GESEL
Grupo de Estudos do Setor Elétrico
UFRJ

Brazil – Economic Regulation of Energy Transmission: Incentives for Innovation

Energy Economics Iberian Conference

EEIC - Lisbon - 2016

Authors:
Rogério Pereira de Camargo
Maurício Moszkowicz
Nivalde de Castro
Roberto Brandão

UFRJ nuca ie.

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

- About Gesel:

GESEL/UFRJ is the Study Group on the Electric Energy Sector (GESEL) of the Economy Institute of the Rio de Janeiro Federal University (UFRJ) was set up in 1997 with a view to promoting a greater understanding of electric energy issues in Brazil as well as overseas.

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

- **Introduction**

The purpose of this paper is to discuss the regulatory complexity of the energy transmission sector process of innovation, considering that the Brazilian Electric Sector.

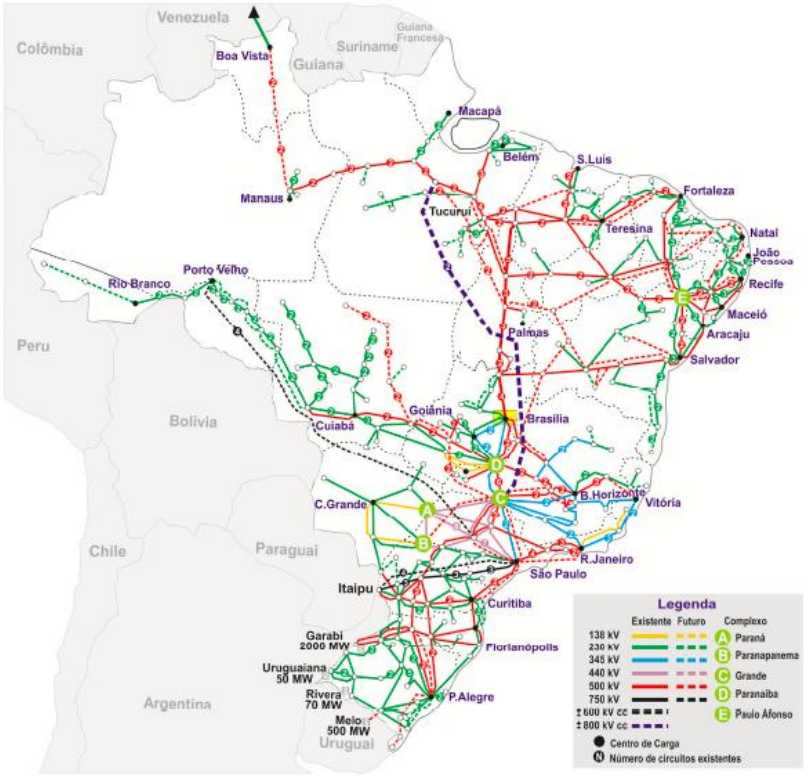
Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

Summary

- Section 1 – Brazilian electric sector overview.
- Section 2 – Brazil - Special characteristics of the network.
- Section 3 - Advantages of implementation of technological innovation.
- Section 4 - Regulatory situation in Brazil.
- Section 5 - Regulatory innovation to stimulate the use of new Technologies.

Brazil – Economic Regulation of Energy Transmission: Incentives for Innovation

- **The Expansion Forecast of the Brazilian Transmission Network**



The Basic Brazilian Transmission System is composed of voltage lines in the range of 230kV up to 750kV.

Brazil – Economic Regulation of Energy Transmission: Incentives for Innovation

Forecast Growth for 10 years – 2014-2024

Transmission Lines

- Investment 20 billion dollars
- 15%/800 kV, 66%/500 kV, 16%/230 kV, 1% 440 kV e 2%/345 kV.

Substations

- Investment 8 billion dollars
- 17%/800 kV, 1%/750 kV, 4%/500 kV, 7%/440 kV, 5%/345 kV, 27%/230 kV.

The data presented forecast a growth of 60% in the overall line extension and transformation capacity.

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

Brazilian Electric Sector – Current and Future Characteristics

Large Hydro Power Plants HPPs

- Located in the North Region: mainly the power plants of the Tapajós, Madeira and Teles Pires Rivers, HPP Belo Monte.

