The Case of Brazil and Others in Latin America

Private investment in electricity transmission in Africa

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*With a tremendous help from Amanda Fernandes and Rodrigo Novaes from PSR

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AGENDA

1. About us
2. The Brazilian system
3. The Brazilian ITP model at a glance
4. Some practical implementation aspects
5. Other cases in Latin America
6. Common questions and conclusions

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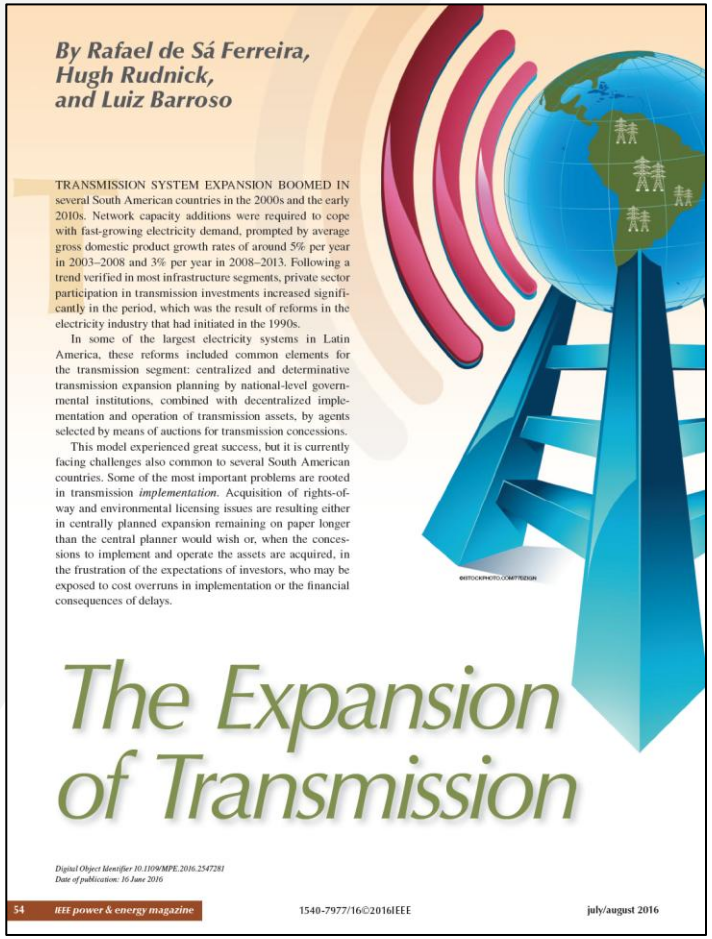
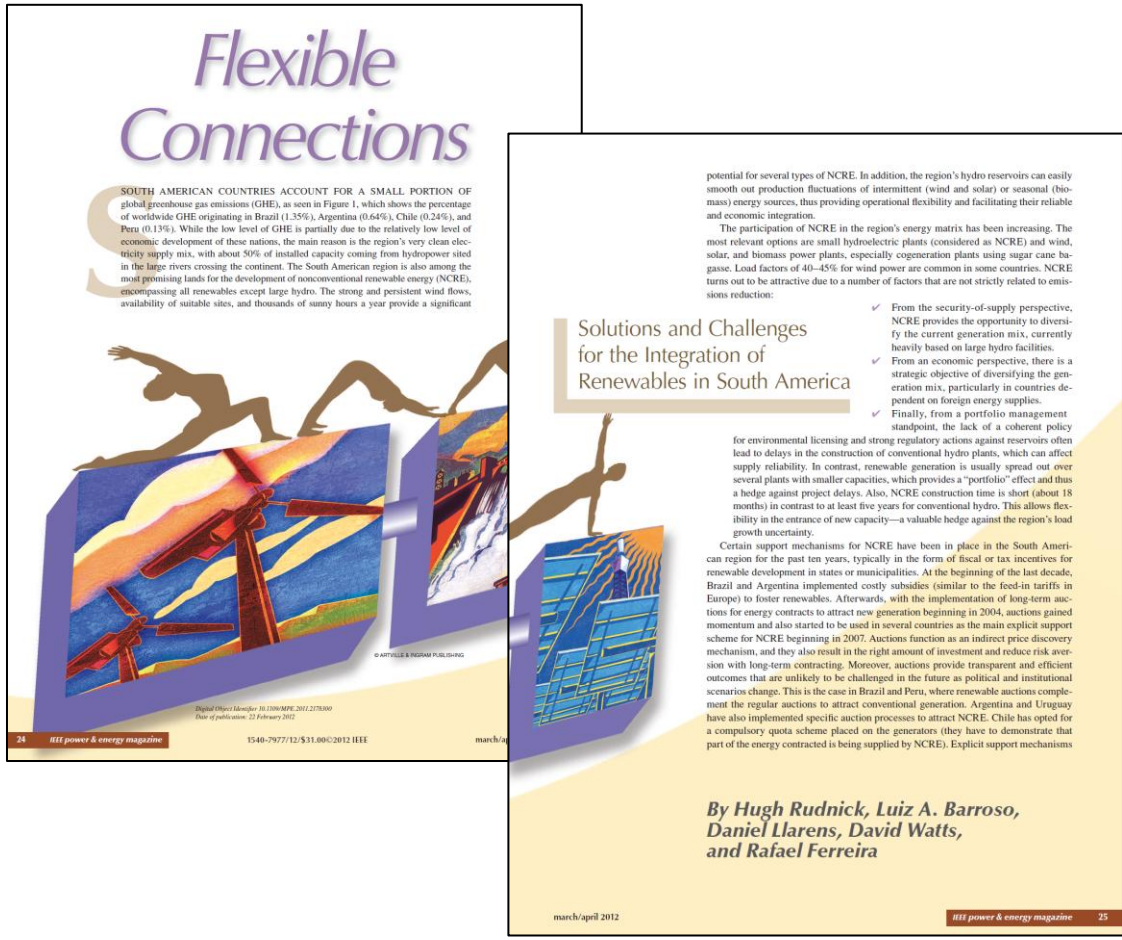
Some topics presented here have been well researched





