Regulation of the Brazilian Power Industry

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Harvard Kennedy School – April 23, 2012

Brazil power sector at glance

(year 2009)

Installed capacity:

107 GW

73% is hydro

Peak demand:

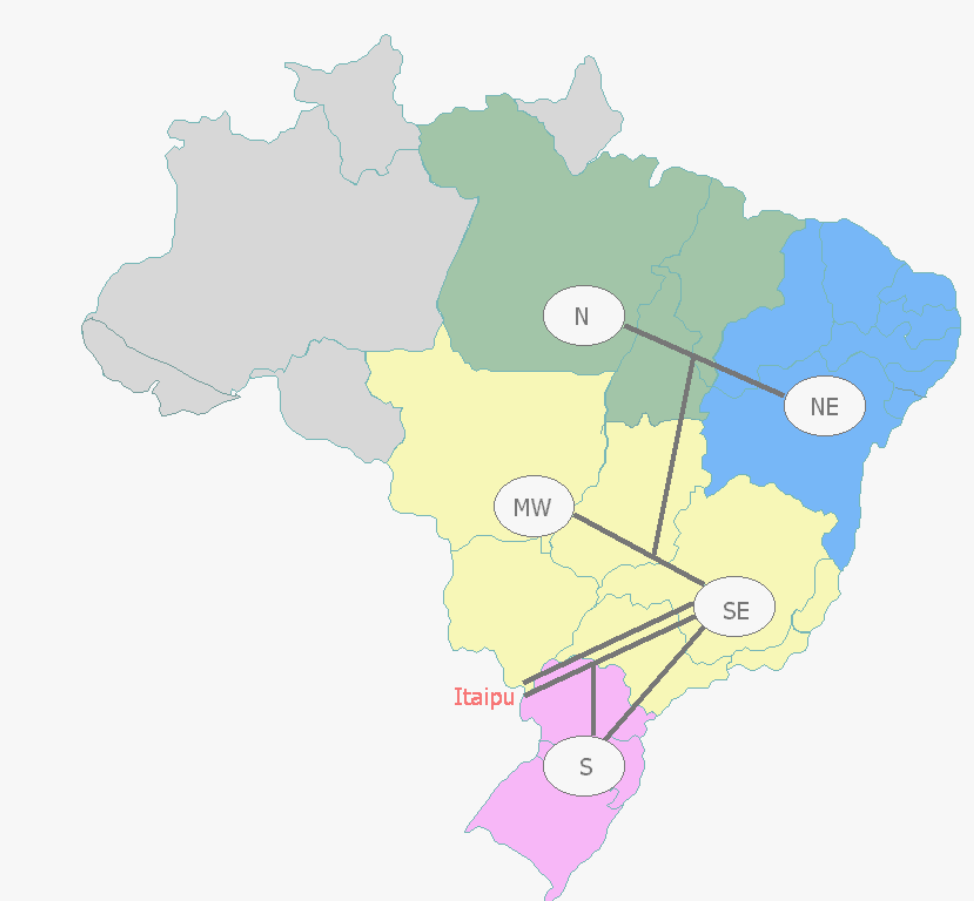
65 GW

(comparable to England or Italy)

Average production:

51GWx8760h/y = 447 TWh/y

90% is hydro



Brazil

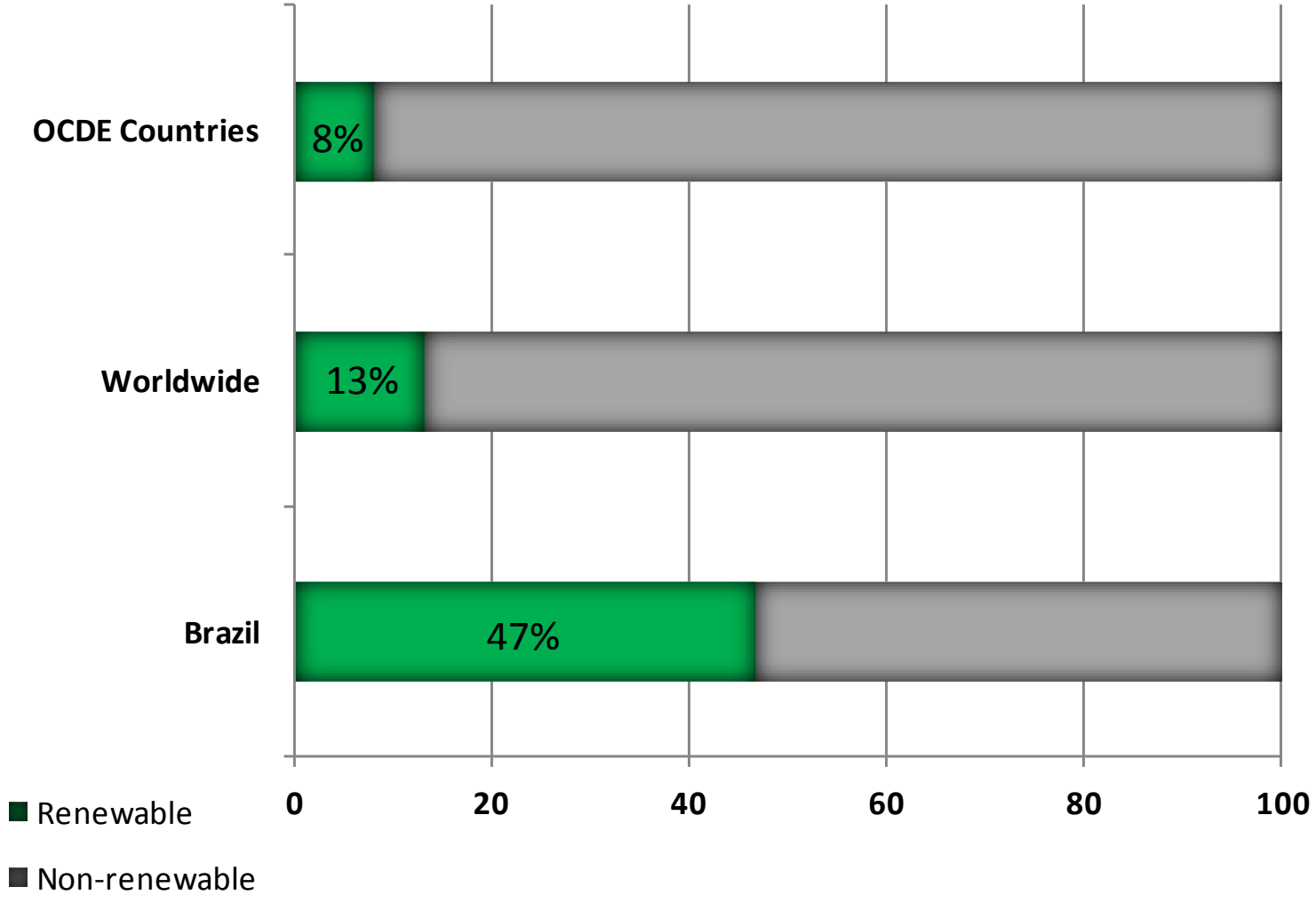
8,5 million km²

180 million people

Sources: ANEEL, EPE

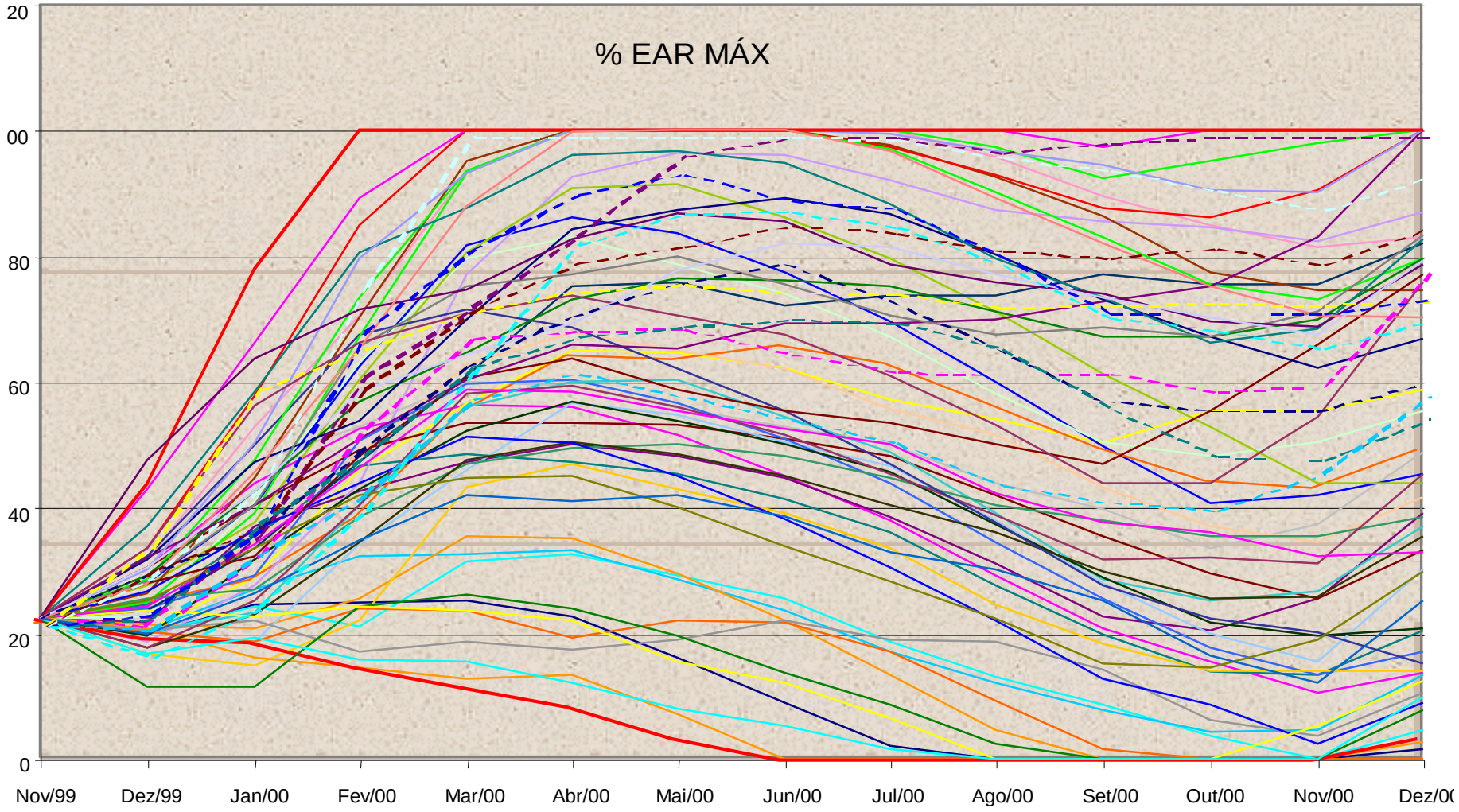
Brazilian energy is renewable due to hydro and ethanol

(year 2009)

