

ELECTRICAL POWER ENGINEERING EDUCATION: HOW TO BRIDGE THE GAP BETWEEN INDUSTRY AND UNIVERSITIES

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Question 1 – What level of specialization of engineering curricula should be sought for? Is basic, fundamentals knowledge more formative and potentially more effective for industry than up-to-date information ?

- Engineering schools produce top level as well as average graduates.
- The top students will usually like and benefit more from a course with focus on fundamentals. They will be the thinkers and leaders in academic life and industry research projects.
- Average students usually is less interested in the fundamentals, being more fond of topics related to engineering practice. They happen in greater numbers and are an essential part in every branch of engineering, for they will gladly and effectively perform routine work which is abundant everywhere.



Question 2 – What are the differences between Industry needs and expectations and Academia ones ?

- A high-tech industry needs a larger share of top research engineers for technologically challenging projects, where innovations are sought.
- An industry that is not so technologically advanced, and whose manufactured products are tropicalized designs of foreign originals, allocates less job positions for thinkers.
- Universities are devoted to education, freedom of thought and research, and should have lots of top level thinkers. But universities also need lots of not so brilliant professors who agree and enjoy to perform routine tasks, and that end up not building a significant scientific production.



Question 3 – What are the reasons behind the gap between Academia and Industry, if any ?

- Academic survival depends on the publication level and number of citations. Brazilian universities produce a large number of papers in high-impact journals, but their proposed methods do not get transferred to industry.
- Industry depends on investment returns and market success to survive. The car and electronic industries in developing countries, for example, are owned by multinationals whose major R&D centers are located in the developed countries.
- As a result, the industry in developing countries does not usually contract many research projects from universities.
- The Brazilian ANEEL R&D program is enforced by law, and has driven the electrical utilities to significantly invest in R&D projects in collaboration with universities.



Question 4 – What is the current status of cooperation between Academia and Industry and in particular the interaction between industry and undergraduate/doctoral programs ?

- The Brazilian Electrical Energy Regulator (ANEEL) was empowered by federal law, to coordinate a very large R&D Projects Program for the electrical energy sector.
- 6,629 R&D projects were approved by ANEEL over the 1998 – 2013 period, out of which 6.319 were executed and finalised or have their final reports/results still under analysis.
- The project average budget, in a set of 490 projects scheduled for the 2012-2017 period, was 840K USD.
- The total investment of the ANEEL R&D program over the 1998 – 2013 period has been of 2 Billion USD, with the participation of 133 companies of the electric sector.



Question 5 – Is at present the number of PhDs produced every year for the higher education establishment too much to be absorbed by Industry?

- Brazilian industry does not have a recruiting focus on PhDs, who are usually employed by universities and research centers such as CEPEL.
- Brazilian scientific production in 2013, with 46,785 journal papers, was the 13th largest, while South Korea ranked in the 12th position.
- However, in the production of Innovation, South Korea ranked as the 18th largest, while Brazil was at the 64th position.



Question 6 – Should industry be involved in the management of Educational Establishments?

- Eletrobras, the holding for a large group of electrical energy utilities, maintains a Professional MSc course (MSc Latu Sensu) in association with several universities. Industry should sponsor such courses always in close collaboration with universities.
- Petrobras, holding for the oil industry, maintains an industry training course for newly admitted engineers, but not a Professional MSc.
- Companies such as Eletrobras and Petrobras, and many others, have continuous training programs and allow their employees to attend MSc and PhD courses as part-time students. But, a good percentage do not conclude their PhD thesis work!



Item 7 – A Low-budget & High-reach example of University-Industry Collaboration

- Despite the existing law, the availability of financial resources, the commitment and efforts of ANEEL and utilities, there remain several obstacles of legal, statutory, regulatory and managerial nature.
- The Wide Area Synchro-phasor System from the University of Santa Catarina, Brazil, is an example of a highly cost-effective ANEEL project that was carried out despite these existing obstacles, being described in the next few slides.