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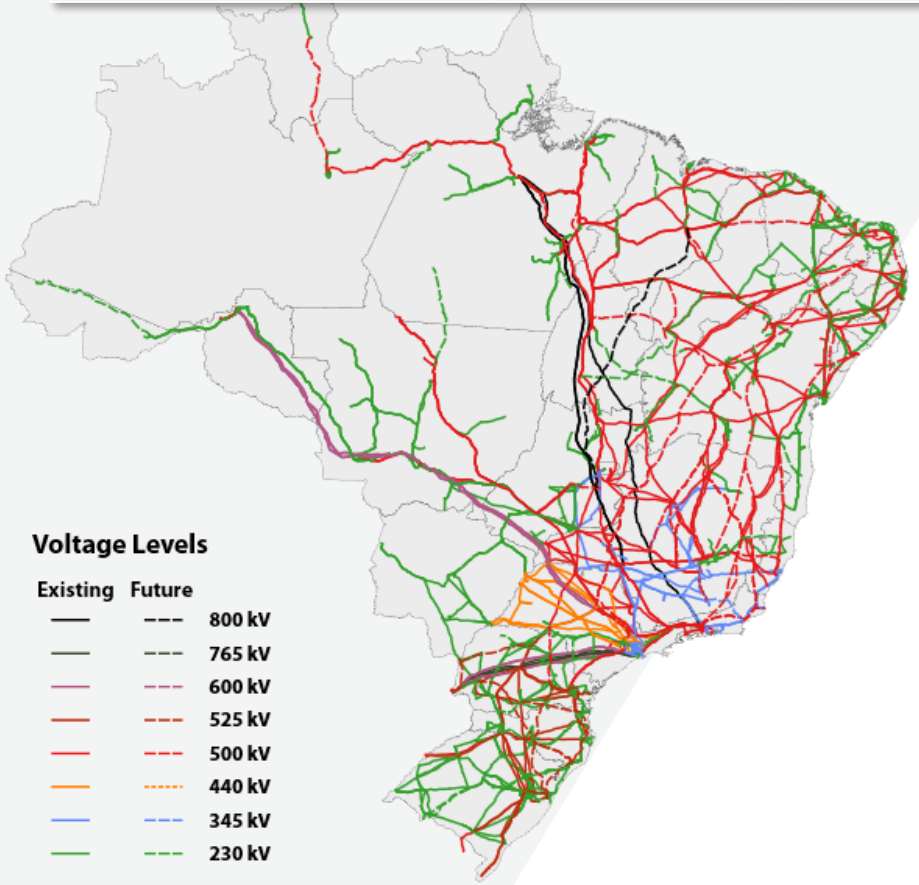
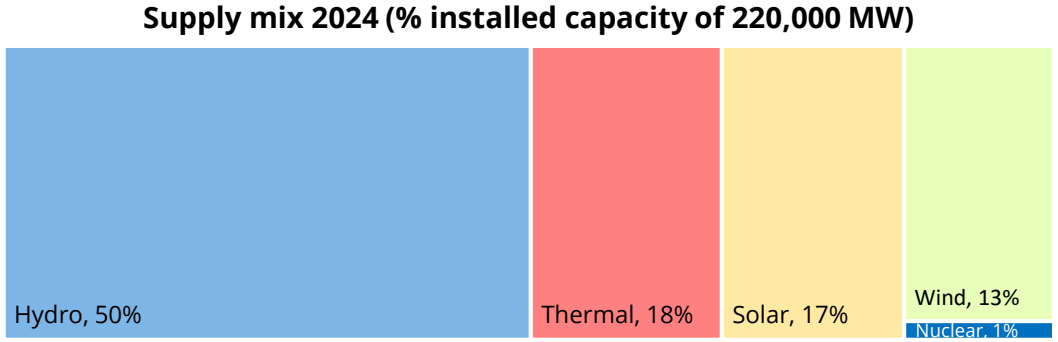
Brazilian electricity sector deregulation at a glance

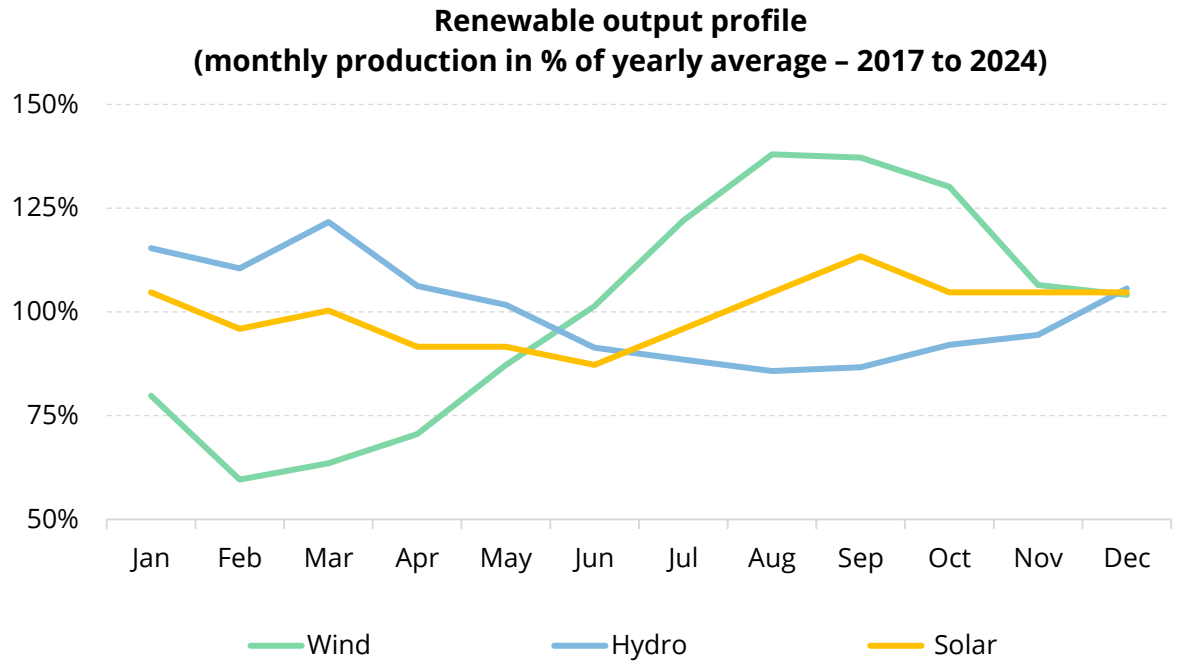
- Middle-income country, electricity demand growth rates at 5%+ per year
- First market reform in 1997, Brazil adopted the “standard model”, led by the UK back then (“spot pricing theory”)
- Major energy rationing in 2001 due lack of generation investments
- Successive regulatory and policy reviews since 2002 until what we have now:
  - Combination of planning and competition to bring investments to serve load growth
  - Cost-based dispatch by an Independent System Operator
  - Decentralized generation investment decisions, centralized transmission planning and investment decisions
  - Competition “for the market”:
    - Technology-specific contract auctions and marketplaces for contract negotiations complement spot market to drive generation investments
    - Independent transmission projects framework
    - Industry that is almost 100% private over the value chain (G, T and D)

Brazil's supply mix is highly renewable and interconnected

The 200,000 km high-voltage transmission grid is part of the portfolio of complementary renewable generation sources to serve load growth, reliability and resilience







Source: National System Operator (ONS), ANEEL. All figures related to 2024.

The transmission business model in a nutshell

CENTRALIZED Planning & Operation

Least cost transmission expansion planning: selection of transmission facilities that maximize systemic benefits

Least cost generation dispatch: optimize the use of system resources

DESCENTRALIZED ASSETS IMPLEMENTATION via Transmission Auctions

Efficiency through competition "for the market"

- ✓ Responsibility for construction and O&M assigned to private companies through auctions
- ✓ Price discovery for CAPEX and rate of return

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Institutional framework

Guidelines for policymaking

MINISTÉRIO DE MINAS E ENERGIA

Ministry of Mines and Energy (MME)
Policy

Energy Research Office (EPE)
Expansion planning

T planning

epe

T operation + interface with planning

ONS Operador Nacional do Sistema Elétrico

National System Operator (ONS)
System Operation and planning in the short-term

Regulatory Agency (ANEEL)
Regulation and monitoring

Organizes T auctions.