Renewable Energy Projects

- Integration of 558 renewable energy projects, mainly wind farms, with an installed capacity of 14.000 MW.
- The great majority of the power plants are located in the Northeast and South region of Brazil.

Brazilian Subsystems

- Integration of the Brazilian subsystems to take advantage of energy complementarities between the Brazilian regions.

Brazil – Economic Regulation of Energy Transmission: Incentives for Innovation

Technical and geographical characteristics increase complexity:

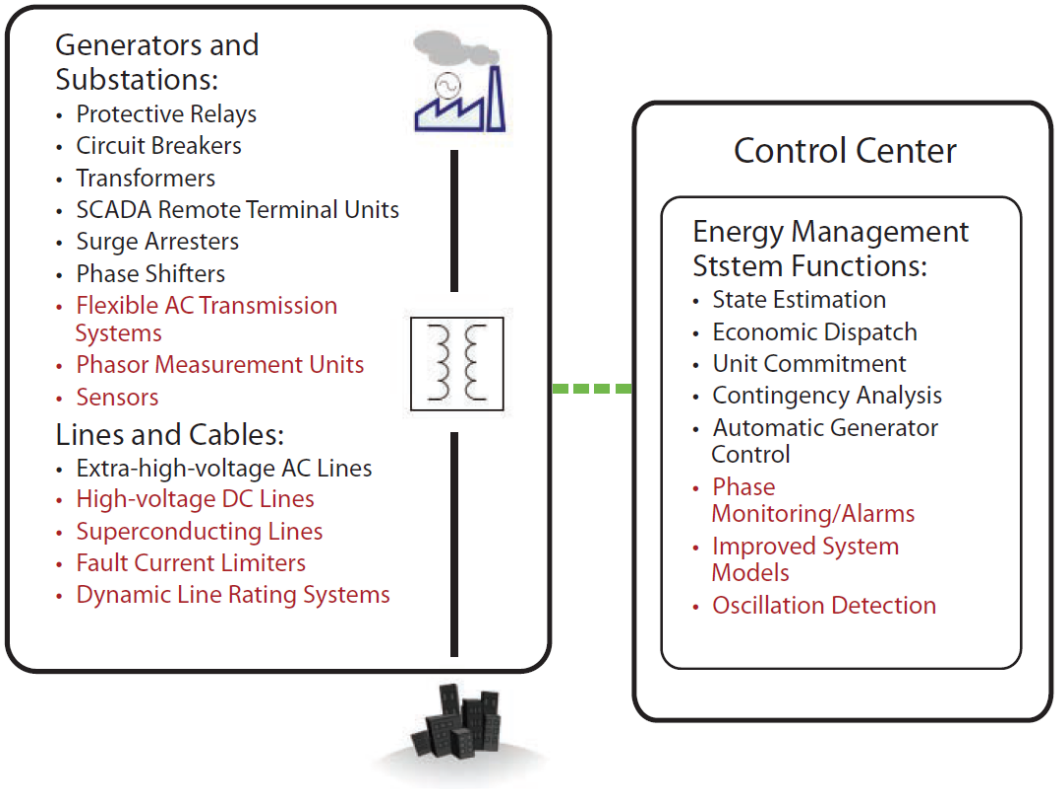
The tropical climate constraints (high temperatures, high humidity and high level lightning activity).

The variability of high energy blocks flow during the year, stressing the regional interconnections.

Generation far from the load center / consumer.

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

New Technology Opportunity



Note: Existing technologies and functions are listed in black; new and emerging elements are shown in red.
SCADA = Supervisory control and data acquisition.

GESEL
Grupo de Estudos do Setor Elétrico
UFRJ

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

New Technology Opportunity – PMU Case

Improves the models simulating the behavior of major interconnections and power plants.

Supports operators to supervise and coordinate the active reliably knowing operating limits and analyzing in real time, thus avoiding errors and blackouts.

Measures defining characteristics of voltages and currents at key substations, generators, and load centers, such as cities.