The Federal University of Santa Catarina

MedFasee Project: First Prototype (2003)

- The main goals were:
 - Development of a Synchronized Phasor Measurement System prototype
 - Applications for power system monitoring and analysis
- Project sponsored by:
 - Brazilian Government (Finep/CT-Energ)
 - Reason Tecnologia S.A. (www.reason-international.com)
- First Prototype
 - 3 PMUs installed in Southern Brazil universities
 - Three-phase low voltage
 - Data transmission using Internet
 - The PDC is located in the Federal University of Santa Catarina



MedFasee Project

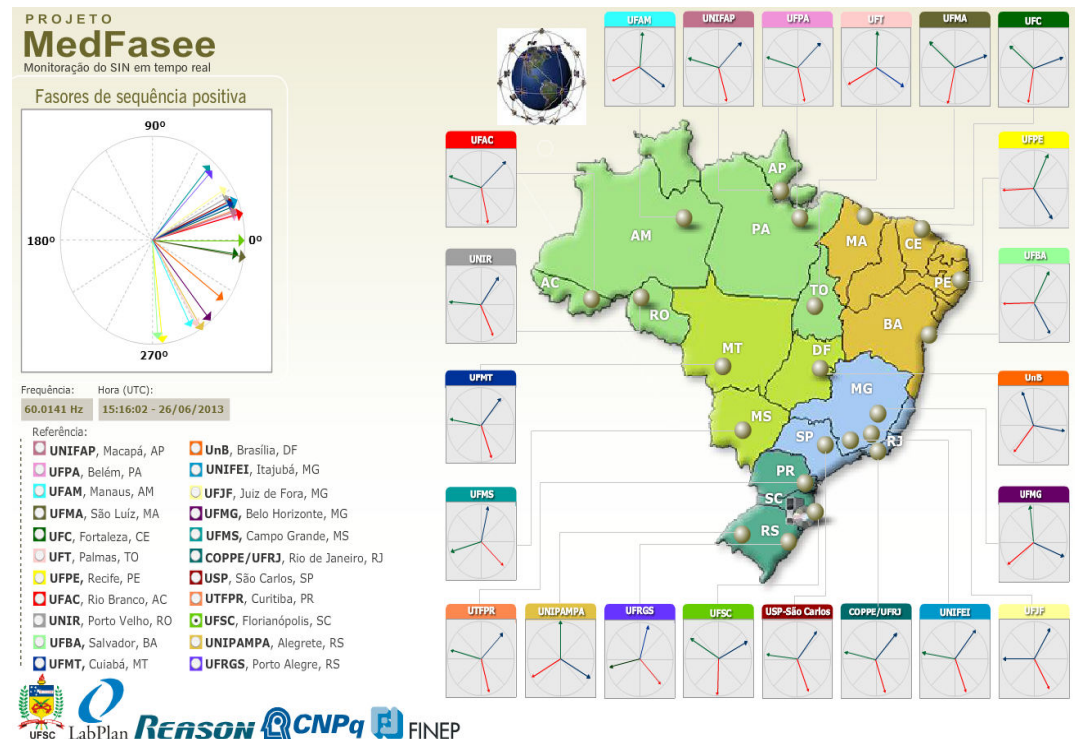
Current configuration of the National Synchronized Phasor Measurement System (SPMS MedFasee BT)

- PMUs are installed at 23 universities, covering the 5 geographical regions
- Virtual Private Network over Internet for communication between PMU and PDC (LabPlan/UFSC)

PDC



PMU



www.medfasee.ufsc.br/temporeal



Main MedFasee Projects in partnership with industry



2003

2007

2009

2011

2013

2015

First Prototype

- UFSC
- Brazilian Government (Finep/CT-Energ)
- Reason Tecnologia
- Prototype of low voltage WAMS

Eletrosul Project

- UFSC
- ELETROSUL Transmission Company
- R&D ANEEL Project
- WAMS prototype for the 500kV transmission system

CTEEP Project (1)