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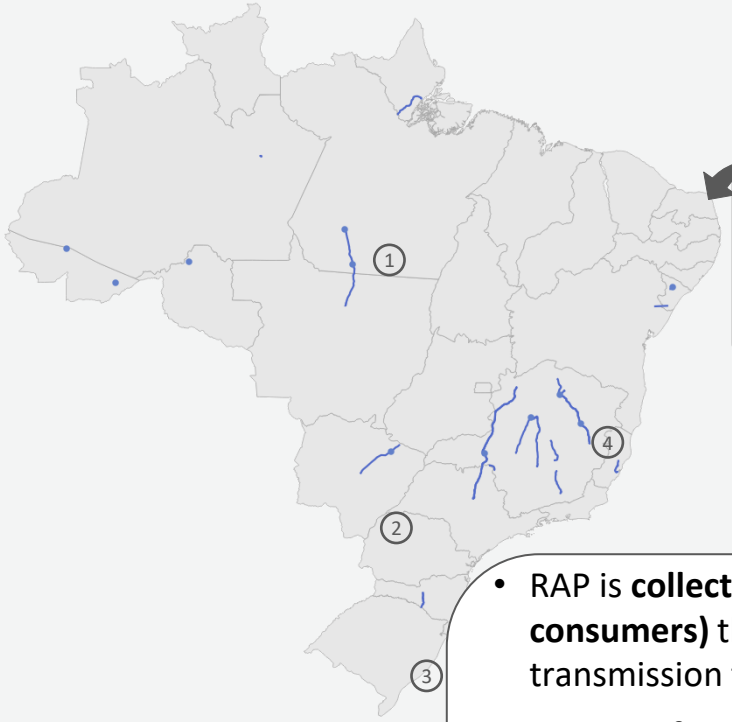
Long-term concessions awarded through public auctions (revenue cap model), transmission is recognized as infrastructure



- EPE plans the expansion of the grid according to system needs.
- The (new) assets needed are divided into lots and put up for auction.

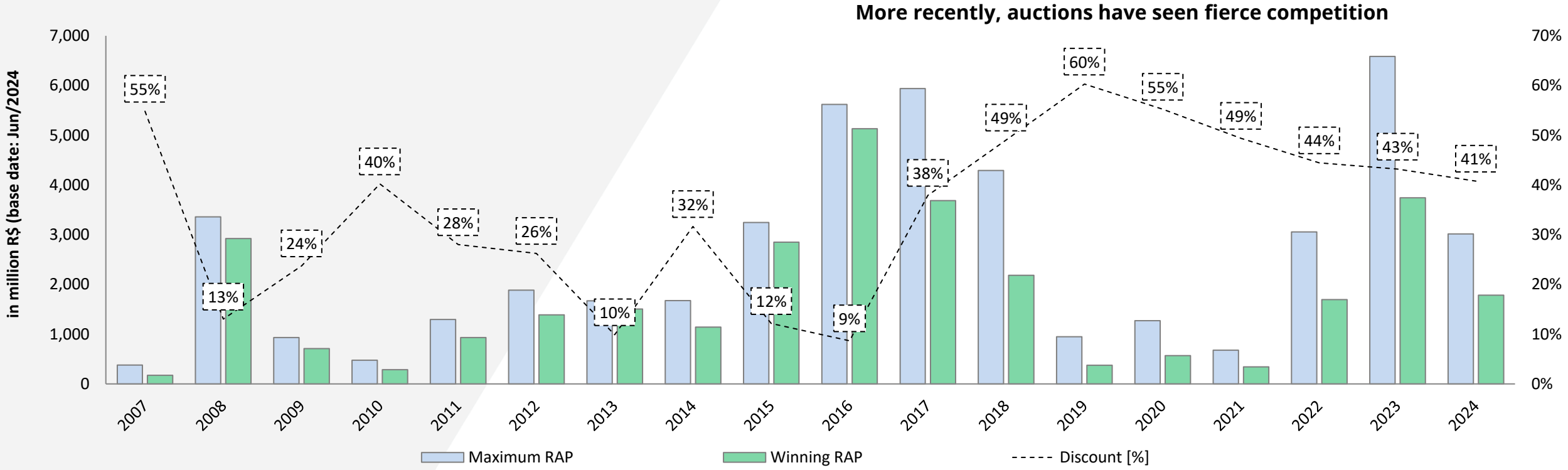
- Players compete for an annual revenue stream (RAP[1]) granted to build, maintain an operate the assets.
- ANEEL sets the auction's **cap for RAP**
- Whoever offers the **smallest** RAP, wins the right to develop the projects and becomes a "Transco"

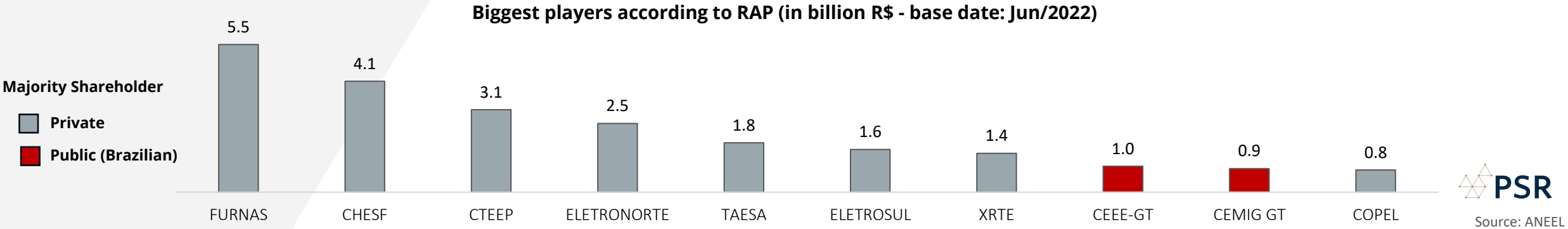
- **30-year concession** contracts are awarded.
- Transco commit to **build, maintain and operate** the assets.
- In return, they are paid a **fixed revenue stream**, in BRL, starting at the asset's COD, is **adjusted for inflation** and **revised every 5 years**[2].
- Revenues are independent from the actual power flow trough the facilities (**there is no volume risk**).
- There are penalties for outage events, delays and unavailabilities (temporarily reduce the RAP)

- RAP is **collected from all grid users (generators & consumers)** through a charge known as the transmission tariff (**TUST**).
- **System of guarantees and collaterals minimize credit risk. ISO collects payments from grid users**.
- ANEEL may (unilaterally) require that certain **improvements or reinforcements** are implemented, in which case it will grant an additional RAP.
- At the **end of the concession, assets are reverted** to the State and (re)auctioned.

[1] RAP stands for Annual Allowed Revenue (*Receita Anual Permitida*, in Portuguese).
[2] Revisions, which consist in updating the regulatory cost of debt and operating & maintenance costs, are intended to share potential gains derived from technological improvements or better macroeconomic conditions with the public.

