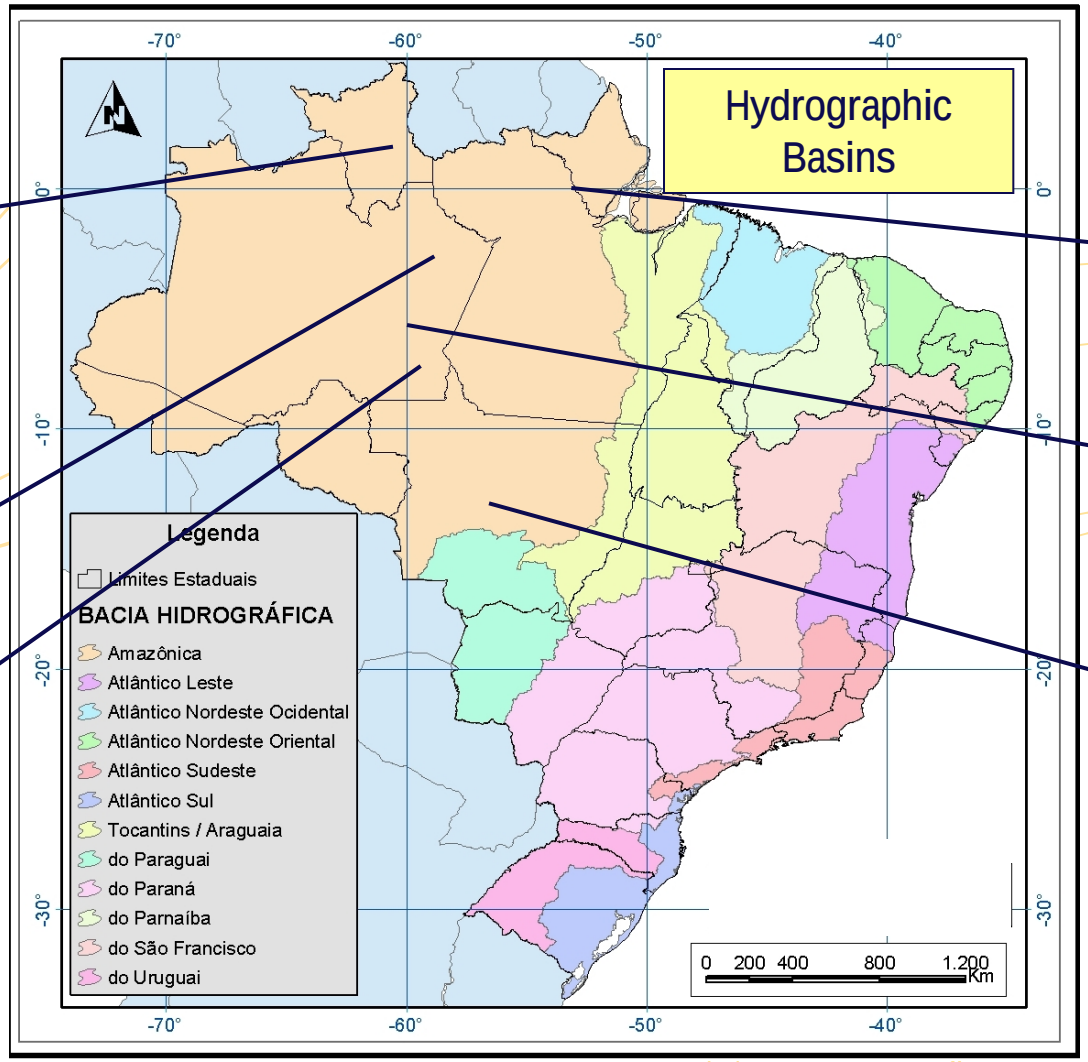
Total: 19,750 MW

Branco River
2,000 MW

Trombetas River
3,000 MW

Aripuanã River
3,000 MW



Jari River
1,100 MW

Sucunduri River
650 MW

Juruena River
10,000 MW

INTEGRATED ENVIRONMENTAL EVALUATION - IEE

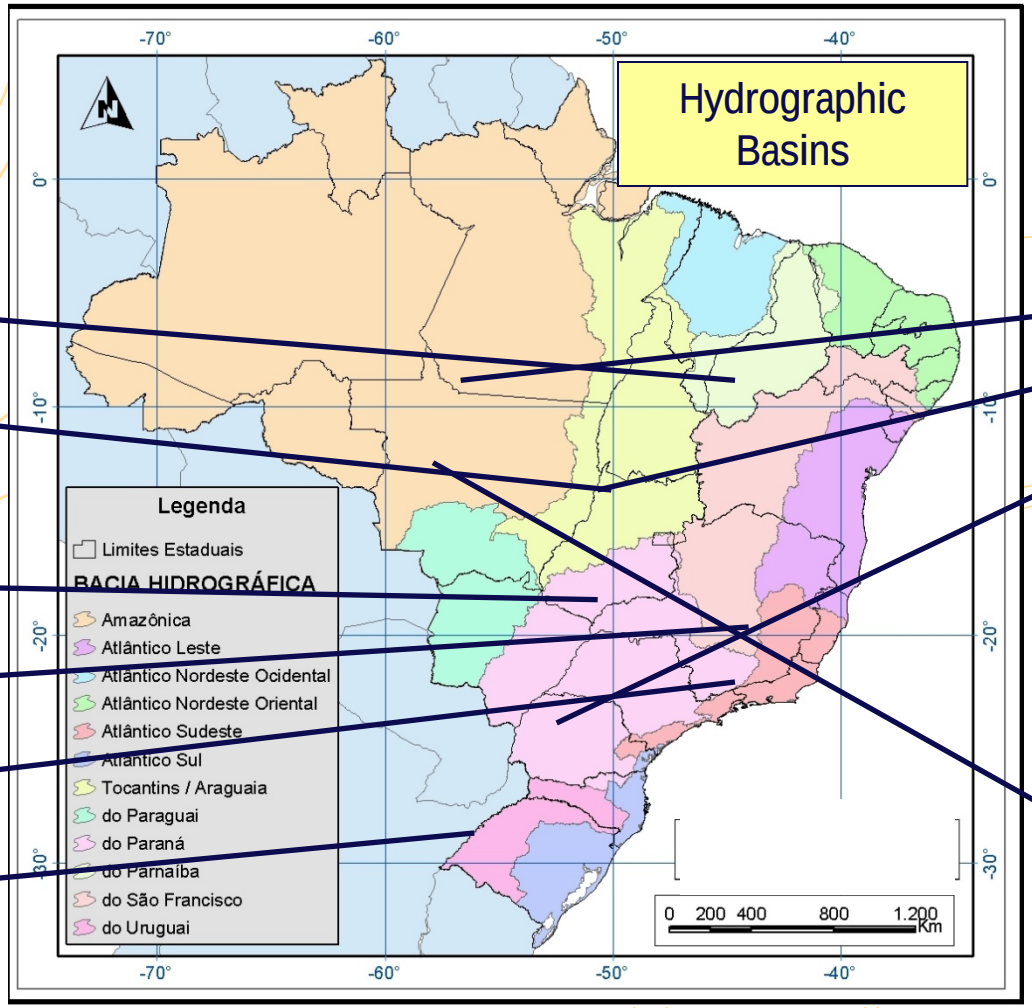
OBJECTIVE

Identify and valuate the cumulative and synergistic effects resulting from environmental impacts caused by the potentials hydroelectric plants in a river basin

INTEGRATED ENVIRONMENTAL EVALUATION STUDIES

Completed

- Parnaíba
- Tocantins e Formadores do Tocantins
- Paranaíba
- Doce
- Paraíba do Sul
- Uruguai