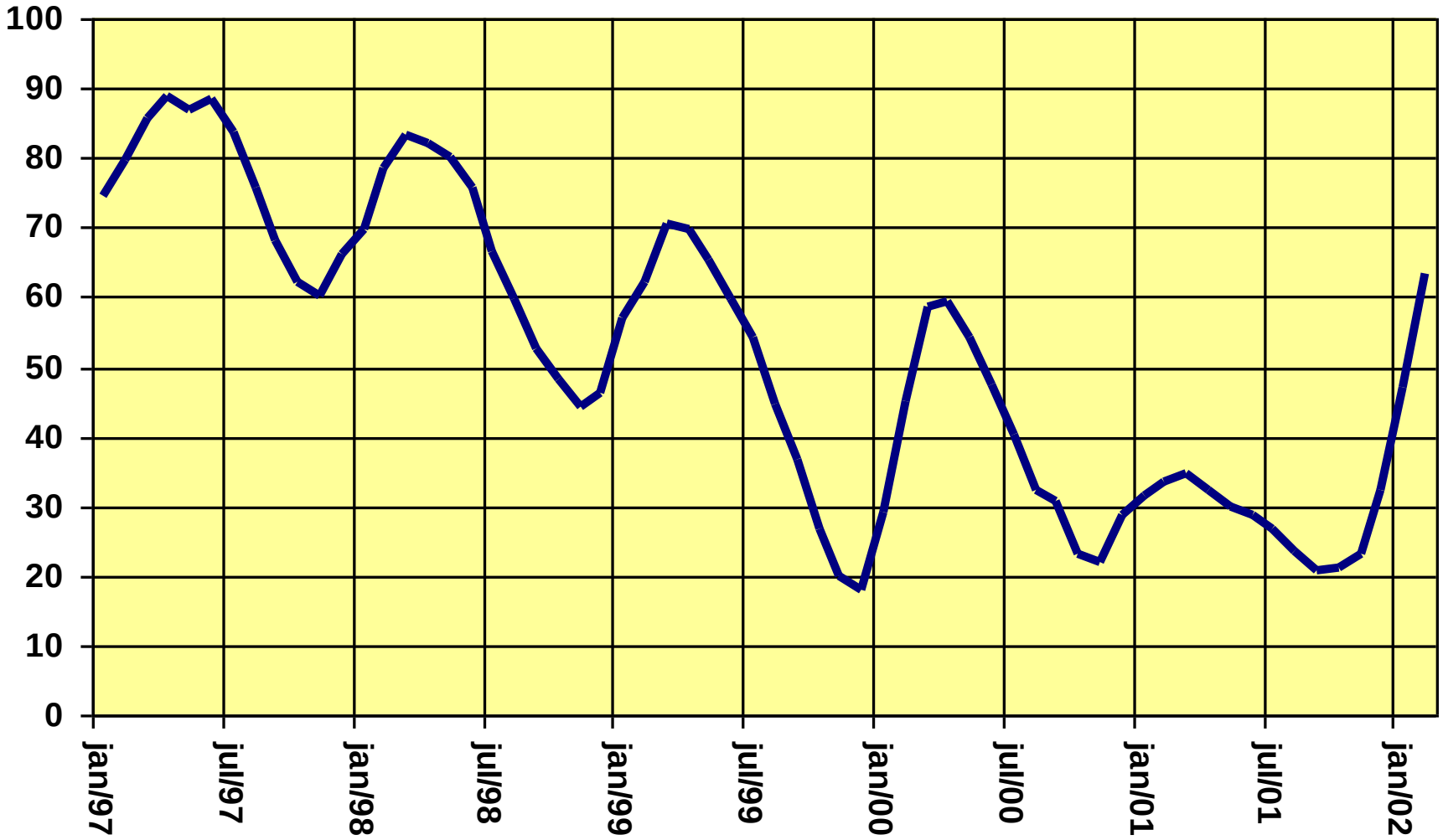


Sources: IEA, EPE

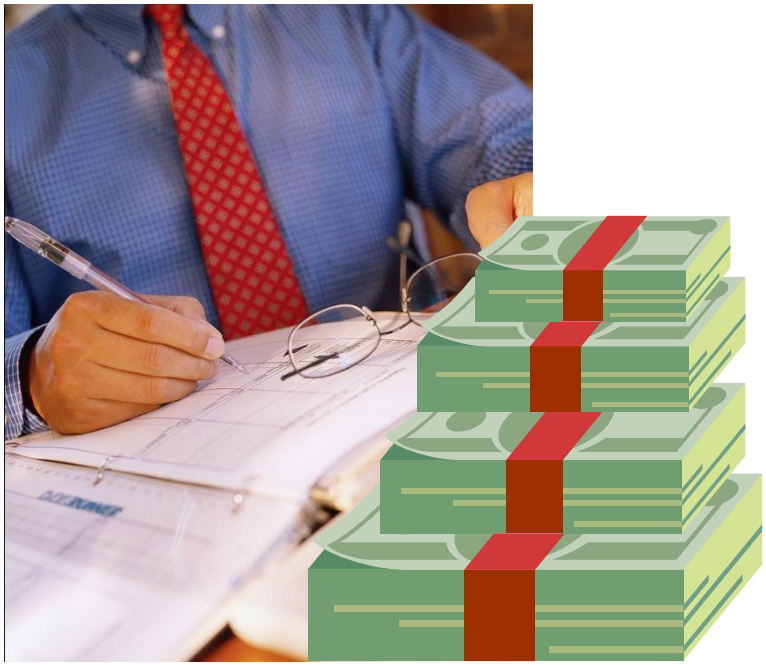
Hydrological uncertainty



Storage of energy in the water reservoirs

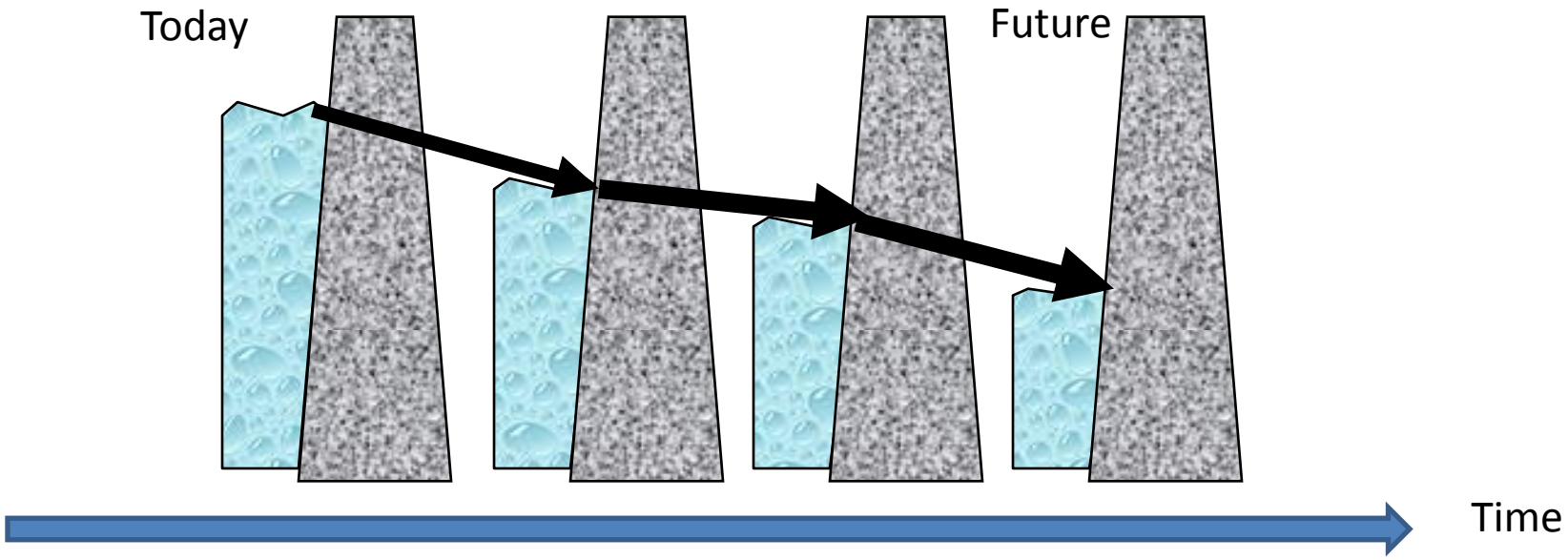


In countries that get electricity from coal or oil, power dispatch is done "locally" and is conceptually a simple matter



The dispatcher ranks the generators by unit price

In countries that most of the electricity is generated by hydro plants, hydrological uncertainty is a relevant issue

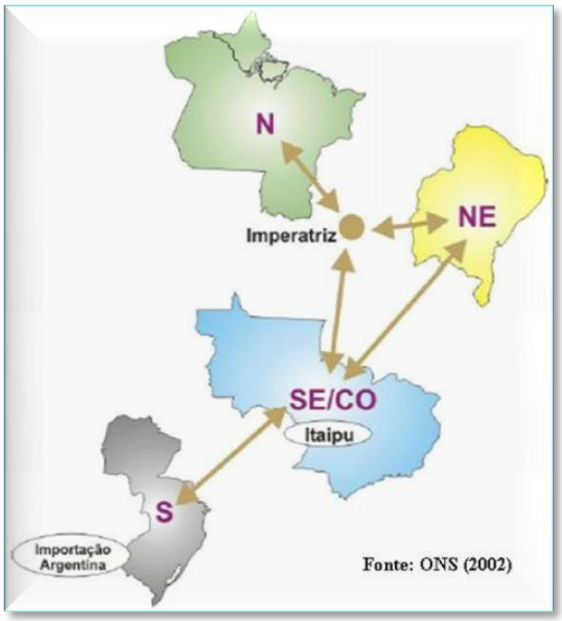


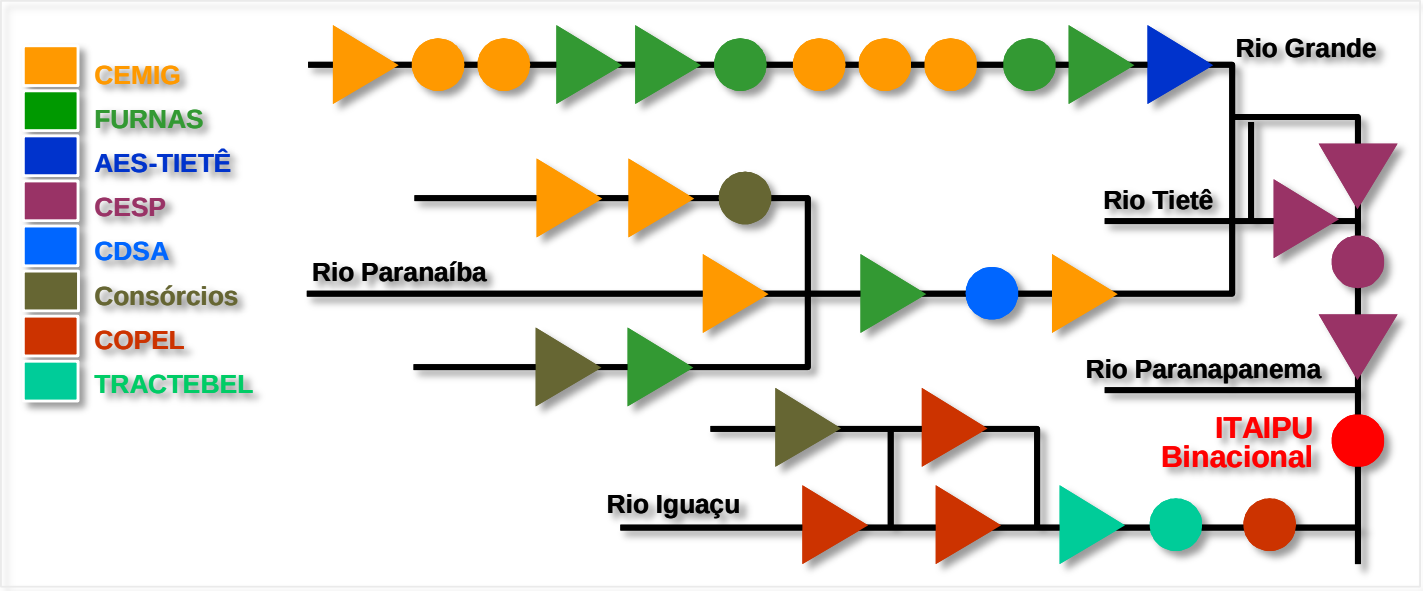
Future water storage depends on present storage, future water inflow and the <u>decision</u> about how much thermoelectricity could be substituted by hydroelectricity