In the last 16 years, approximately 86,000 km of high-voltage lines and 223k MVA have been auctioned (~ USD 40 billion in new investments)





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Source: ANEEL

This framework allowed an efficient expansion of grid

In 2012

97,000 km of transmission lines

73 different transmission companies

Biggest players in terms of revenue

#	Transmission Company
1	FURNAS
2	ISA-CTEEP
3	CHESF
4	ELETRONORTE
5	ELETROSUL

In 2024

189,000 km of transmission lines

239 different transmission companies

Biggest players in terms of revenue

#	Transmission Company
1	FURNAS
2	CHESF
3	ISA-CTEEP
4	ELETRONORTE
5	TAESA

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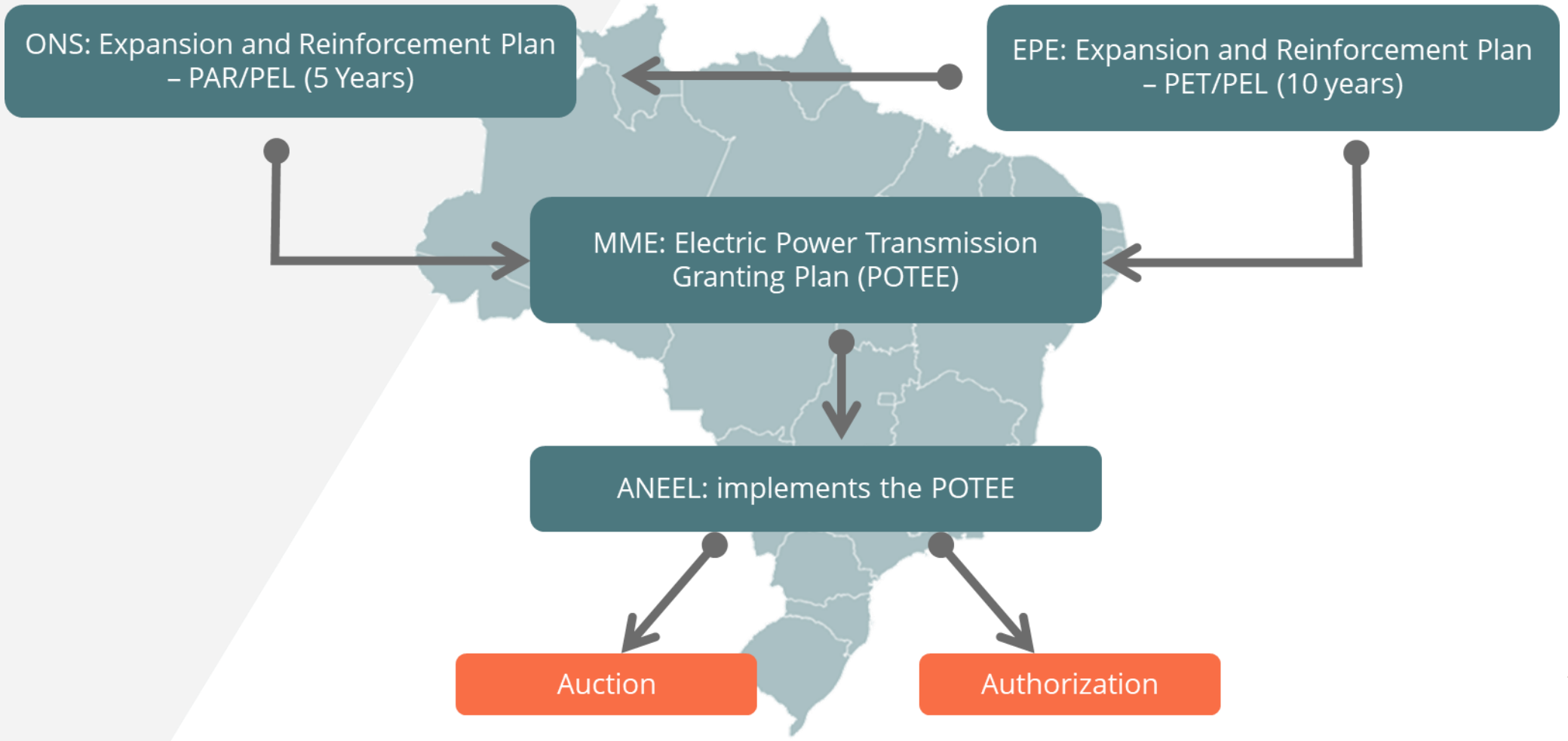
The selection process for transmission projects

The Ministry of Mines and Energy, based on studies by EPE and ONS, defines which projects will be implemented



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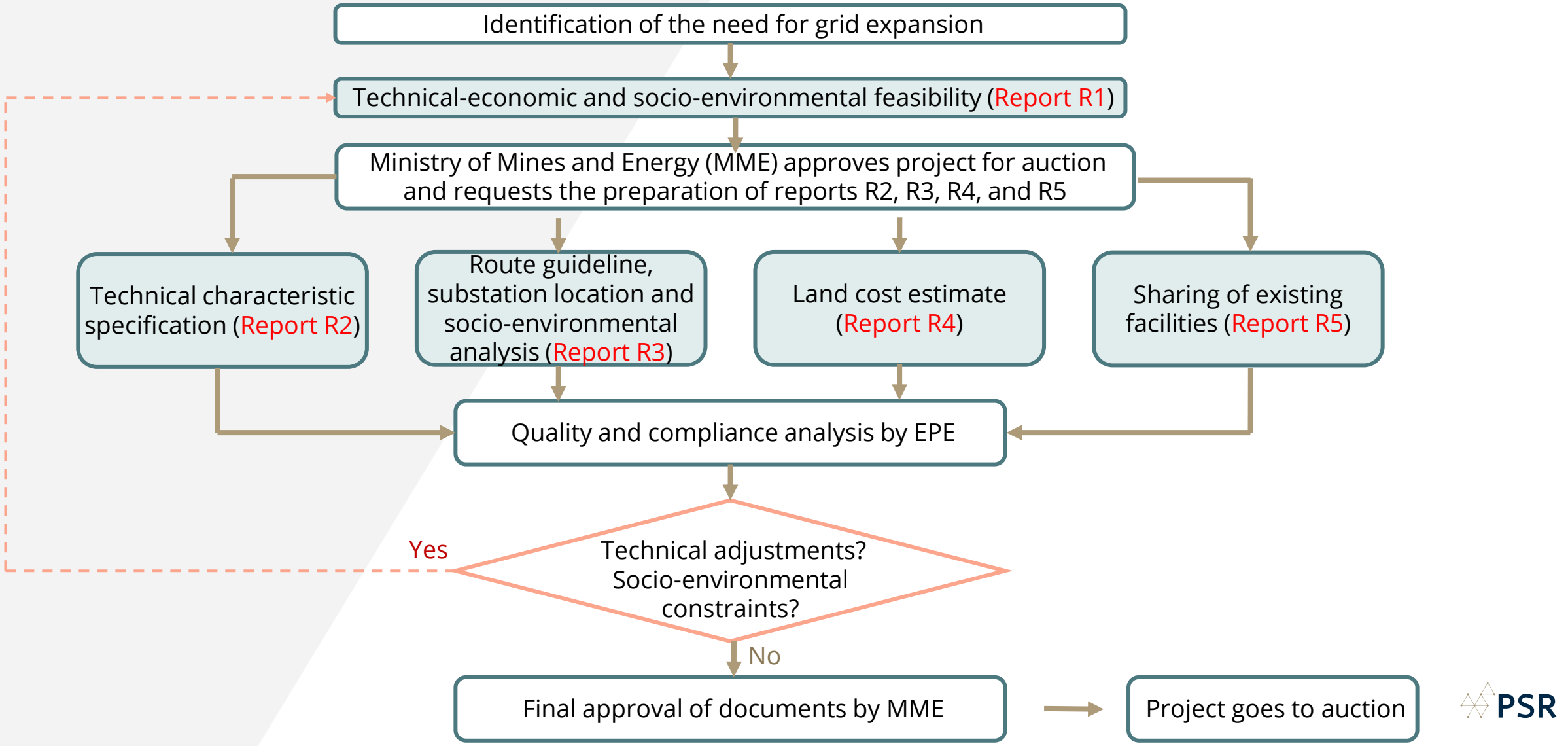
Detailed process until auction



From auction to contract: key phases in the process

PUBLIC CONSULTATION
Project reports and the draft bidding notice are made available to the public, encouraging open discussion and questions.

APPROVAL OF RESULTS
ANEEL certifies the technical and finance qualifications of the winning company.

