Power Engineering Education in Brazil and its Appeal in Fast Growing Energy Market

Tatiana M L Assis  
Sandoval Carneiro Jr

Fluminense Federal University  
Federal University of Rio de Janeiro
Introduction

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Outline

• Brazilian educational system structure
• Major degrees of engineering
• Typical structure of power engineering course
• Need for power engineers in Brazil
• Some numbers and statistics regarding undergraduate and graduate in Brazil
• Final considerations
Brazilian Education Structure

- **Basic Education**
  - Upbringing
  - Fundamental
    - Reading
    - Writing
    - Natural Sciences
    - Physical Sciences
    - Mathematics
    - Communication
    - Self-learning
  - High School
    - Personality
    - Intelligence
    - Socialization
- **Higher Education**
  - Undergraduate
    - B.Sc.
  - Graduate
    - M.Sc.
    - D.Sc.

**Entrance Exams**
- Personality
- Writing
- Communication
- Mathematics
- Natural Sciences
- Reading
- Socialization
- Intelligence
- Self-learning
- Physical Sciences

**Age [years]**
- 1
- 5
- 14
- 17
- 22
- 24
- 28
Major Degrees of Engineering

- Civil
- Chemistry
- Computer
- Control and Automation
- Electrical
- Materials
- Mechanical
- Metallurgical
- Naval and Ocean
- Petroleum
- Power/Industry
- Electronics
- Telecommunications

• The regular courses are planned for 5 years
Typical Structure of a Power Course

- Ministry of Education
  - Total number of hours in class should be above 3,600 hours
Need for Power Engineers in Brazil

• In the 80s, Brazil was facing economic recession
  – There was little interest in careers related to infrastructure
  – A substantial decrease in the number of engineering graduations was observed
• Today, the scenario is totally different
Present Situation (1)

- In the last years economic activities have resumed a growing tendency
- Brazilian system load [MWavg]

![Graph showing system load trends from 1990 to 2014 with 20% rationing line]
Present Situation (2)

• Currently, Brazil faces a lack of qualified professionals in all engineering fields
  – It is usual to find retired professionals that are invited to resume their jobs or work as consultants

• In the case of power engineering, other factors tend to increase the need for qualified professionals:
  – Electrical sector restructuring process
  – New technologies coming out
  – The need of exploring renewable energy sources with less environmental impact
What is being done?

• Some important actions:
  – A task-force was created in 2006 – inOVA
    • Federal government, academy and industry
    • Increase from 30,000 to 100,000 the graduations per year
  – In 2007, the federal government established a program for federal universities restructuring and expansion – REUNI
    • Take better advantages of physical infrastructure and human resources available
  – Increasing of federal investment in Scientific, Technological and Innovation projects – S&T&I
What is being done?

• S&T&I: Federal investments
  – Billion [R$]
  – Ratio of investment to the GNP
Some Numbers and Statistics

• Number of students (undergraduate level)
• Number of graduations
  – Undergraduate level
  – Specialization (M.Sc. and D.Sc.)
• Institutions
How many students?

- Registered students in different engineering areas (2008)
- Electrical: power, electronics and telecommunications
How many graduations?

- Number of degrees awarded in electrical engineering (undergraduate)

![Bar chart showing the number of degrees awarded in electrical engineering from 2004 to 2008. The chart shows a steady increase with a peak in 2006 and 2007.](chart.png)
How many specializations?

Electrical Engineering

Only Power

D.Sc. M.Sc.
How many institutions?

- 174 higher education institutions offering electrical engineering undergraduates courses (2008)
- Most private do not develop postgraduate and research activities
Institutions with Doctorate Programs

- Research areas in power engineering
- Qualified by CAPES
  - Federal Agency for Evaluation and Support of Graduate Education
- In 1990, only 6 institutions offered courses at doctoral level
  - 20 years latter, doctoral programs are available at 22 institutions
Geographical Location
Final Considerations

• Brazil is experiencing economic development, accompanied by rapid growth in basic infrastructure.
• Today, there is a lack of qualified professionals.
• The present convenience and image of power engineering careers has resulted in a high demand for power engineering courses.
• Important actions have been taken by the government, industry and academy.
Sources

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Thank you!

tatiana@vm.uff.br