Centralized dispatch

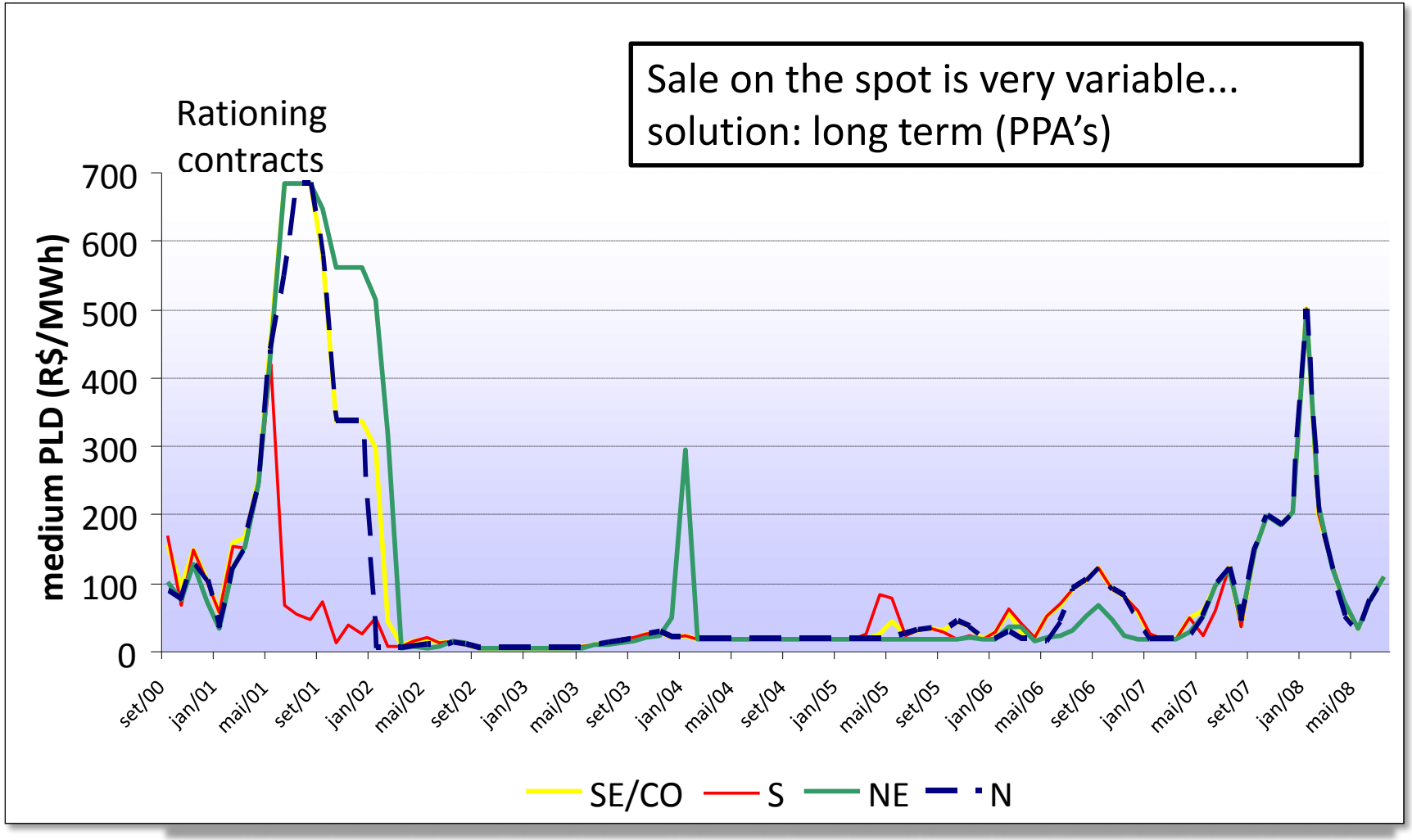
In order to take advantage of hydrological diversity, energy is transported through long distances