In progress

- Teles Pires
- Araguaia
- Tibagi

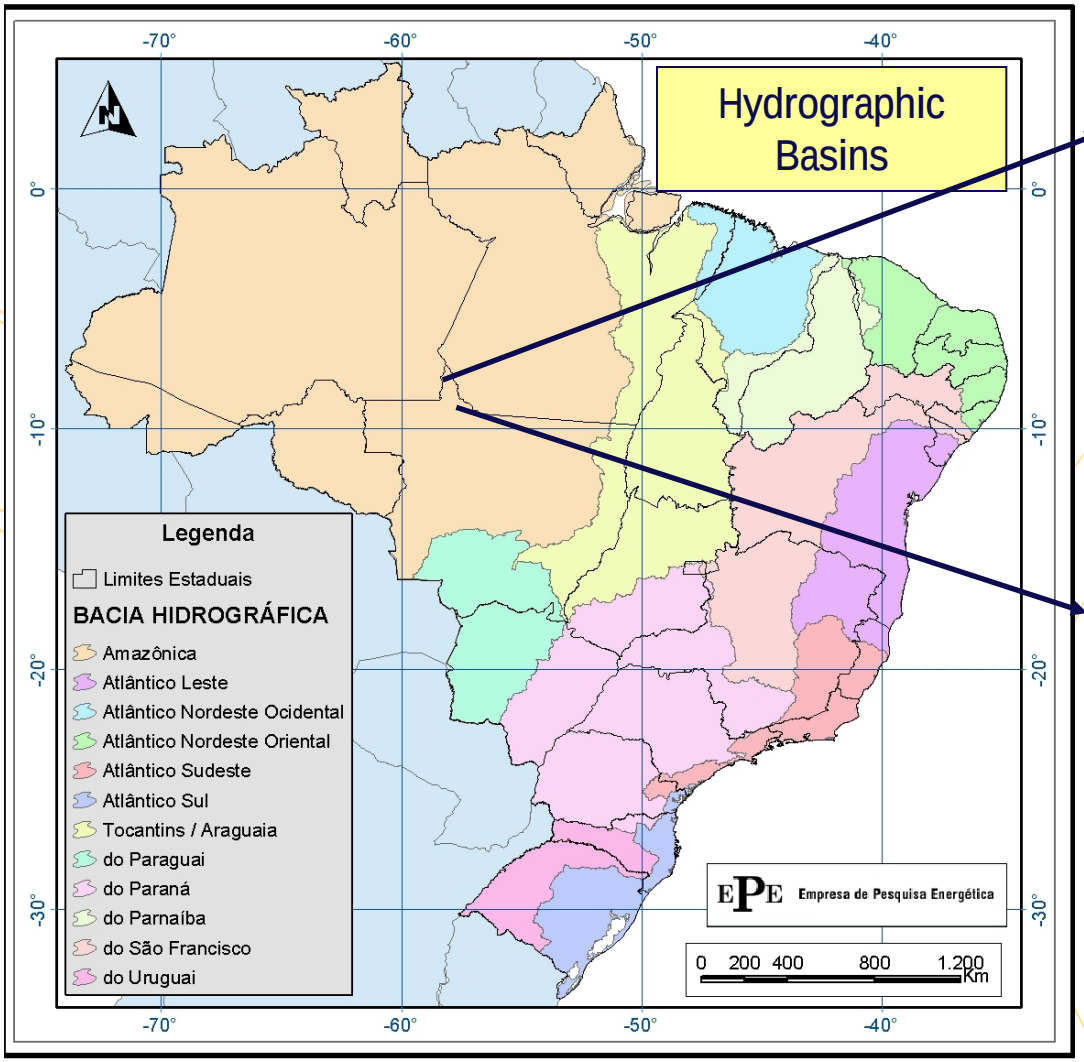
To be hired in 2009

- Tapajós

FEASIBILITY HYDRO POWER PLANTS STUDIES

Preparation and monitoring of Environmental Impact Studies, ensuring the integration of energy, engineering, social and economic aspects, according to the document "Instructions for Feasibility Studies of the Hydroelectric Projects" (1997)