- UFSC
- CTEEP Transmission Company
- R&D ANEEL Project
- WAMS prototype for the 440kV transmission system

ONS Project

- UFSC
- Official partnership between UFSC and the Brazilian ISO (ONS)
- Disturbance Analysis

CTEEP Project (2)

- UFSC
- CTEEP Transmission Company
- R&D ANEEL Project
- Pilot system for automatic evaluation of dynamic security



MedFasee ELETROSUL Project (2006-2009)

- Partner
 - ELETROSUL Transmission Company
- Objective
 - Development of a SPMS prototype for the ELETROSUL transmission system
- Developments:
 - Prototype with 4 PMUs and 1 PDC
 - Development of a new PDC
 - Evaluation of the prototype performance
 - Applications for system monitoring tools for power system performance analysis

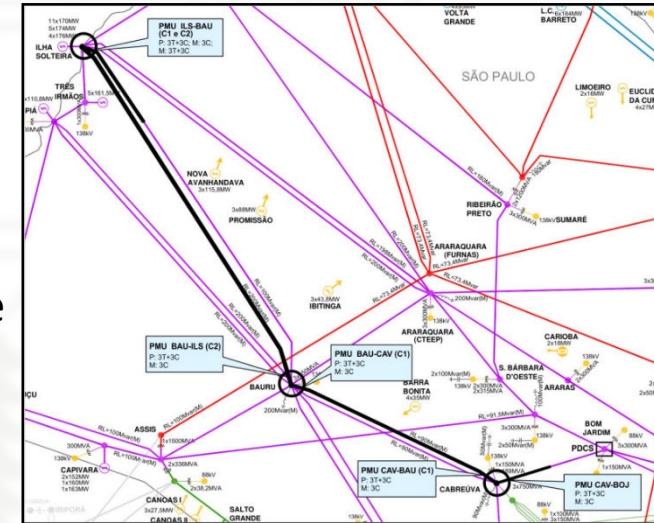


MedFasee CTEEP Project

- Partner
 - CTEEP Transmission Company

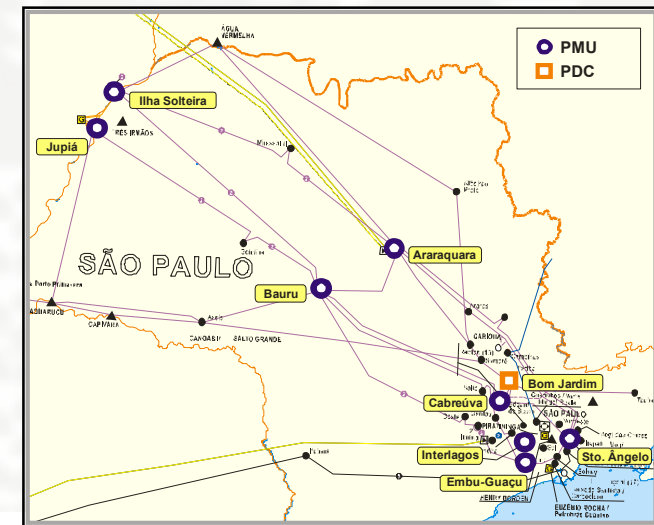
Project 1 (2009-2011)

- Objective
 - To implement a WAMS prototype for the 440kV transmission system of the CTEEP Company (São Paulo State)
- Main Developments
 - Monitoring applications in real time
 - Applications for off-line disturbance analysis