Power plants in the same river basin are own by different companies



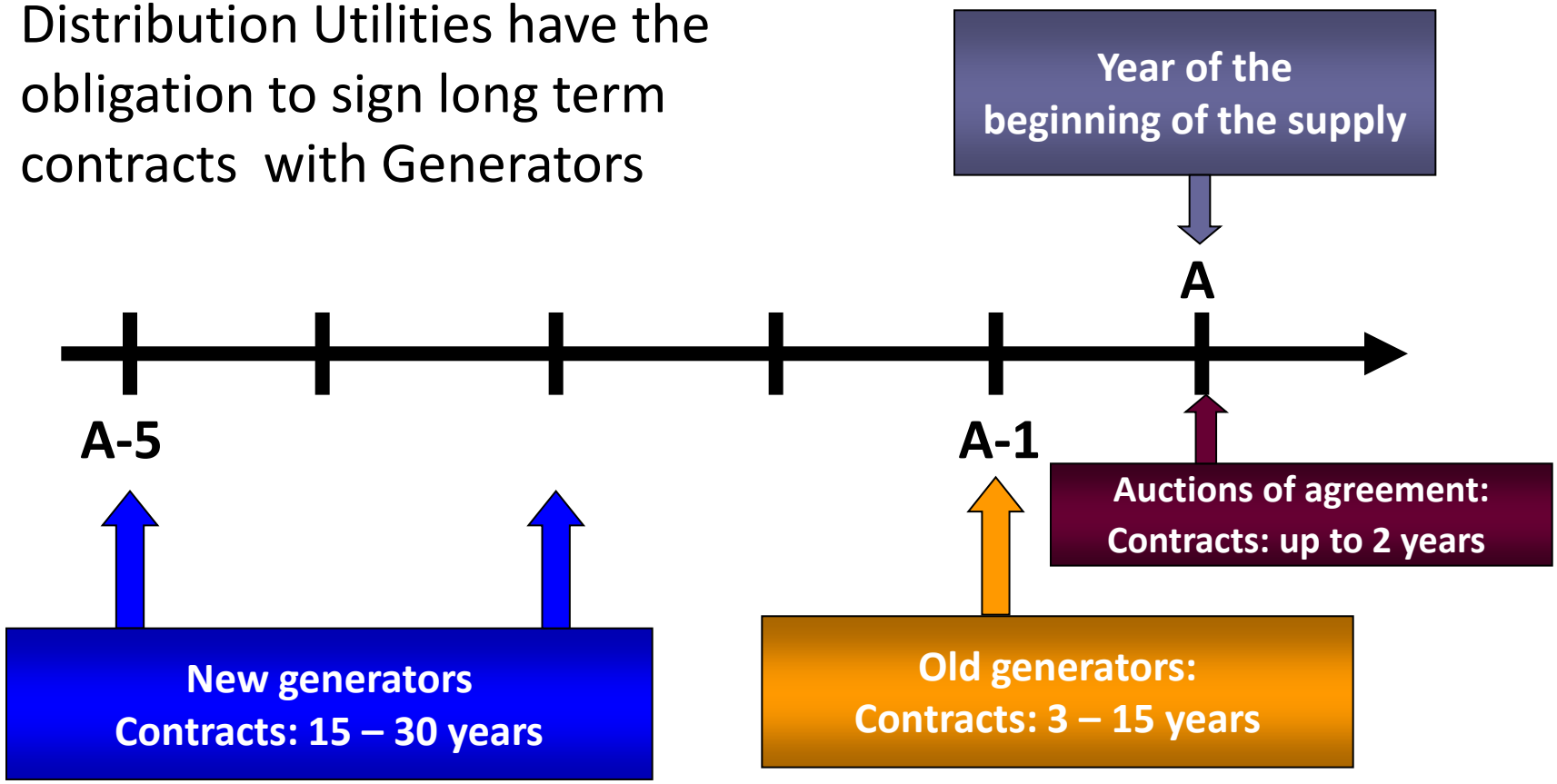


Short term marginal cost
Spot price

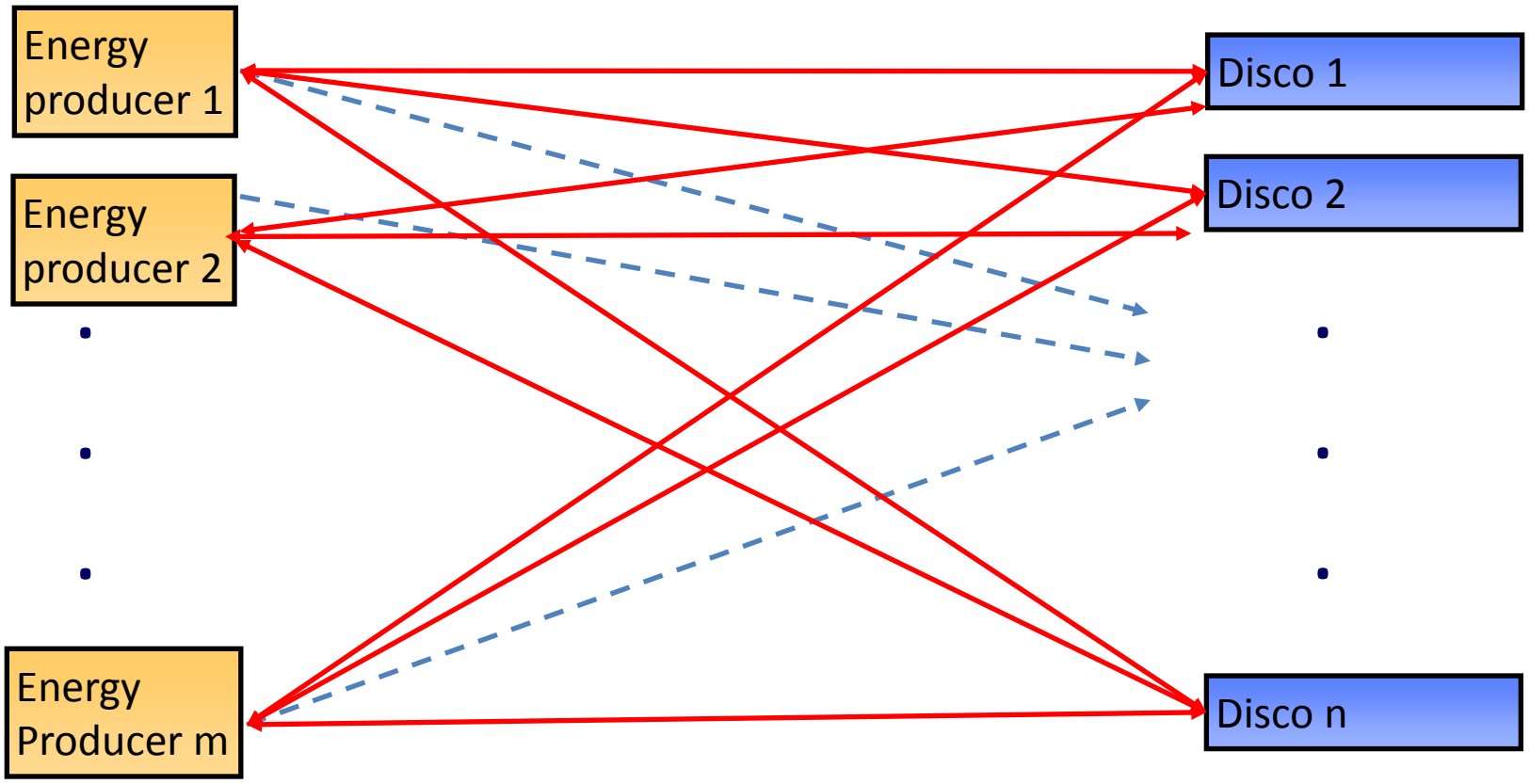


Auctions

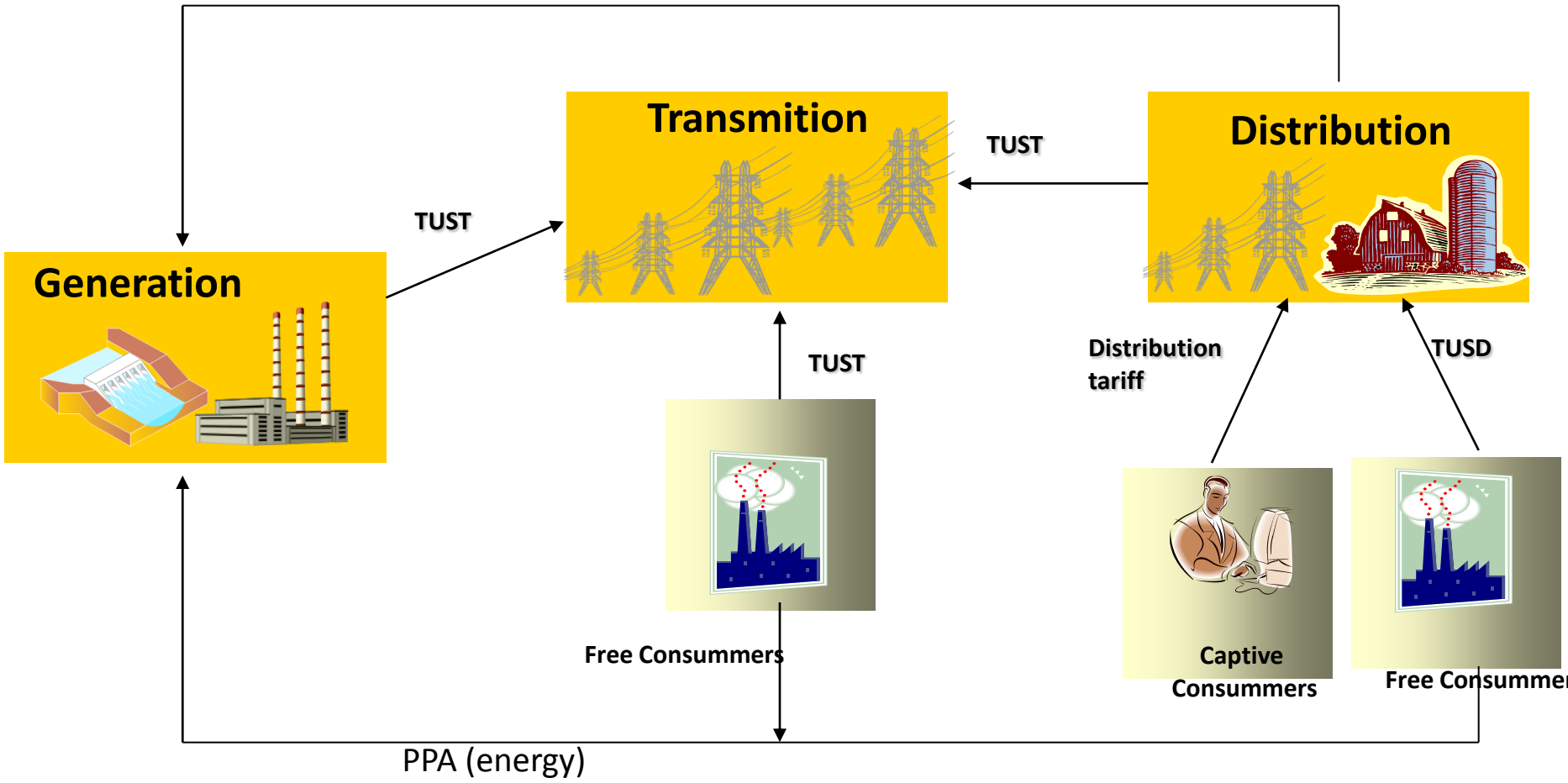
Distribution Utilities have the obligation to sign long term contracts with Generators



New power plants are built if their proponents win Government organized auctions of PPAs



Long term power purchase agreements (PPAs)



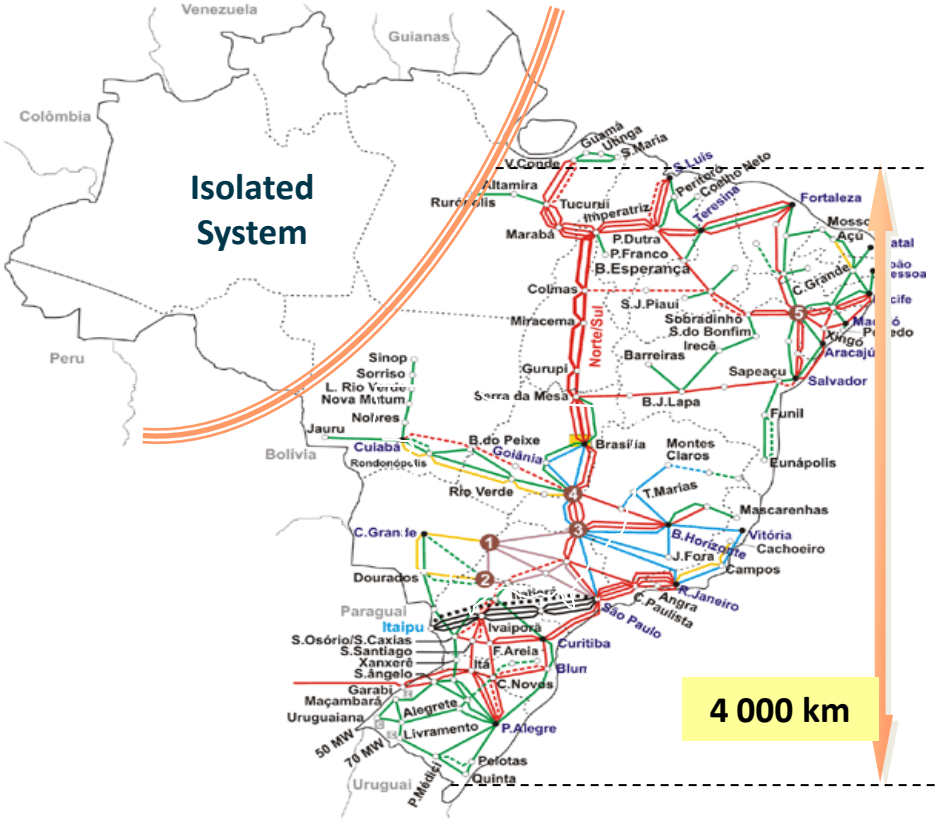
TUSD - Distribution network charge + taxes

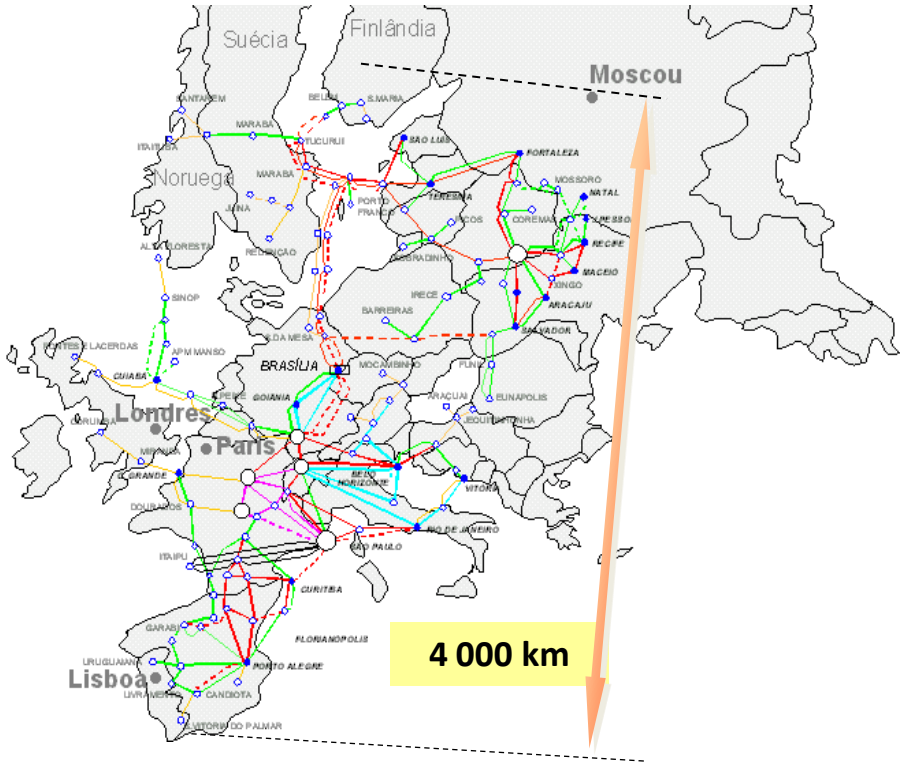
TUST – Distribution network charge + taxes