FEASIBILITY HYDRO POWER PLANTS STUDIES



Teles Pires River

Teles Pires Power Plant	1820 MW
São Manoel Power Plant	746 MW
Sinop Power Plant	461 MW

Apiacás River

Foz do Apiacás Power Plant	275 MW

Total

3302 MW

ABOUT EPE

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EPE ROLE

- EPE is a 100% State-owned Office, related to the Ministry of Mines and Energy, created by Law # 10.847, of April 16th, 2004
- EPE started to work in January 2nd, 2005
- EPE is responsible for power sector planning studies: electric sector, oil & gas sector, renewable sources, nuclear power and energy efficiency
- Its studies give support to establish governmental policies for the energy sector

EPE STRUCTURE

- EPE has a Presidency and 4 Directories:

1. Economic and Demand Studies and Long Term Integrated Energy Planning
2. Power Studies (Generation, Transmission and Environment)
3. Oil & Gas and Bioenergy Studies
4. Corporative Management

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SOME RESULTS

RESUMPTION OF PLANNING

- Integrated Environmental Evaluation of Hydrographic Basins
- New Hydro Power Inventories and Feasibility Hydro Power Plants Evaluation
- 2006, 2007 & 2008 Brazilian Energy Balance
- 25-year Integrated Energy Plan - PNE 2030
- 10-year Energy Sector Expansion Planning (2007-2016)
- Economic forecasting studies up to 2030 (monthly)
- Energy demand forecasting studies up to 2030 (quarterly)
- 5-year Transmission Expansion Program
- Long Distance Engineering, Planning and Specification Studies
- Economic and Engineering Studies for support the power expansion auctions
- Several studies in oil & gas area

SOME RESULTS UP TO 2005

RESUMPTION OF PLANNING – AUCTIONS (MW)