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

Regulatory innovation to stimulate the use of new Technologies

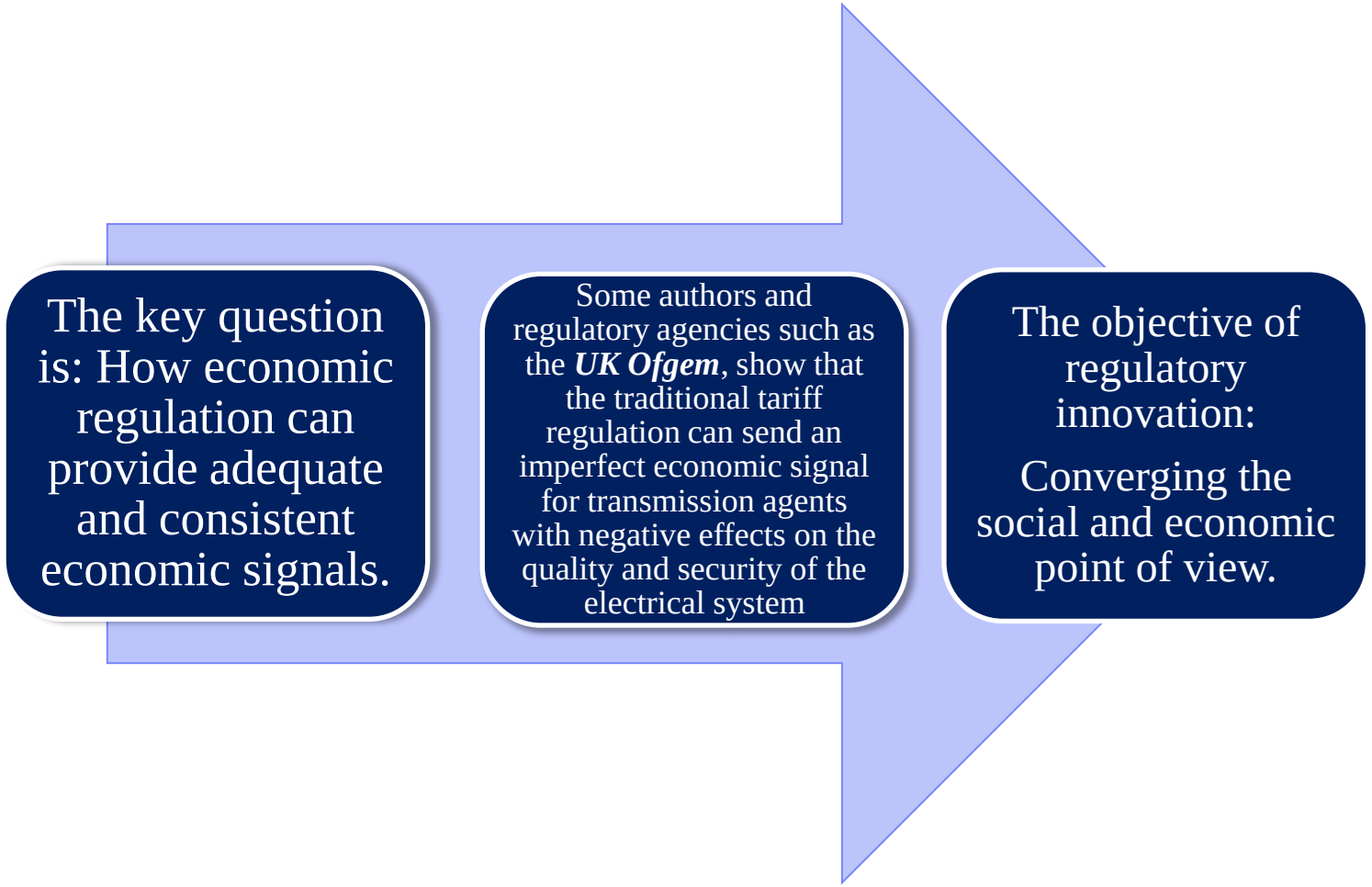
In Brazil We have a conflit because the goals of transmission auctions are low prices (reverse auctions), so the projects don't have incentive to use a new technologies

The key question is: How economic regulation can provide adequate and consistent economic signals for agents to invest in automation and technological innovations?