Distribution Tariff = Energy + TUSD

PPA – Power Purchase Agreement

The Interconnected high voltage grid transports energy all over the country from river basin with good hydrological conditions to those suffering a drought





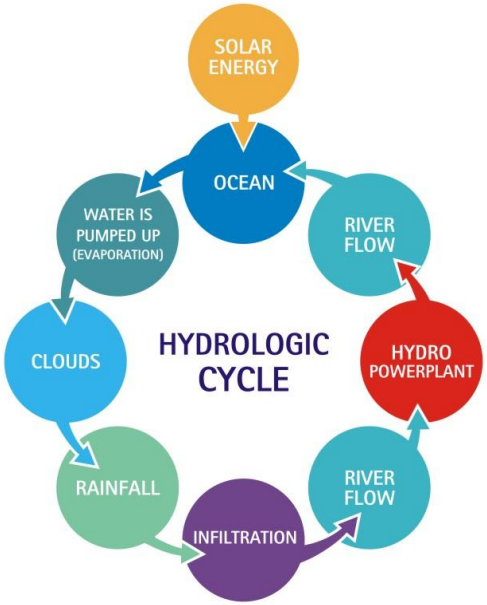
(year 2007)

TUSD = low voltage connection tariff

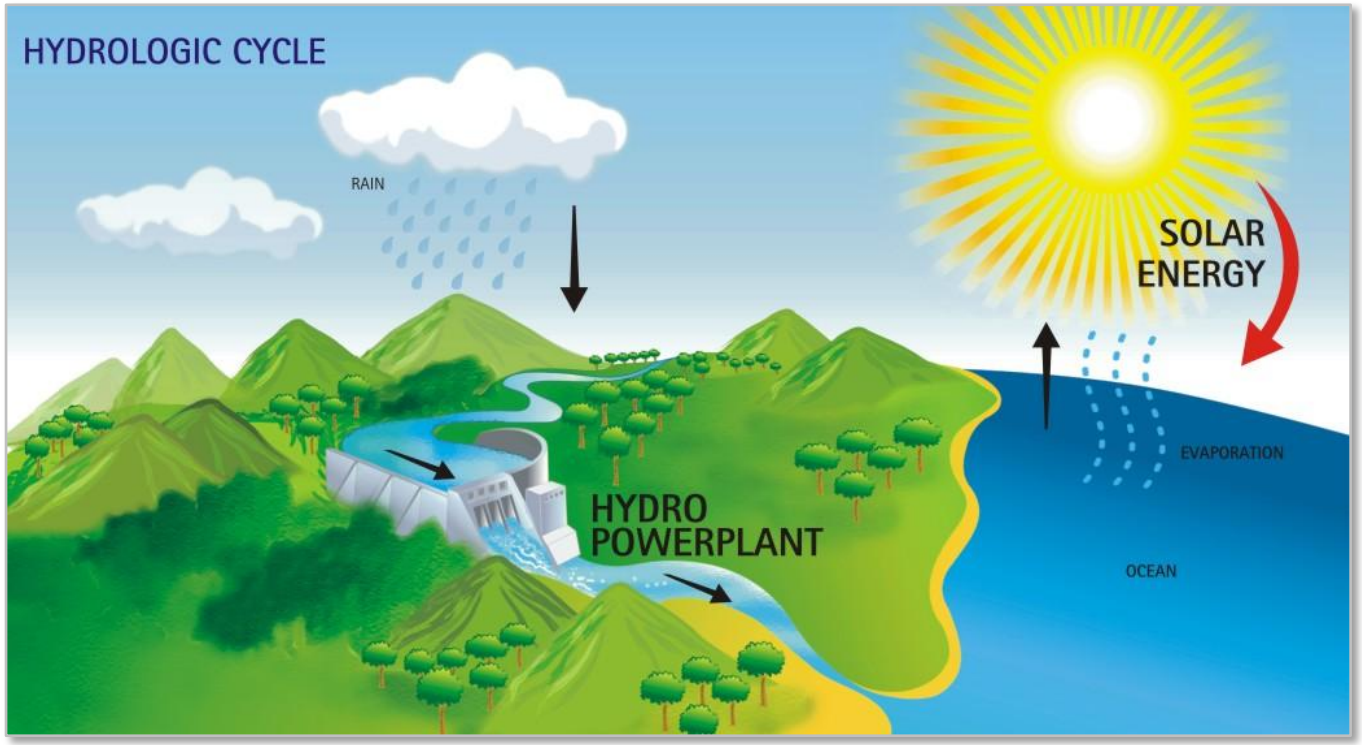
TUST = high voltage connection tariff

Reduced TUSD and TUST for the alternative sources of energy:

- ✓ **biomass**
- ✓ **small hydro**
- ✓ **wind**
- ✓ **waste**



We have been producing electricity from solar energy for more than a century

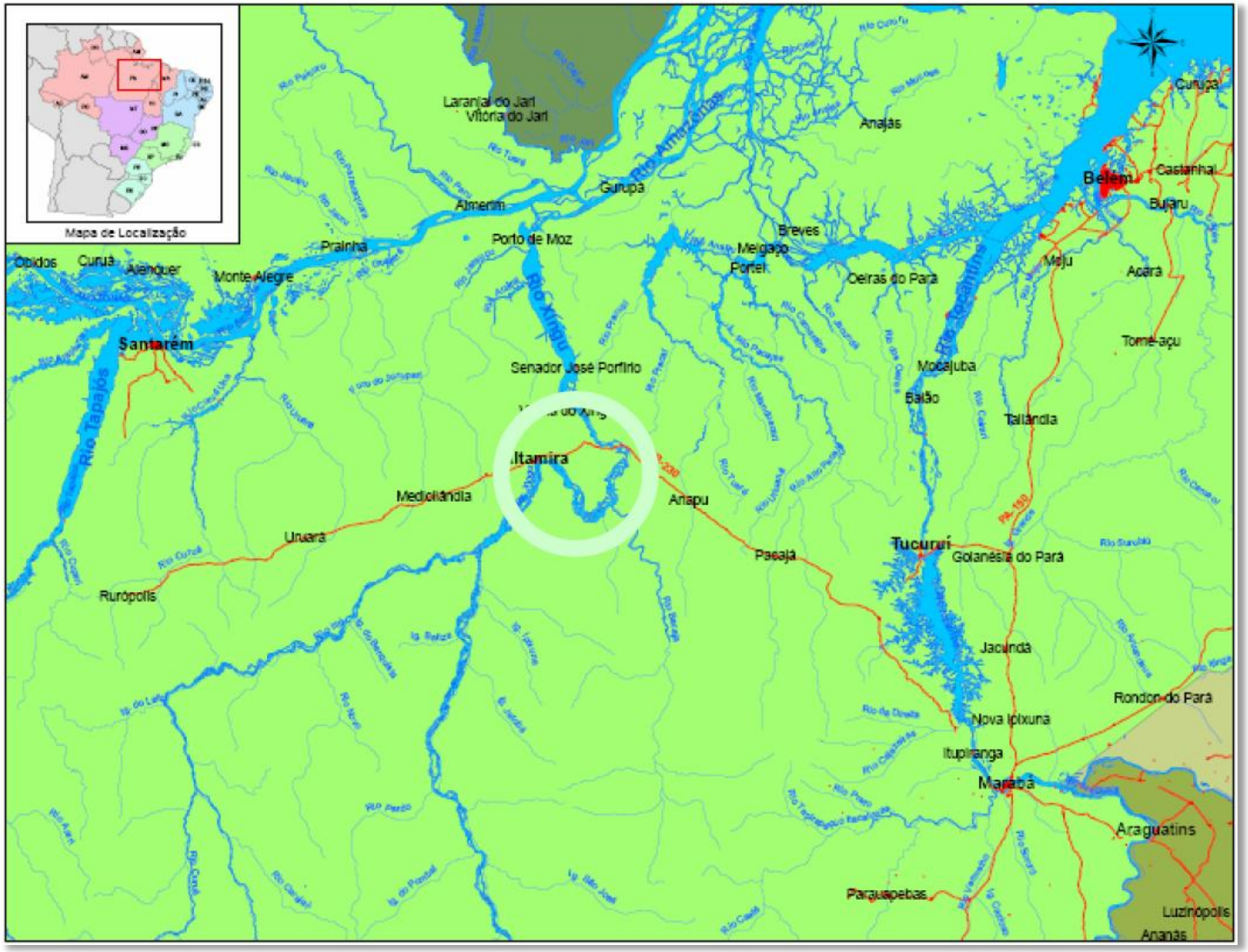


Does it make sense to build new hydro plants in the Amazon?

THE MADEIRA RIVER PROJECT

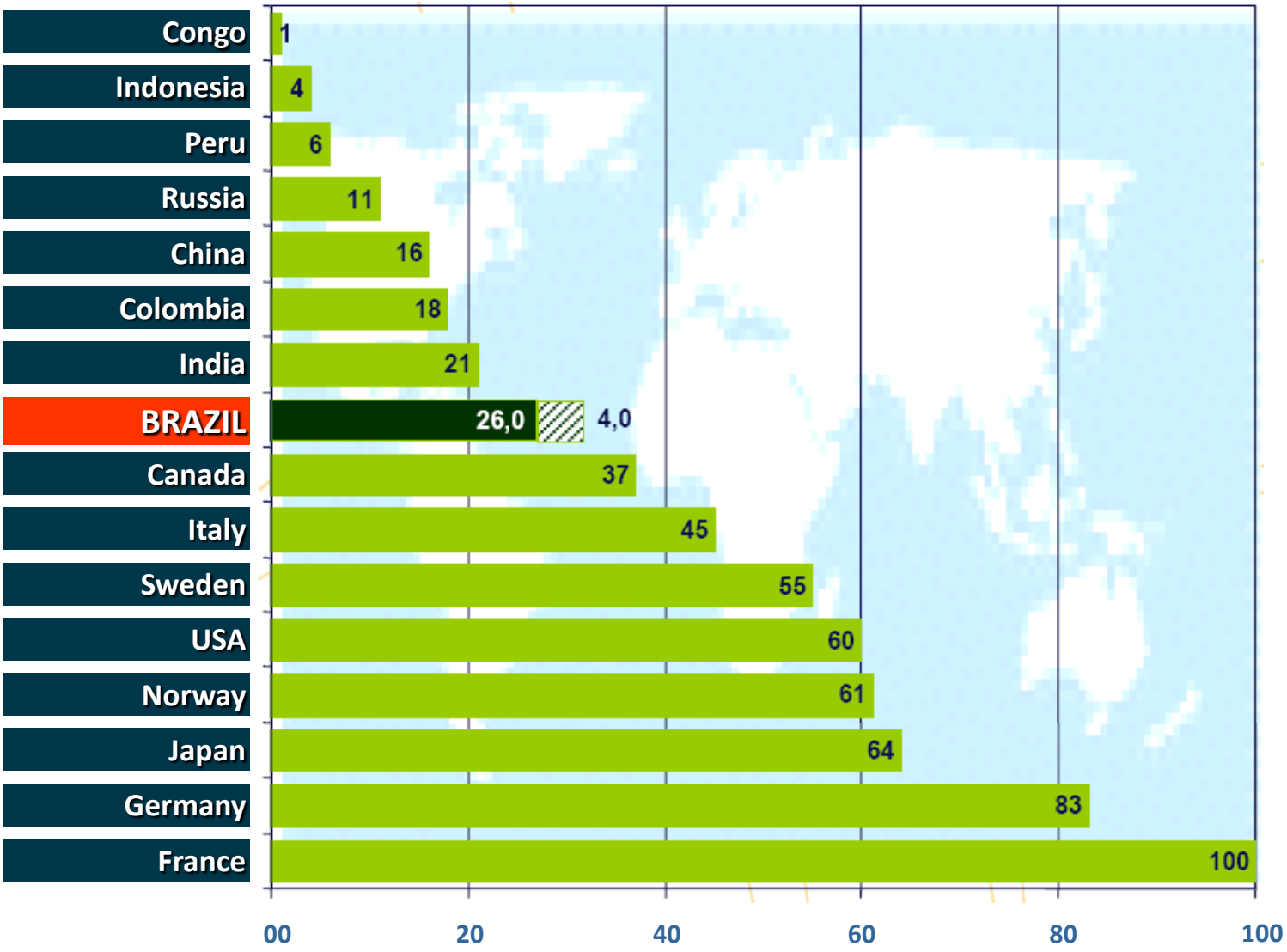
What would be the alternatives?