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10
Public Hearing – Contribution period	1 month									
Review of auction documents after the public hearing		1 month								
Technical inspections of the facilities			3 months							
Approval of the bidding notice by the TCU			3 months							
Registration							1 week			
Preparation for the auction day							1 week			
Approval of results								2 months		
Signing of the concession contract										1 month

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Source: EPE and PSR

Rights of way, and environmental licenses: after the concession contract is granted

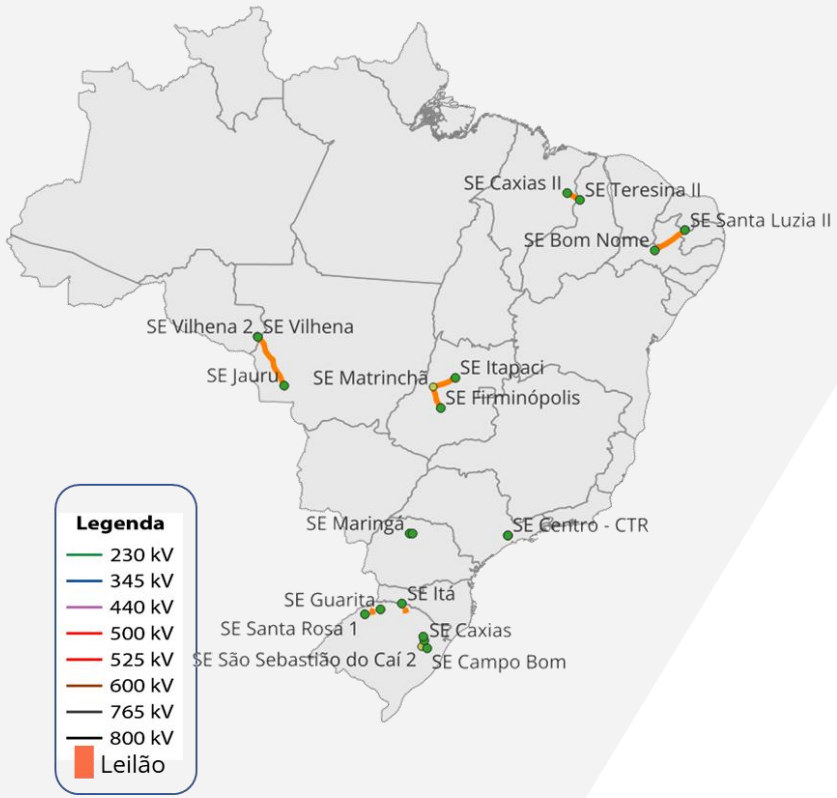
Right Acquisition Framework

- ✓ **Public Utility Declaration (DUP):** legal instrument issued by ANEEL that enables land acquisition or right-of-way for transmission projects.
- ✓ **Land use rights:** companies must prioritize friendly negotiations for property purchase or right-of-way; compensation to landowners is mandatory. Lawsuits may happen if a friendly deal is not reached, discussions usually around compensations. Regulatory provision to alleviate penalties for delays due to lengthy negotiations with landowners.
- ✓ **Regulatory framework:** governed by Decree-Law 3,365/1941 and Laws 9,074/1995.

Enviromental licenses

- ✓ **Three-stage licensing process:** transmission projects must obtain Preliminary (LP), Installation (LI), and Operating (LO) licenses.
- ✓ **Flexibility depending on impact level:** LP can be granted based on different studies that demand different complexity (and time consuming) (RAS, RAA, or EIA/RIMA), depending on the project's environmental impact.
- ✓ **Delays are common:** caused by complex studies, coordination with multiple institutions, and land or vegetation permitting—often considered a risk factor for investors. Alleviation of regulatory penalties defined on a case by case basis.

Example of transmission auction: 2025



- Tender documents and other technical information in a Public consultation from April 4, 2025 to May 19, 2025
- Auction date: October 31, 2025
- 11 lots, 1200 km
- About 4,000 MW of transformation capacity
- Estimated investment: 1,4 billion USD
- Deliveries in 42 to 60 months
- Include 4 lots won by a company in a 2020 auction but not delivered (concession intervened by ANEEL, are being reauctioned now under a slightly different planning approach)

Source: https://www.gov.br/aneel/pt-br/assuntos/noticias/2025/proposta-de-edital-do-leilao-de-transmissao-de-2025-entra-em-consulta-publica

Example of T auction: 2025

Informações sobre os lotes previstos para o Leilão nº 4/2025

LOTE	DESCRIÇÃO	UF(S)	PRAZO (MESES)	FUNÇÃO DO EMPREENDIMENTO
1 1A 1B	**Sublote 1A:** - LT 345 kV Miguel Reale - Centro, C1 e C2, com 5,72 km (subterrânea) **Sublote 1B:** - LT 345 kV Norte - Miguel Reale, C3 e C4, com 14,5 km cada (subterrânea). (Possível caducidade)	SP	60	Atendimento à Região Metropolitana de São Paulo – Sub-regiões Norte, Leste e Sul.
2	- LT 500 kV Santa Luzia II - Bom Nome II, C1, CS, com 228 km. - LT 230 kV Caxias II - Teresina II C1, CS, com 92 km; LT 230 kV Teresina - Teresina III C1, com 14 km (reaproveita faixa da LT 230 kV Teresina - Piripiri C1 a ser desativada); SE 230 kV Caxias II - Controle Automático Rápido de Reativos – CARR (-50/50) Mvar.	PB/PE/MA/PI	54	Escoamento de geração na área Leste da região Nordeste. Atendimento às regiões leste do estado do Maranhão e centro-norte do estado do Piauí.
3	- SE 525/138 kV Erechim(2) - (6+1 Res) x 50 MVA; - SE 230/69 kV Boa Vista do Buricá 2 - (6+1Res) x 33,33 MVA; - Trechos de LT 525 kV entre a SE Erechim e a LT 525 kV Itá - Caxias Norte C1, com 2 x 1,5 km; - Trechos de LT 230 kV entre a SE Boa Vista	PR/RS	48	Atendimento às cargas da região noroeste do Rio Grande do Sul e aumento de confiabilidade. Atendimento Elétrico ao Estado do Rio Grande do Sul: Região Metropolitana de Porto Alegre. Atendimento à região noroeste do Paraná.

LOT	DESCRIPTION	STATE	TIME TO COD (MONTHS)	REASON FOR THE ASSET
LOTE	DESCRIÇÃO	UF(S)	PRAZO (MESES)	FUNÇÃO DO EMPREENDIMENTO
5	- LT 230 kV Itapaci - Matrinchã 2, C1, com 146,6 km; - LT 230 kV Matrinchã 2 - Firminópolis, C1, com 138,3 km; - SE 230/138 kV Matrinchã 2 - (6+1Res) x 50 MVA	GO	48	Atendimento às regiões de Itapaci, Firminópolis e Matrinchã, no estado de Goiás.
6 6A 6B	**Sublote 6A:** - SE 500 kV Nova Ponte 3 - Compensações Síncronas 2 x (-200/+300) Mvar; **Sublote 6B:** - SE 500 kV Paracatu 4 - Compensação Síncrona 1 x (-200/+300) Mvar.	MG	42	Aumento da capacidade do sistema de transmissão com a implantação de compensadores síncronos na área Minas Gerais
11 11A 11B	- SE 500 kV Açu III - Compensações Síncronas 2 x (-200/+300) Mvar; - SE 500 kV João Câmara III - Compensação Síncrona 1 x (-200/+300) Mvar.	RN	42	Aumento da capacidade do sistema de transmissão com a implantação de compensadores síncronos na área Rio Grande do Norte.

