

UNITED STATES GOVERNMENT

at 4/79 6802

5120278 (4)

Memorandum

PD-AAA-314-A1

TO : Bureau for Latin America, LA/CD
AID/Washington

DATE: January 26, 1971

FROM : Eugene Tierney - ENRP
USAID/Rio de Janeiro *E.T.*

278
512-070

11/24/70

SUBJECT: AID Loan 512-L-070 (ELETROBRAS)
Power Training & Tech. Asst. Project
Final Report (1970) 3rd Group Power Engineers.

1. Enclosed are two copies of the borrower's Final Report covering the training of the third group of ten Power Engineers, who have completed their training under AID Loan 512-L-070.
2. The report covers the second semester training in the Rensselaer Polytechnic Institute, Troy, and their Practical Training in the U.S.
3. Annex 1 gives a full report, by the U.S. Supervisor of the Course, giving the subject taken of each trainee and the grade obtained. In Appendix III a list is given of the Inspection Trips made. The highlight of the course, from the Power Engineer's point of view, was the training, from June 22, 1970 until departure for Brazil, in computer technology applied to electric power problems.
4. The ELETROBRAS Report by the CESE Coordinator registers the good impact the success and continued improvement of the course of training has had on them. The Student's Report and Criticisms have emphasized the sections requiring improvement and which have already received attention for improvement for the forthcoming Groups of Engineers.
5. Finally it must be very satisfying to all concerned that the whole group of ten engineers qualified for the Master of Engineering degree.

Encls: Report (2)

cc:
C D L S
WJHodgin-AID/W(LA/CD/ENGD)

ENRP:AGBonny:ia.

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Rensselaer Polytechnic Institute

TROY, NEW YORK 12181

November 24, 1970

SCHOOL OF ENGINEERING
Office of the Chairman
Electric Power Engineering
Curriculum

Telephone 270-6424
Area Code 518

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INDEXED
26-71
2 of 2
WALD A. MANN

Report by U. S. Course Supervisor of the ELETROBRAS Power Education Project for Ten Engineers in Group 3 of CESE

This report covers all phases of the educational program in electric power engineering carried on for ten engineers from Brazil during their attendance at the Graduate School of Rensselaer Polytechnic Institute from the middle of September 1969 through the beginning of June 1970, i.e. during the academic year 1969-70.

It is the main purpose of this program to provide the engineers with advanced education in electric power engineering in order to make them qualified for the solutions of modern problems of advanced electric power systems engineering. As a by-product of their enrollment in the Rensselaer Graduate School and as a result of their studies, the engineers may qualify for the Rensselaer Master of Engineering degree which requires one year of residence and a minimum grade average of "B" in a specified number of graduate courses.

The report covers the following:

- C. E. Caroli G.
- M. J. D. Carvalho N.
- A. Ferreira
- C. Ferreira
- E. F. Figueiredo
- S. d.A. Melo
- L. S. Riera
- P. D. Salgado
- F. A. S. Santos
- X. Vieira F.

Since 1962, Rensselaer has developed and put into operation a graduate program emphasizing electric power engineering for graduates of engineering colleges who have received the Bachelor degree in Engineering at an accredited college in the United States. This program was developed jointly with representatives from American industry, i.e. electric power utility organizations, manufacturers of heavy electrical equipment and consulting engineering firms, and appropriate graduate courses established which are taken by the students in this program. The program is available to everyone fulfilling the admission requirements of the Graduate School. The same courses in essentially the same grouping were assigned to the engineers in Group 3 of CESE.

In Appendix I are listed the courses made available to the ten engineers in this group, each of whom completed the eight required courses listed under "A".

RECORD COPY

In addition, every graduate student of the group took two more courses as elective courses.

Each course listed in the Appendix is a 3 "credit" course, if not indicated otherwise. It meets three times each week during one semester for one hour, and the student is expected to devote a minimum of six hours to home work study of the course material.