Belo Monte Hydroplant
Xingu River



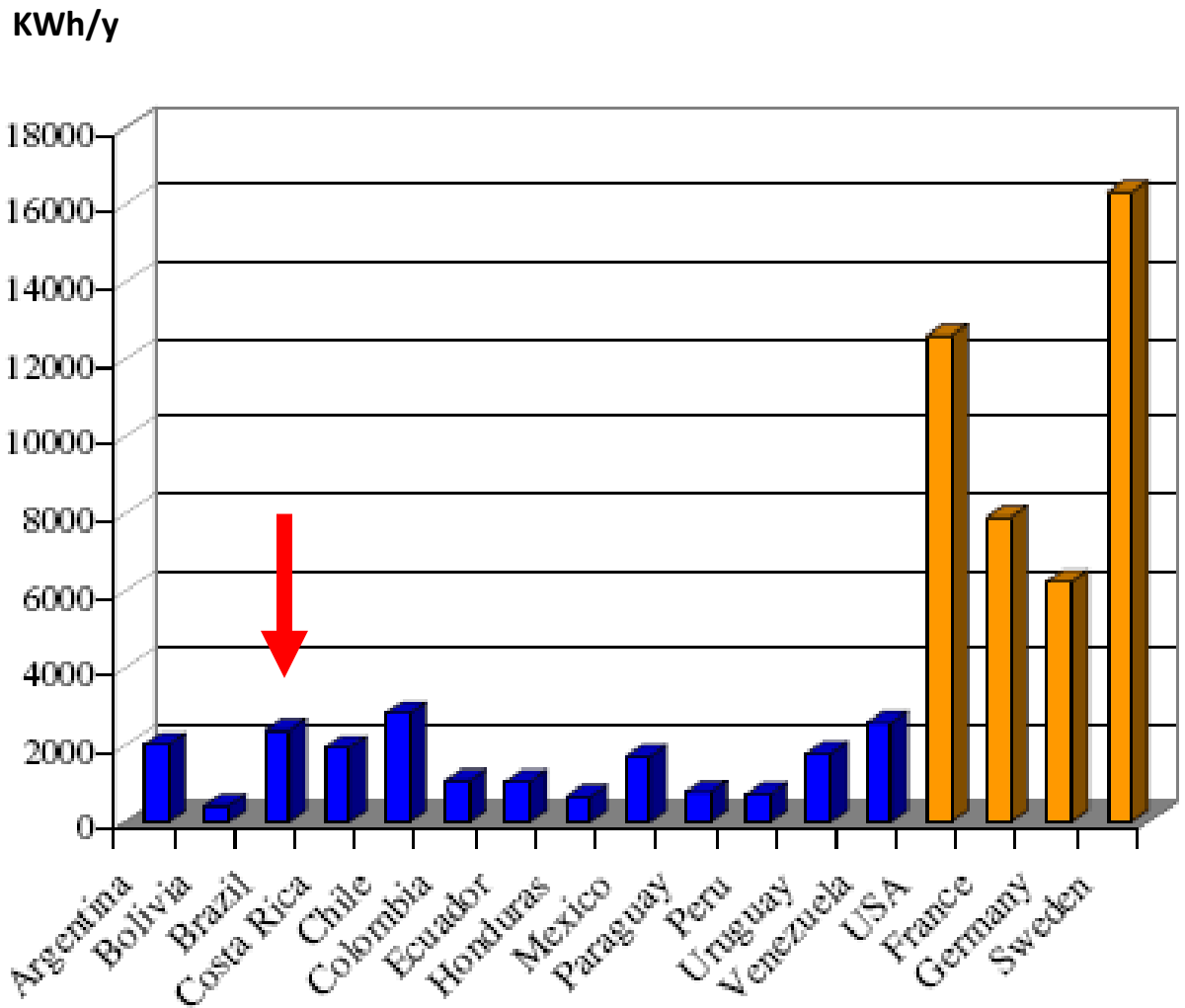
Relationship between storage and monthly consumption