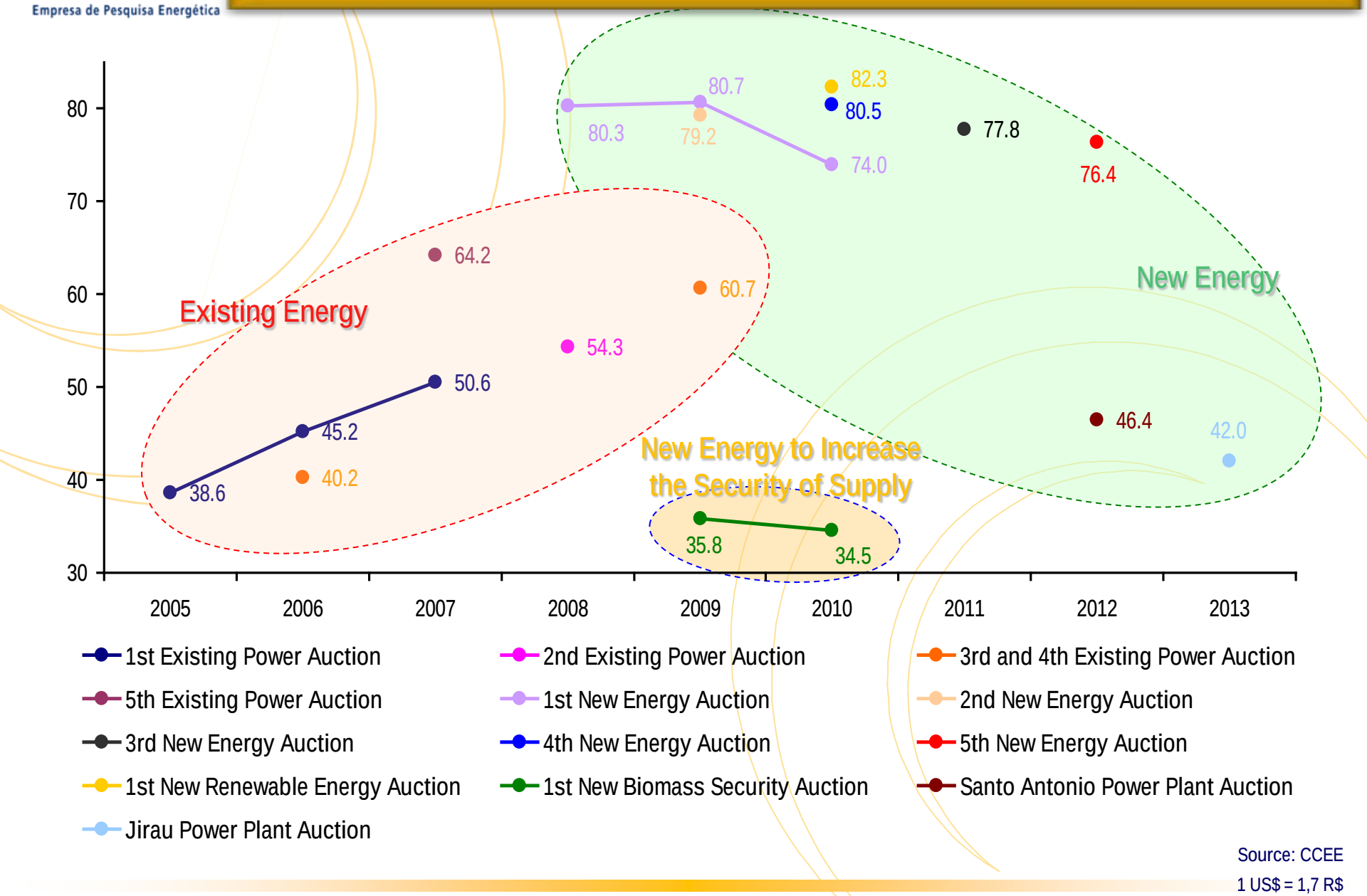
- 9 New Energy Auctions 32,164 MW
  - For supply the needs of the market expansion
- 1 New Energy Auction 2,379 MW
  - Above the needs of the market
  - Goal: Increase the security of supply

34,543 MW

Hydro, Small Hydro, Oil, Natural Gas, Coal & Biomass

SOME RESULTS UP TO 2005

RESUMPTION OF PLANNING – AUCTIONS (US$/MWh)



Source: CCEE

1 US$ = 1,7 R$

NEXT STEPS

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A - 3 AUCTION (2008)

- Start of supply: 2011 (15 years' PPA)
- It will be held on September 17th, 2008
- Price Cap = US$ 88.2 / MWh (*)
- Qualified and Prospect Bidders:

Sources	Units	Capacity (MW)	Energy (MWmed)
Wind	49	2,578.8	893.7
Sugar Cane Biomass	49	2,217.4	890.9
Other Biomass	6	250.0	205.9
Liquefied Natural Gas (LNG)	2	504.0	272.0
Natural Gas	1	65.9	33.1
Oil	86	15,016.7	7,830.7
Total	193	20,632.8	10,126.3

(*) 1 US$ = 1,7 R$

A - 5 AUCTION (2008)

- Concession of Public Use and Energy
- Start of supply: 2013 (30 years' PPA)
- It will be held on September 30th, 2008
- Price Cap = US$ 85.9 / MWh (*)