Observações: (1) Os sublotes 1A/1B, 6A/6B e 11A/11B não são interdependentes entre si e poderão ser apregoados individualmente.

Source: https://www.gov.br/aneel/pt-br/assuntos/noticias/2025/proposta-de-edital-do-leilao-de-transmissao-de-2025-entra-em-consulta-publica

Some further issues of practical implementation

- International interconnectors are quasi-ITP but treated out of the national ITP-scheme
- The Brazilian National development Bank (“BNDES”) has had a relevant role in financing transmission
- Brazil has a long track-record on least-cost development transmission plans
- The environmental licensing process is far from being easy and (still) has many challenges
- The ITP framework has evolved over time to deal with bad outcomes, examples:
  - Systematic increase of empty lots in the auctions due to issues with environmental licensing process
  - Delays in the transmission implementation schedules
  - Mismatches between G & T expansion

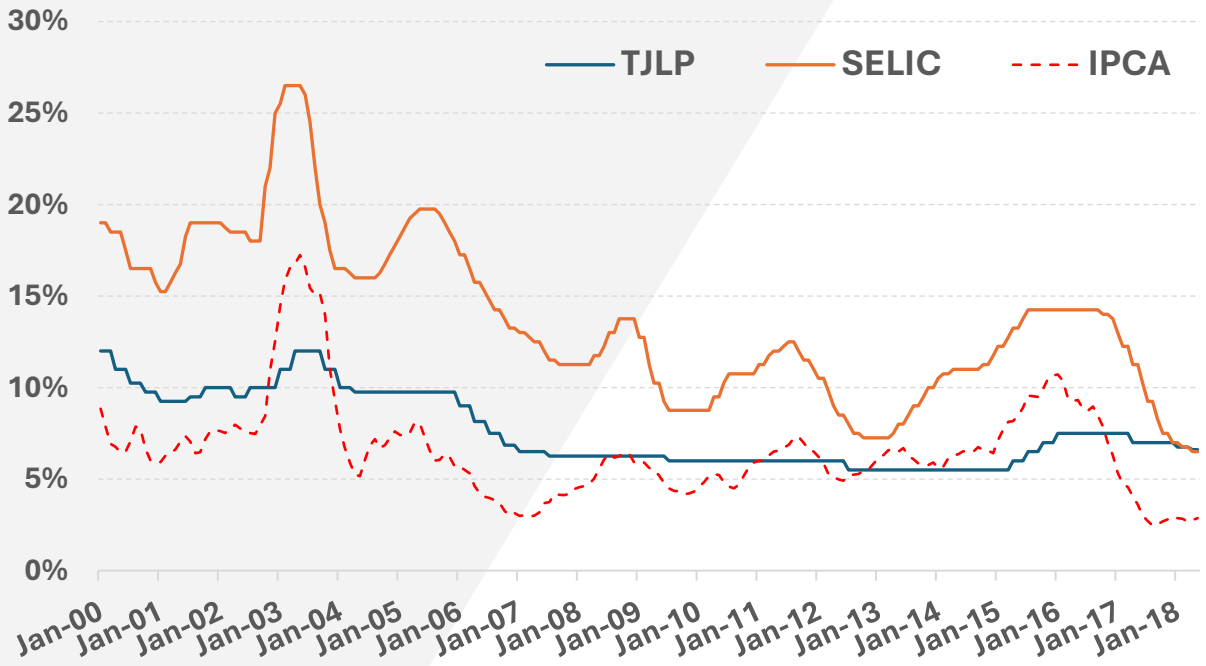
National Development Bank (BNDES) role in the Development of Transmission

Long-term financing for large projects

Stimulating private participation

Supporting system expansion

Fostering equipment nationalization (requirements on LDC)



For many years, the Brazilian Government's borrowing cost (**SELIC**) was higher that BNDES' lending rate (**TJLP**). Now all rates are marketbased

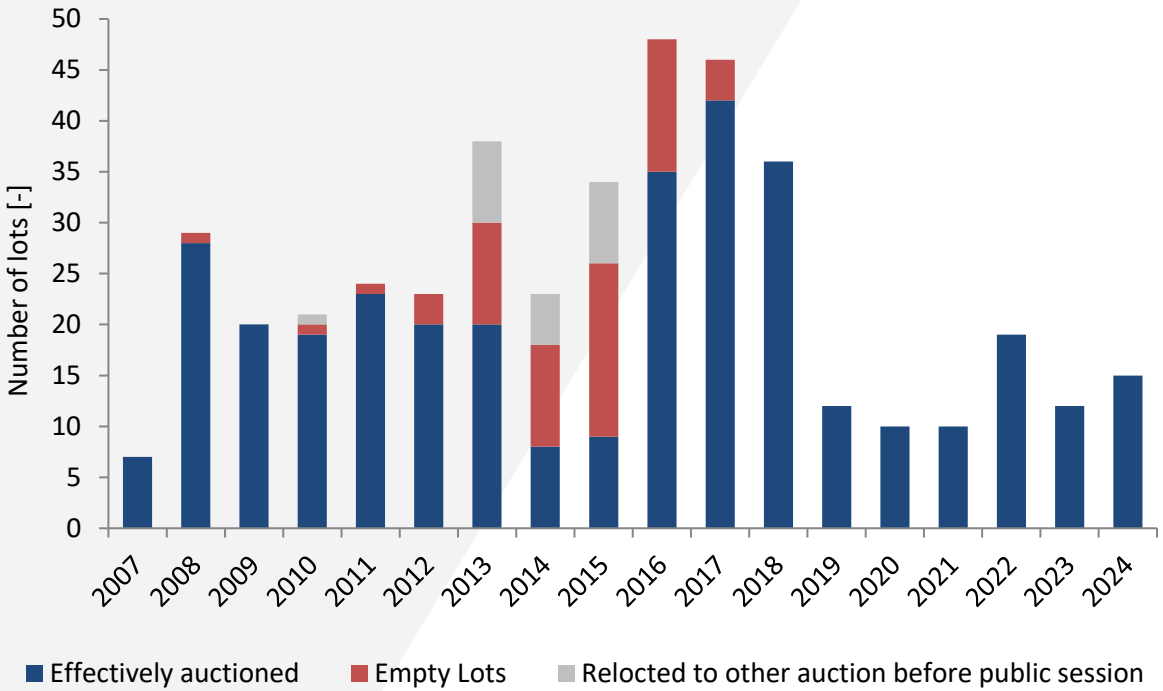
BNDES acts as a major catalyzer of funding at competitive rates:

- In 2021, BNDES issued the country's first loan with green certification, and it was granted to a transmission company.
- Last week, BNDES announced that it raised 190 million dollars from the Japan Bank for International Cooperation (JBIC) to support investments in transmission and biofuels

Some lessons: reduction in competition during 2012-16

The Problem

Delays in environmental licensing became a systematic problem in the transmission sector, raising investors' perception of risk → **increase of empty lots in the auctions in 2012**