Hydroelectric potential utilized

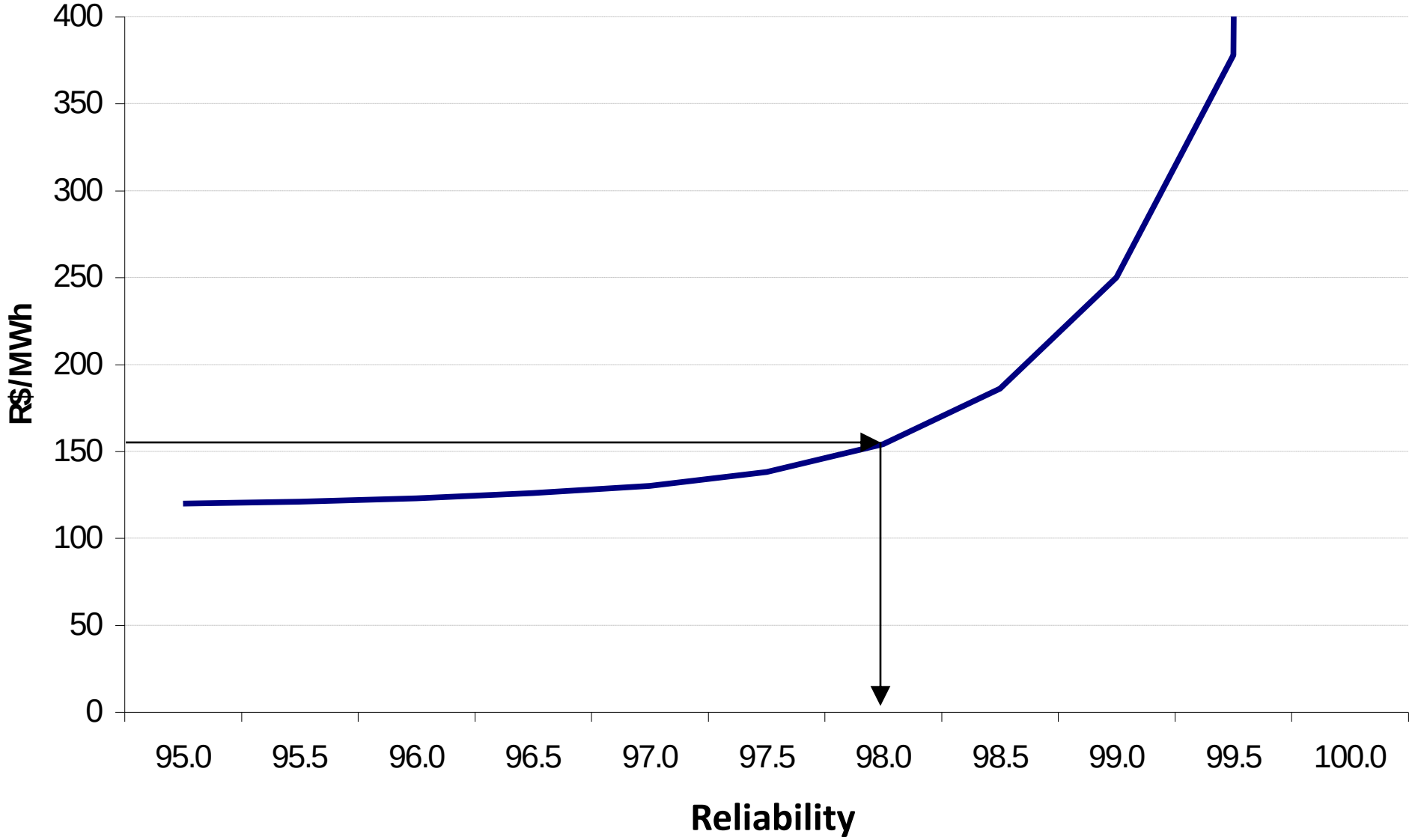


Source: EPE

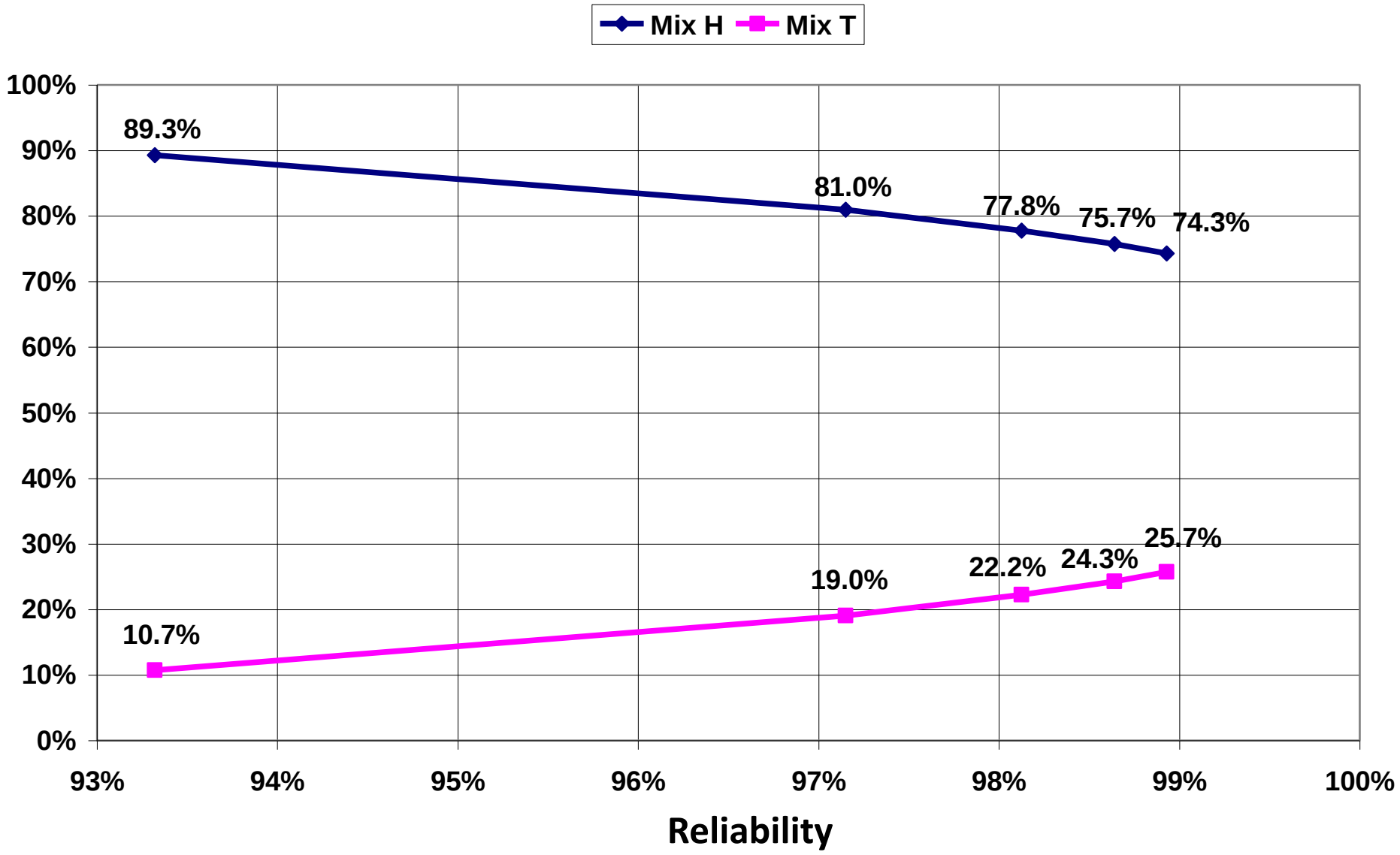
Per capita consumption of electricity



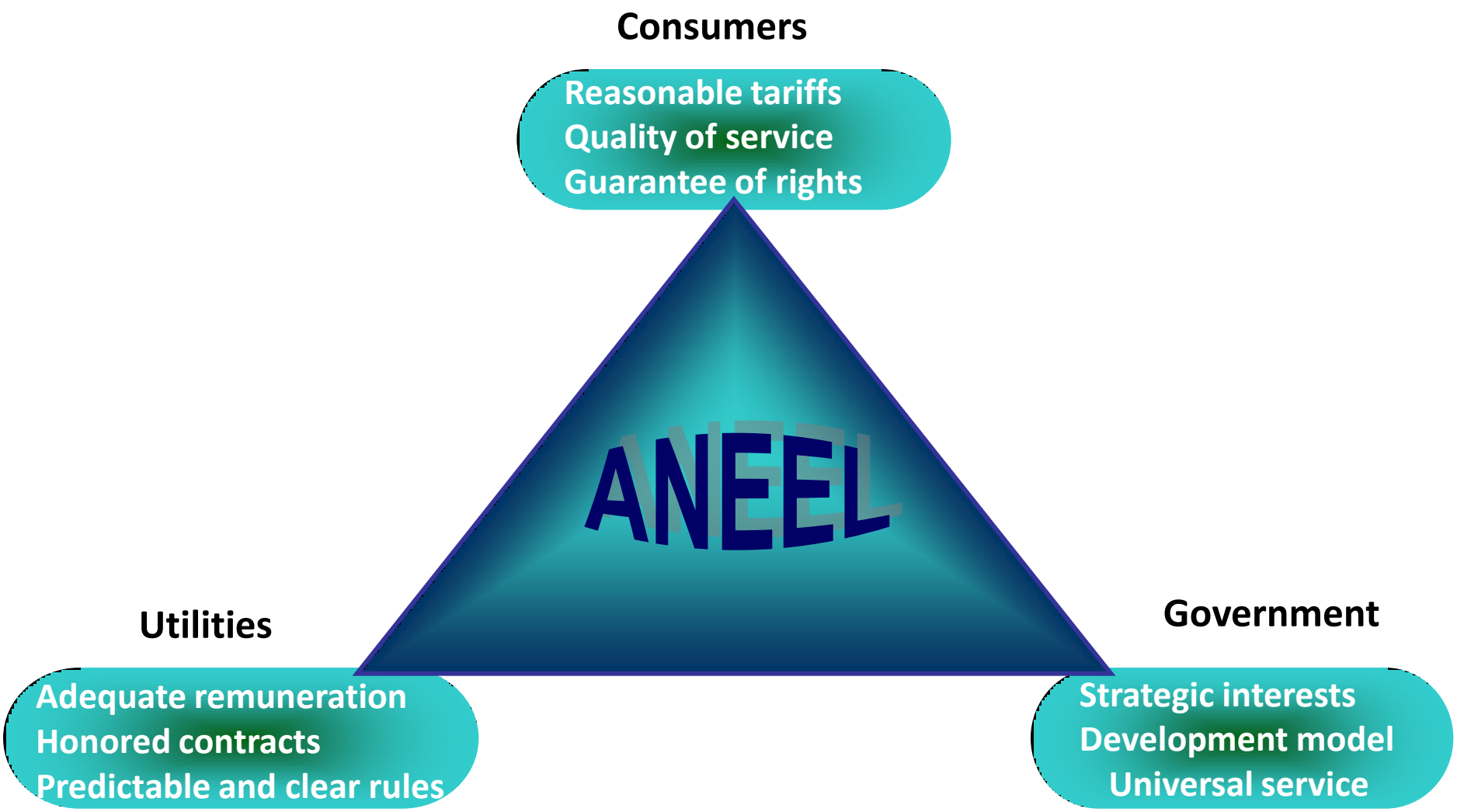
Hydroelctric cost X Reliability



Optimal mix Hydro X Thermal



Regulator´s mission



Tariff calculation is based on the “required revenue” of the discos

Non manageable costs (Parcel A): Pass through

- Energy
- Taxes
- Transmission system

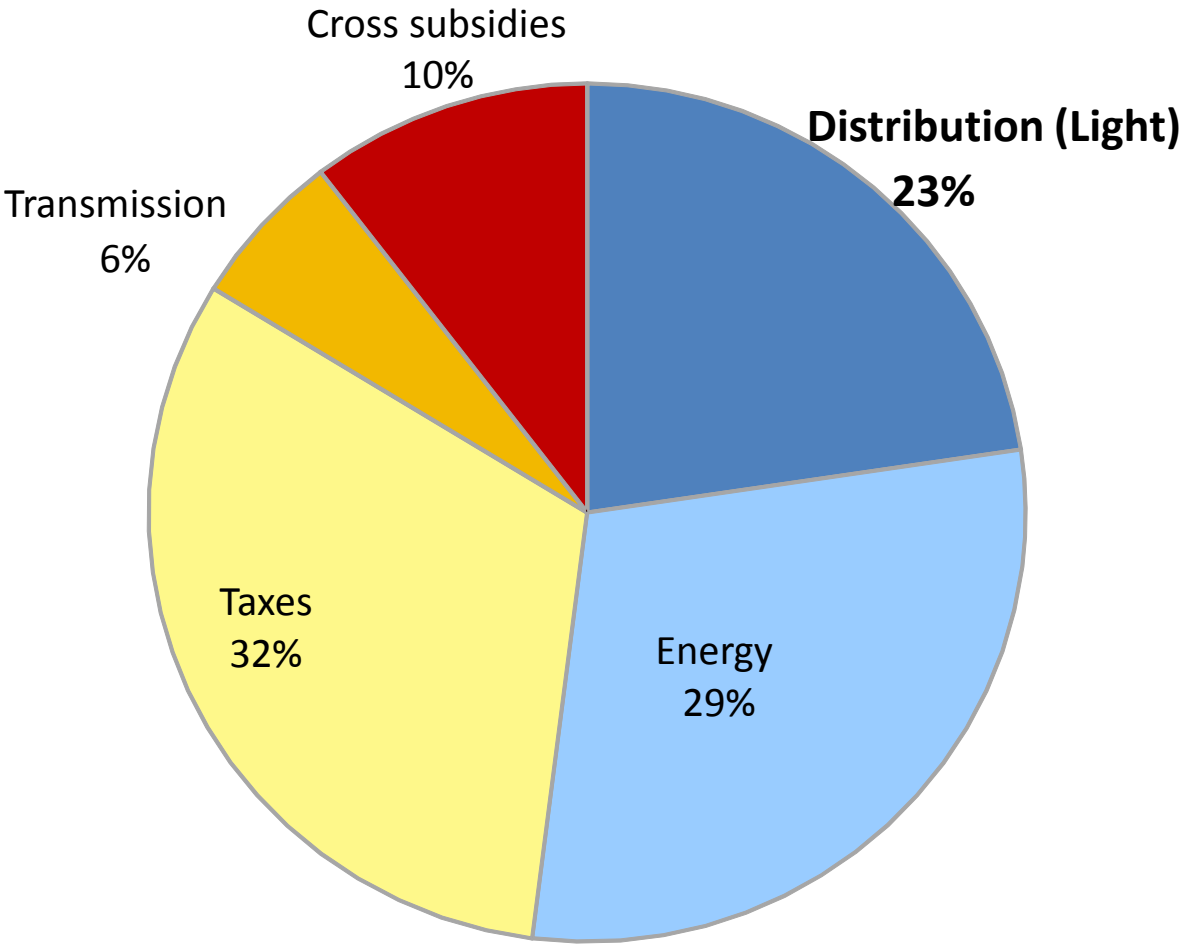
+

Manageable costs (Parcel B): Subject to the regulator

- O&M
- Depreciation
- Remuneration of the capital

64 distribution companies

Light's tariffs



In a regular year...