The solution is to create a regulatory innovation to stimulate the use of new technologies and demonstrate the systemic gains.

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

Regulatory innovation to stimulate the use of new Technologies



Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

The Regulatory Framework for Innovation – *UK Ofgem* Case

UK Ofgem (Office of Gas and Electricity Markets) that is developing a new regulatory framework focusing what they termed RIIO (Revenue = Incentives + Innovation + Outputs- Products).

The starting point is the recognition that over the next decade the transmission companies will face an unprecedented challenge of securing significant investment to maintain a reliable and secure network, and dealing with the changes in demand and generation that will occur due to a low carbon future.

Put stakeholders at the heart of their decision-making process;

Invest efficiently to ensure continued safe and reliable services;

Innovate to reduce network costs for current and future consumers;

Play a full role in delivering a low carbon economy and wider environmental objectives

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

Regulatory innovation to encourage the use of new Technologies - RIIO: A new approach to Network Regulation – Case - UK - Ofgem

Revenue

- **Constraint set up front to ensure:**
  - Timely and efficient delivery
  - Network companies are financeable
  - Transparency and predictability
  - Balance between costs faced by current and future consumers

Incentive

- **Deliver outputs efficiently over time with:**
  - 8 yr control
  - Rewards/penalties for delivery
  - Upfront efficiency rate

Innovation

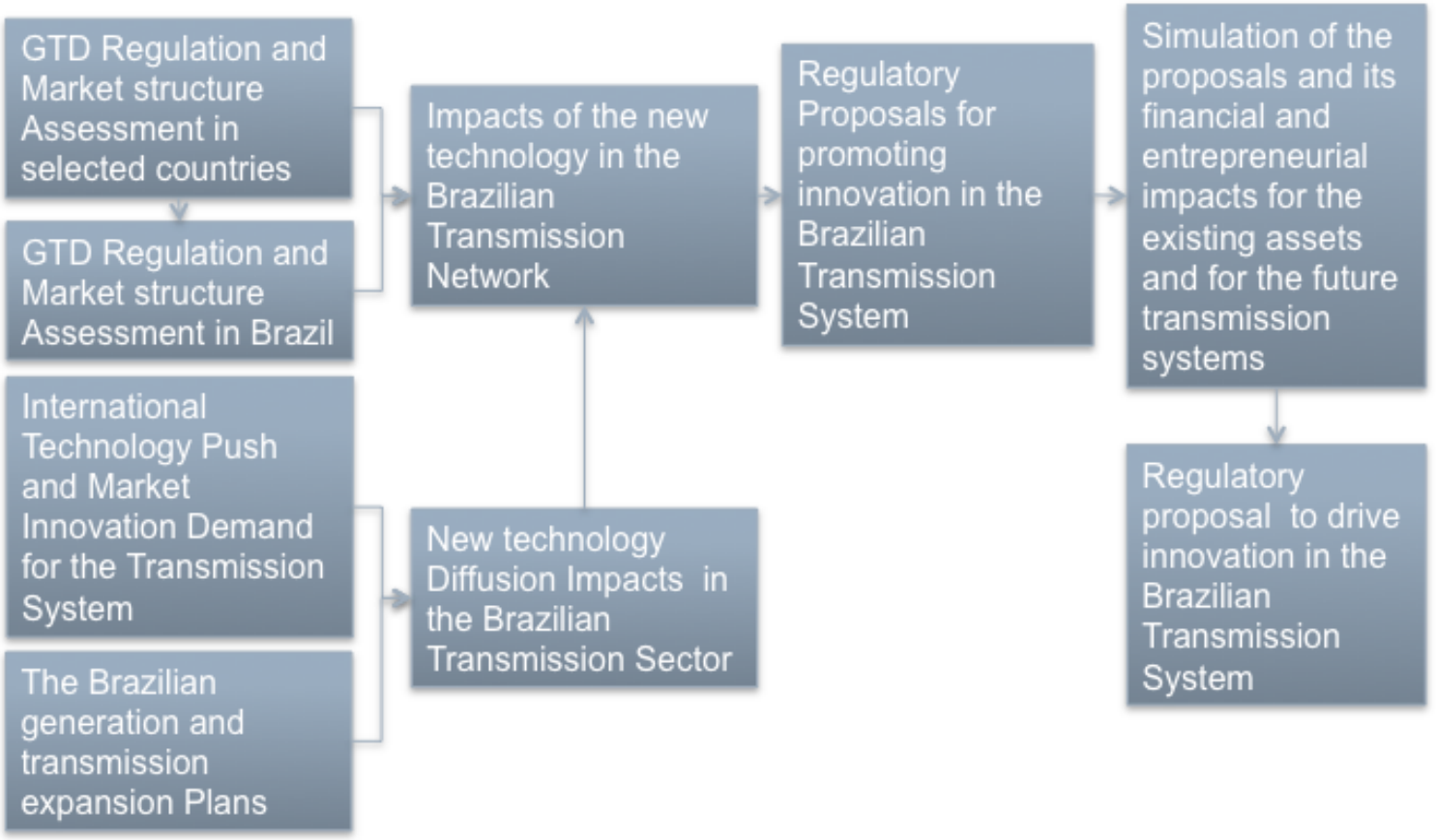
- **Technical and commercial innovation encouraged through:**
  - Core price control incentives
  - Option to give third parties a greater role in delivery
  - Innovation stimulus package