The Solution

Regulatory + Planning effort to decrease investors risk perception

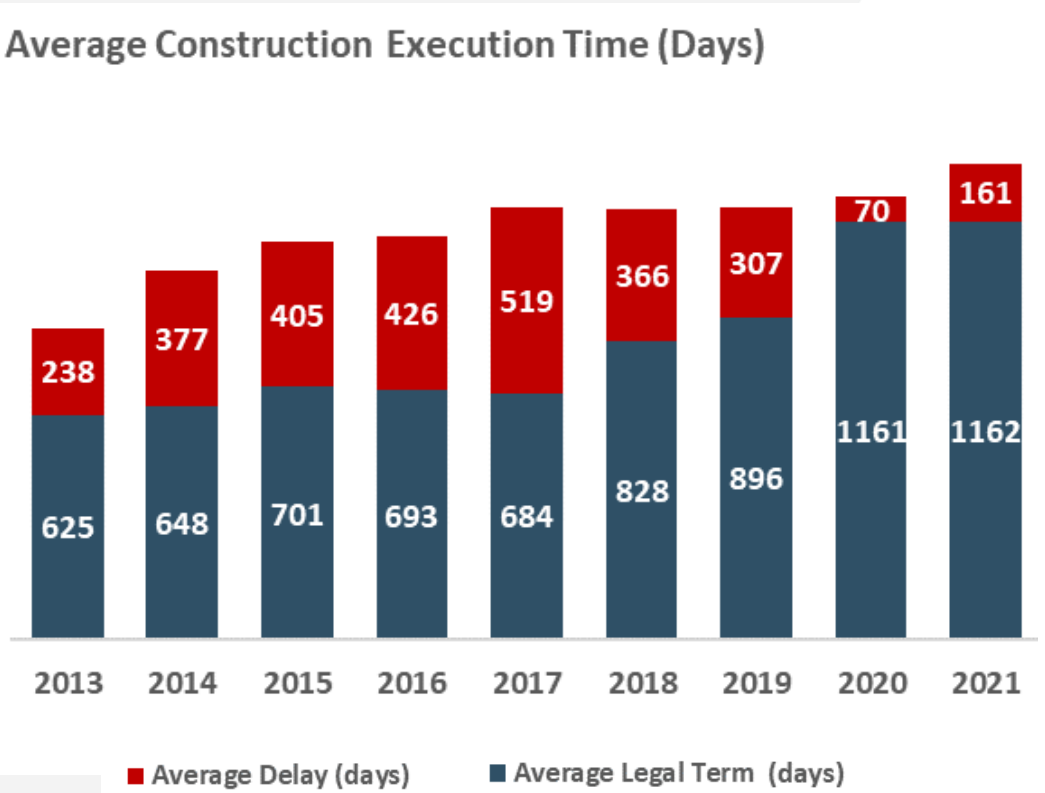
- Increased regulatory period to start commercial operation
- Incentives to anticipate the entry into operation of assets
- EPE reinforced the preliminary studies for the auction to expose more clearly the social and environmental risks to which the investor who acquire certain lot would be exposed.

Source: ANEEL

Some lessons: licensing and an increasing time for construction

The Problem

Recurrent delays in the transmission implementation schedules have been a great concern



The Solution

Regulatory effort to ensure efficiency in construction

- Review of penalties rules
- Improvements in inspection processes of transmission services
- Requirement of performance bonds with milestones according to the works schedule
- Preclusion of the companies that were behind schedule in the transmission auctions

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Source: ANEEL

Some lessons: mismatches between G & T expansion

The Problem

Period for the transmission system to be planned, auctioned, and start operation → **7 years**

Period for the wind and solar to be planned, and start operation → **less than 3 years**

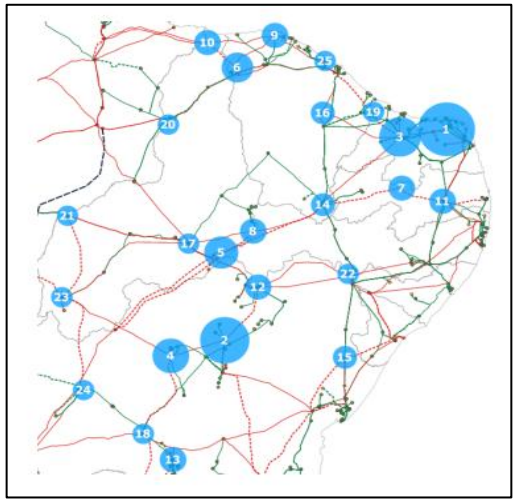
Those 4 years of difference led to greater transmission bottlenecks, and impacting the generation expansion

The Solution

Proactive transmission expansion

The system planner (EPE) started to identify the most likely locations of interest of new generators and to plan the main "highways'" in advance of generation with decision-making under uncertainty techniques

Identification of hotspots for generators considering land conditions, and irradiation/wind factors.



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Some lessons: de-risking ITP for financing

Currency Risk
Contracts and long-term financing in BRL

Volume Risk
No volume risk (energy flow or losses) is applied

Construction Risk
Technical qualification is required, and regulator oversees the project construction evolution.

Counterparty risk
The default rate spread out among users and default rates are below 0.25%.

BNDES

- ✓ **financing with low-cost loans in local currency;**
- ✓ **financing strategies, and;**
- ✓ **risk mitigation instruments.**

EPE

- ✓ **Centralized planning process**
- ✓ **All information and studies to mitigate risks such as information asymmetry.**

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Other ITP Experiences in LatAm

In Latin American, other countries have also current experiences with ITP models, following the same framework of Brazil

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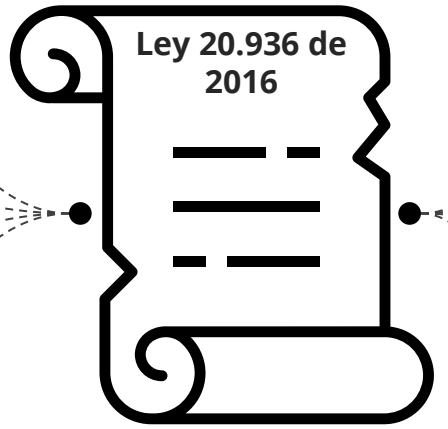
Other ITP Experiences in LatAm: Chile

The 2016 law in Chile brought significant changes to the Transmission sector model to create an environment that fosters the development of a competitive market, facilitates the transport of energy from clean sources to consumption centers, and helps reduce energy prices for both households and businesses



Nomenclature: National Transmission Systems, Zonal Systems, Dedicated Systems, Development Hub Systems

Transmission System Remuneration: Transmission tariffs charged per kWh and updated every 6 months to fully recover the transmission system costs

Establishment of the Independent System Operator for the National Electric System

New Energy Planning and Transmission Expansion Process

Electricity System Security: Introduction of a new compensation system for supply unavailability

Project Definition: New procedures from the Ministry for transmission project development

Open Access to Dedicated Transmission Systems

Definition of ancillary services required by the system

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Other ITP Experiences in LatAm: Colombia

Colombia's competitive bidding process has strengthened transmission infrastructure by awarding over 70 projects with a balance of public and private participation. Clear guarantees, performance bonds, and stable 25-year revenue streams ensure financial stability, while strict penalties incentivize reliability and high operational standards

Right to Build Awarded via Auctions

Scheduled periodically according to transmission planning studies conducted by the Planning Agency

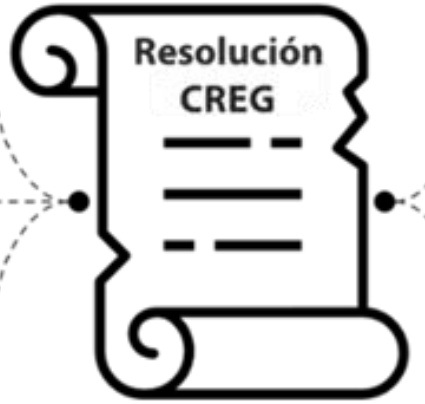
Provision of Public Transmission Service

Includes construction, operation, and maintenance

Guaranteed revenue for 25 years

End of Payment Period

After 25 years of operation, assets remain under the ownership of the transmission company, and continue to be subject to regulated tariffs



Right to Receive Annual Revenue

Yearly revenues determined in the auction (in USD).