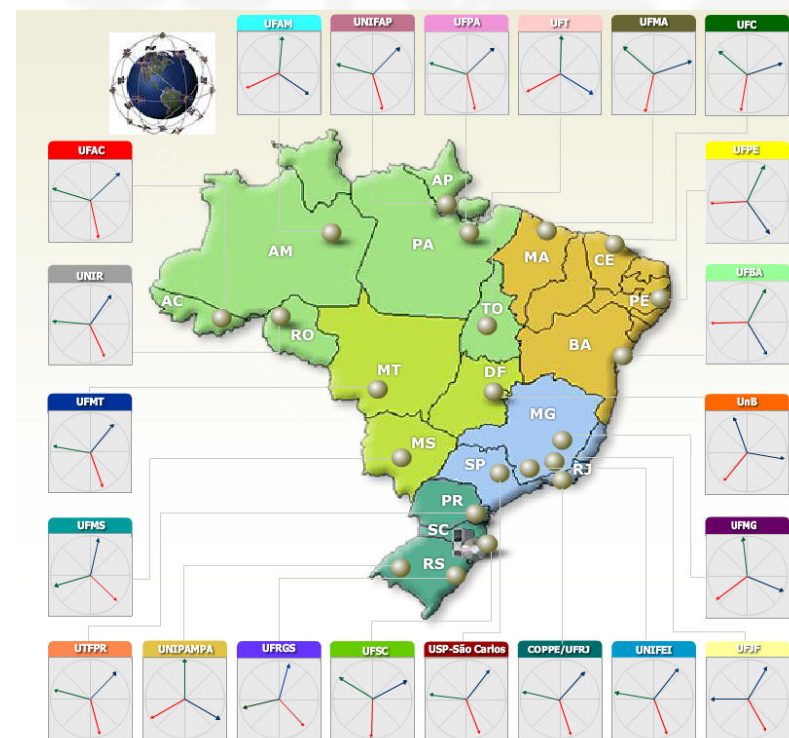
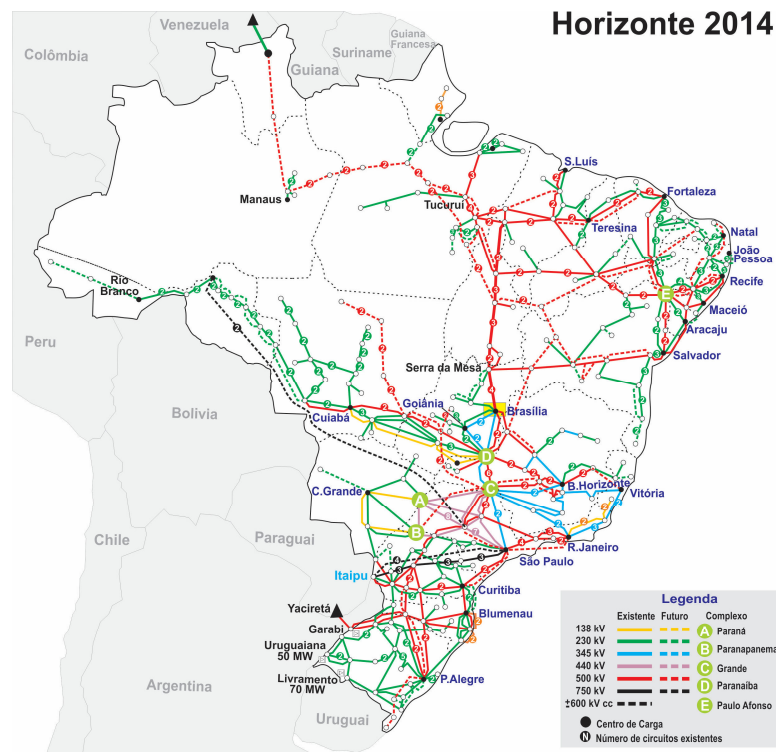
Project 2 (2013-2015)

- Objective
 - Development of a system for automatic evaluation of dynamic security based on security regions and synchronized phasor measurement



MedFasee ONS Project (2011-2014)

- Partner
 - National System Operator (ONS)
- Objective
 - Application of synchronized phasor measurement data for the analysis of the dynamic performance of the Brazilian Interconnected Power System (BIPS)



MedFasee Project

Disturbance in BIPS (15/12/2012)

- Trip of 5 generation units in Itumbiara Hydroelectric Plant
 - Load interruption (16,26% of BIPS)
 - ~8.000 MW in S/SE
 - ~1.704 MW in MG, MT, AC/RO e GO