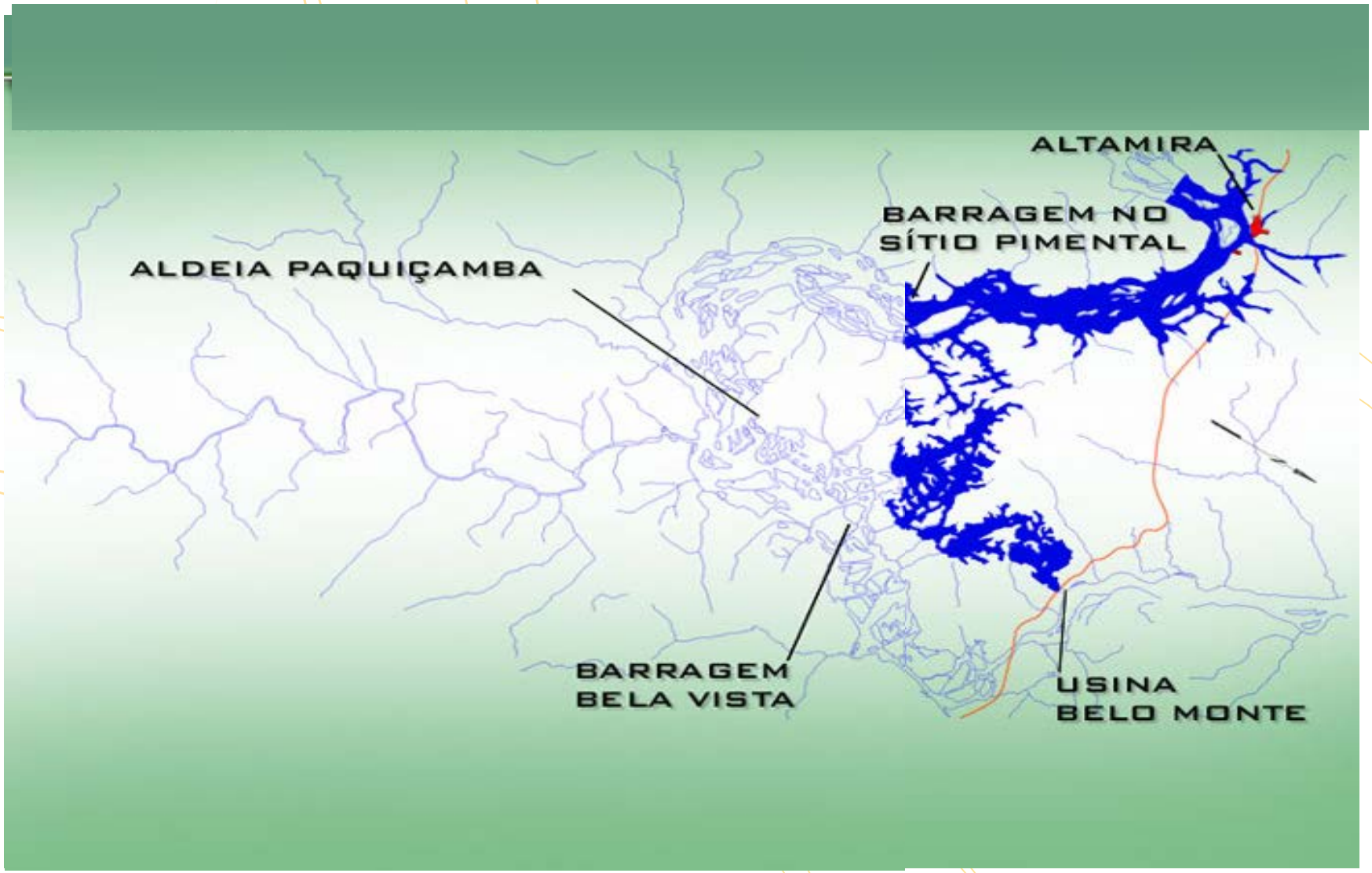
(*) 1 US$ = 1,7 R$

BELO MONTE HYDROPOWER PLANT

It will be held on September, 2009

Technical Data	Belo Monte (principal)	Belo Monte (addicted)	Belo Monte (total)
Capacity (MW)	11,000	181	11,181
Energy (MWmed)	4,719	77	4,796
Generators	20	7	27
Turbines	*Francis*	*Bulb*	
Units (MW)	550.0	25.9	
Investments (US$ billion)			7.0

BELO MONTE HYDROPOWER PLANT RESEVOIR



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(Energy Research Office)

Ministry of Mines and Energy