The transmission company defines the annual payment profile, with payments made monthly and adjusted for inflation

Risk Allocation

The transmission company bears the financial, construction, operational risks, as well as any delays or applicable penalties.

No contractual agreements are signed; the conditions are set by the Regulator following the auction.

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Some common questions

1. **How do you guarantee that the annuity of the remuneration to the private investor will be guaranteed with a low risk?**

   There is a system of guarantees (escrow accounts, etc.) that ensures the bankability of payments. The system has never had a default since the implementation of the business model. Financing has come from private lenders, debenture holders and listed companies.

2. **Does the fact that some transmission infrastructure is privately owned represent a security risk for the power system?**

   No. The System Operator (ONS) dispatches generation and transmission resources independently of ownership.

3. **Has private participation in transmission made transmission more expensive than paying for it with public funds?**

   No. Auctions have been competitive, financing has come from public and private lenders, and public funds, instead, have been destinated to other uses.

Some common questions

4

What if a transmission line already auctioned does not get implemented?

If a previously auctioned transmission project fails, it can disrupt future planning, as new projects assume that all prior ones will be built. To manage this risk, ANEEL and EPE regularly update expansion studies and hold new auctions. If a failure occurs, the government typically re-auctions the affected projects quickly and adjusts new expansion plans to compensate for delays.

5

Has any player ever won the auction and then been disqualified?

Yes. There was a notable example in June 2023, when a consortium won with bids that were up to 60% below the maximum revenue allowed. However, the consortium was disqualified by ANEEL because it failed to present the required guarantees. After this disqualification, ANEEL selected the winning bidders based on the second most competitive offers.

6

How are the allowed revenues (i.e., RAP) updated through the years?

Auctioned revenue for transmission contracts is adjusted annually for inflation, with tariff reviews conducted in the 5th, 10th, and 15th years. Concession contracts clearly define which parameters are fixed and which are subject to review. While this classification can vary between auctions, once a concession contract is signed, the distinction between fixed and revisable parameters becomes final.

Conclusion

- **Brazil has experience in building an extensive transmission system that allows it to integrate renewable generation and portfolio optimization**
- **In the country, the regulatory framework of the transmission business has been successful – It demands a constant balance of stronger incentives, stricter rules and solid institutions to secure the enforcement**
- **A good and strong regulatory framework combines security to investors while encouraging efficiency**
- **Private participation has always been significant in the transmission business environment**

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Thank you!

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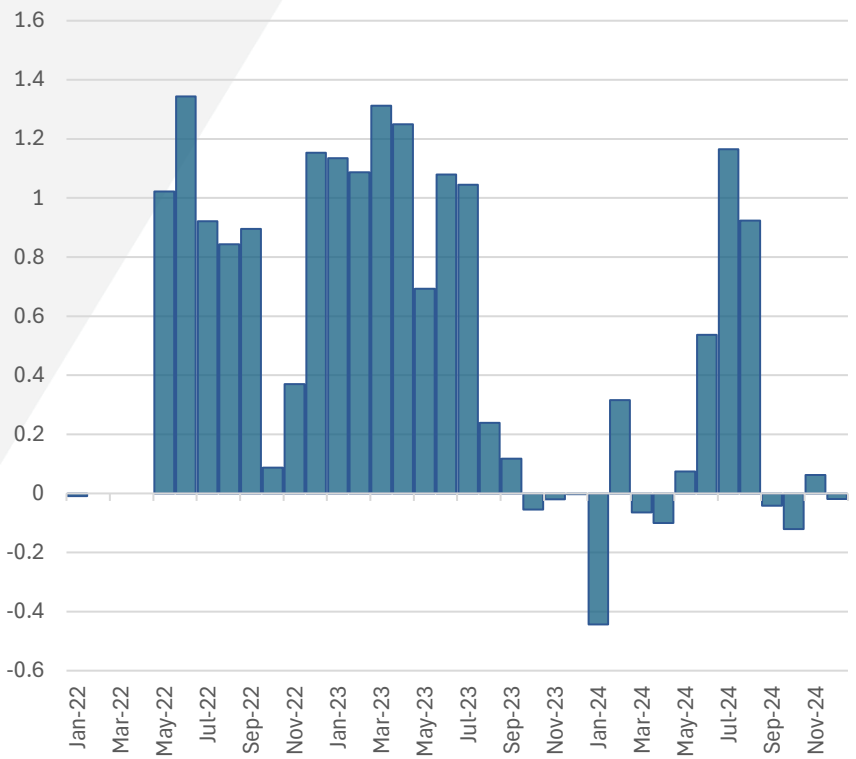
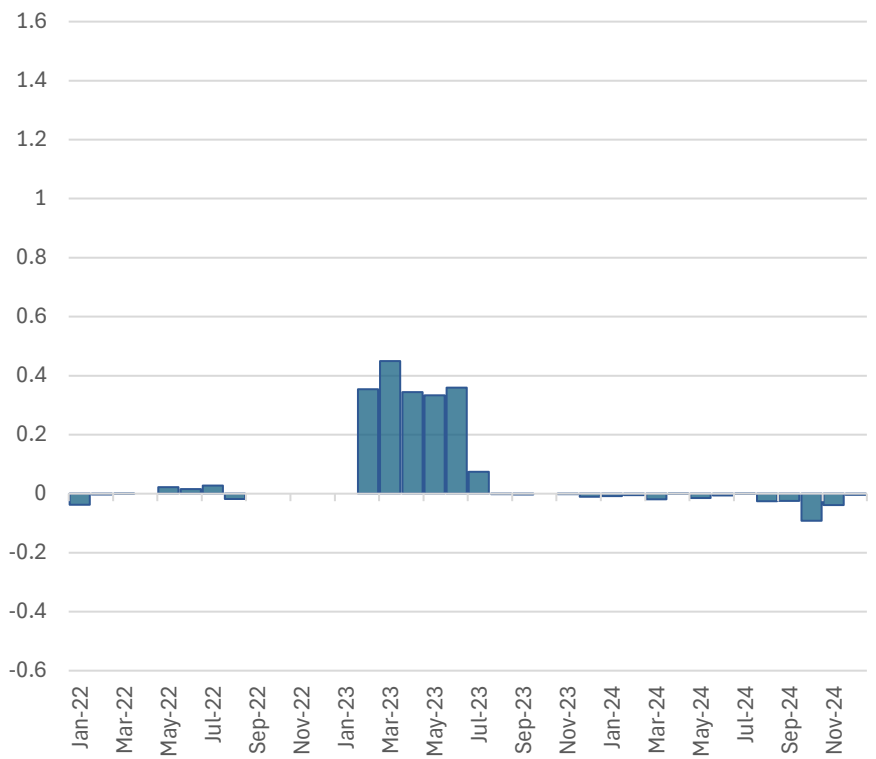
Electrical International Connections

Brazil's electrical interconnections with other countries were established prior to 2000, before the sector reform, through specific bilateral agreements between the countries.

Energy Exchange in GWh– Brazil to Argentina



Energy Exchange in GW– Brazil to Uruguay



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