Update the non manageable cost

+

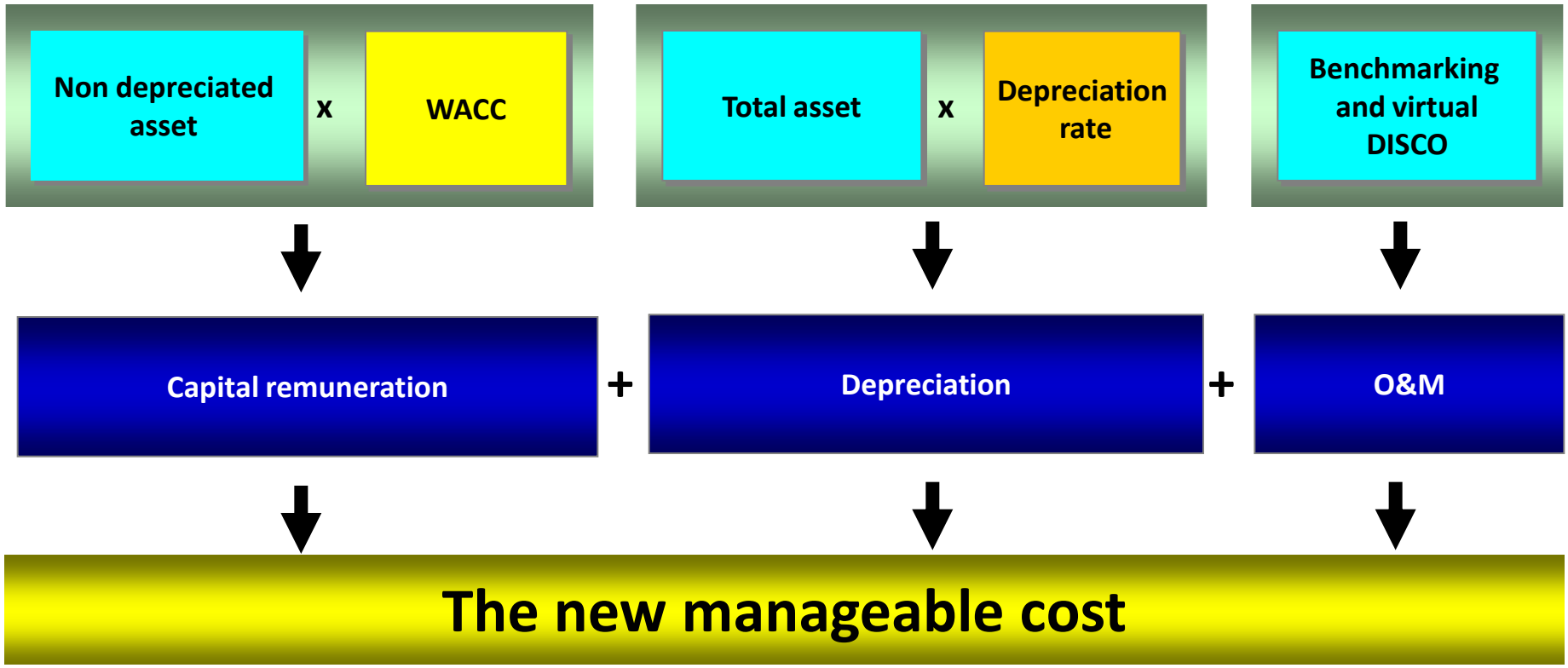
Update the manageable cost by the inflation minus X factor

In a revision year...

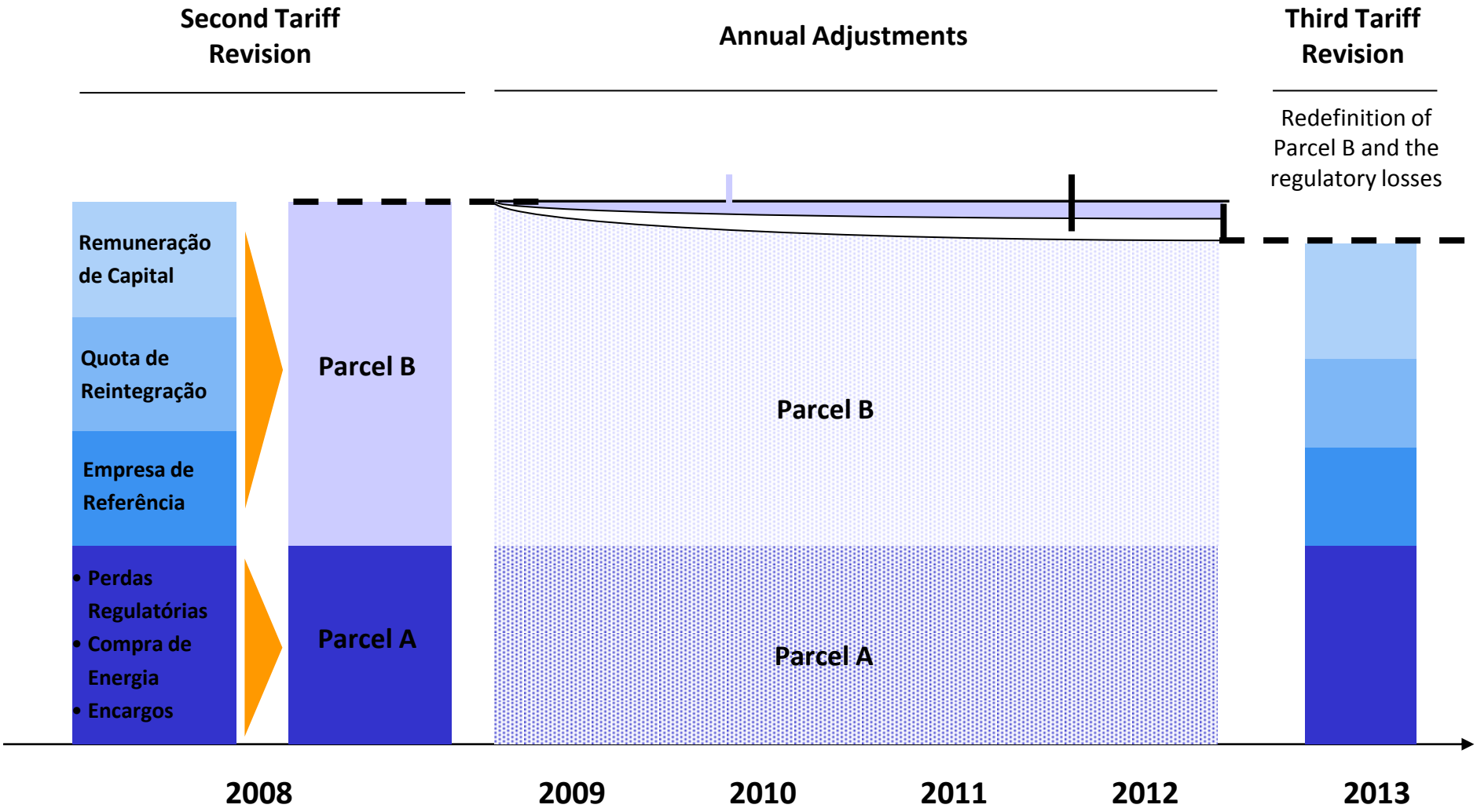
Update the non manageable cost

+

Calculate a new manageable cost through benchmarking and virtual DISCO


Non depreciated asset
x
WACC
Total asset
x
Depreciation rate
Benchmarking and virtual DISCO
Capital remuneration
+
Depreciation
+
O&M
The new manageable cost

Factor X – Estimated gains of scale



Light's tariffs

Tariffs grow as the voltage decreases

Voltage level class	Mean tariff R$/MWh
A2	198
A4	297
BT	325

A2 Blue	
DP(R$/kW):	22,08
DFP(R$/kW):	5,15
EPS(R$/MWh):	252,14
EFPS(R$/MWh):	160,62
EPU(R$/MWh):	228,90
EFPU(R$/MWh):	147,13

Payment for the grid is 4 times more expensive at peak hours

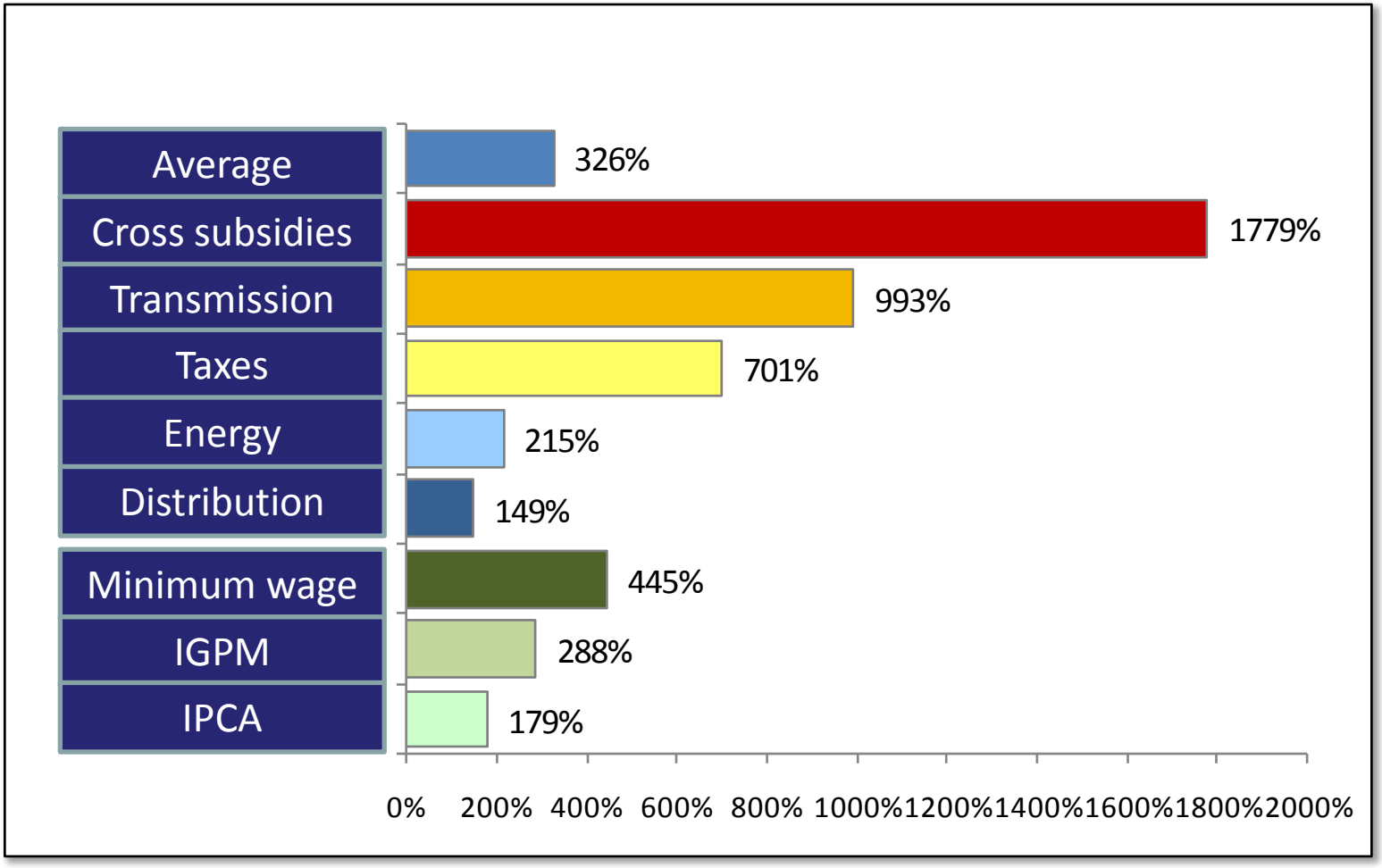
A4 Blue	
DP(R$/kW):	45,07
DFP(R$/kW):	14,28
EPS(R$/MWh):	252,14
EFPS(R$/MWh):	160,62
EPU(R$/MWh):	228,90
EFPU(R$/MWh):	147,13

Payment for the energy is 1.6 times more expensive at peak hours

Class	Mean tariff R$/MWh
Residential	345
Comercial	311
Public lighting	160

Residencial tariff is more expensive among the low voltage classes due to cross subsidies

Light's tariffs variation (1995-2011)



Thanks!

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