Outputs

- Outputs set out in clear ‘compact’, reflecting expectations of current and future consumers

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

The GESEL R&D Project Proposal



Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

Regulatory innovation to encourage the use of new Technologies

What is the key to the solution of this equation?

Control of tariff x technological innovation (proven innovation, which meets defined criteria)

One possible answer is to create a regulatory innovation that stakeholders are encouraged to look at the changes that we currently live

We need to think of stimulating new investments front of the new scenario: low carbon, improved reliability and system security.

Brazil –Economic Regulation of Energy Transmission: Incentives for Innovation

REFERENCES

[1] - A. C. Esteves, L. C. Lima, M. A. Rodrigues, J. Timbó, M. D. S. Moreale, H. A. R. Volskis, Aplicação de PMUs nas Salas de Controle do ONS – CEPEL e ONS – VIII – SIMPASE.

[2] A.G. Phadke, "Synchronized Phasor Measurement in Power Systems", IEEE Computer Applications in Power, Vol. 6, No. 2, pp. 10-15, Abril 1993.

[3] MIT – Study on the future of the Electric Grid – Chapter 2 - Enhancing the Transmission Network and System Operations.

[4] MORAES, R. M.; VOLSKIS, H. A. R.; "Challenges for Large-Scale PMU Application for the Brazilian Interconnected Power System"; 2nd CIGRE International Conference.

[5] Monitoring of Power System Dynamics Performance, Saint Petersburg, Russia, 28-30 April 2008.

[6] P&D de Tarifas Internacionais: Relatório 4 - Modelo Tarifário e Formação de Tarifas – Gesel, USP, CPFL.

[7] PDE – Plano Decenal – EPE – http://www.epe.gov.br/pdee/forms/epeestudo.aspx.

[8] R. M. Moraes, H. A. R. Volskis, R. Giovanini, Y. Hu, R. Mano, C. Sardinha, D. Novosel, V. Centeno, "Arquitetura do Sistema de Medição Sincronizada de Fasores do SIN Requisitos e Aplicações", SNPTEE, Outubro, 2007.

[9] Revista do BNDES, V.2, N3, JUN 1995 – Eduardo Sá - A Privatização do Setor Elétrico na Inglaterra e Reflexões para o Caso Brasileiro, p. 149.

[10] www.ofgem.gov.uk/network-regulation-riio-model.

[11] US Department of Energy – August 2014 – Smart Grid System Report to Congress.

Brazil – Economic Regulation of Energy Transmission: Incentives for Innovation

Thank you!

Contact:
Rogério Pereira de Camargo
GESEL – Institute of Economy – UFRJ
Brazil
www.gesel.ie.ufrj.br
E-mail: rogerio.camargo@gesel.ie.ufrj.br