Appendix II is a compilation of the grade reports, each sheet of the appendix covering one of the engineers, and listing grades received by him in each course.

The award of the Master of Engineering degree is based on the completion of 30 credits, i.e. 10 courses of 3 credits each, with an accumulated grade average of "B". A limited amount of graduate work at other universities may be used towards the degree requirements at Rensselaer. The maximum acceptable number of transfer credits is 6. A review of the studies of the ten engineers at the Catholic University at Ric de Janeiro showed that each completed enough courses with A or B grades to allow for these transfer credits, so that only eight graduate courses at Rensselaer could be used as basis for the degree requirement. Each of the ten engineers achieved a grade average of "B" or better in eight of his courses at Rensselaer, and qualified for the Master of Engineering degree, which was awarded at the June 1969 Commencement.

The grade average for the students, computed on basis of the best grades received in 8 courses are listed below. The grade of "A" corresponds to 4.00, the grade of "B" to 3.00.

Caroli: 4.00	Melo: 3.37
Carvalho: 3.50	Riera: 3.37
A. Ferreira: 3.62	Salgado: 3.00
C. Ferreira: 3.42	Santos: 3.04
Figueiredo: 3.75	Vieira: 3.67

If the grades of all courses taken at Rensselaer are used, the averages are:

Caroli: 3.88	Melo: 3.13
Carvalho: 3.19	Riera: 3.19
A. Ferreira: 3.38	Salgado: 2.75
C. Ferreira: 3.22	Santos: 2.78
Figueiredo: 3.56	Vieira: 3.50

If rearranged by average of 8 courses, and by average of all courses, in place of alphabetical order, they would rank in this way:

Caroli	1	Caroli	1
Figueiredo	2	Figueiredo	2
Vieira	3	Vieira	3
A. Ferreira	4	A. Ferreira	4
Carvalho	5	C. Ferreira	5
C. Ferreira	6	Carvalho	6
Melo	7	Riera	6
Riera	7	Melo	7
Santos	8	Santos	8
Salgado	9	Salgado	9

-3-

Without consideration of 6 credits accepted as transfers from the Catholic University at Rio de Janeiro, Salgado and Santos would not have qualified for Rensselaer degrees.

There is fairly good correlation between these sequences of names by academic achievements, the grade averages of the courses taken at the Catholic University in Rio de Janeiro in preparation for studies at Rensselaer and the acquisition of good command of the English language as indicated by the language test.

In order to acquaint the engineers with American power industry practices, various inspection trips were taken during the academic year. Interference with regular class periods was eliminated by scheduling these trips on days during the academic "vacation" (such as Thanksgiving, or periods between the Winter and Spring semester) or on days when there were no scheduled classes. Details are given in Appendix III.

Eight of the engineers were elected to membership in the Electrical Engineering Honor Society, "Eta Kappa Nu Association", for excellence in electric power engineering. They are Caroli, Carvalho, A. and C. Ferreira, Figueiredo, Melo, Riera, and Vieira.

Respectfully submitted,

Eric T. B. Gross

Eric T. B. Gross
Philip Sporn Professor of Engineering and
Chairman, Electric Power Engineering

Enclosures

Appendix I

Listing and Outline of Courses Included in the Engineers' Programs of Study

"T" courses are for beginning graduate students.

"G" courses are for advanced graduate students.

**Outline description of courses taken by engineers in CESE
Group 3 (1969-70) at Rensselaer Polytechnic Institute**

A) Required Courses

G38.90 Power Systems Analysis I - Equivalent circuits and characteristics of multiwinding transformers. Per-unit system. Load flow studies. Analysis of balanced and unbalanced conditions in multi-phase systems. Sequence impedances of equipment.

G38.91 Power Systems Analysis II - Sequence impedances of lines and cables. Dynamics and Stability: Short circuit phenomena in machines, dynamic stability, transient stability. Swinging and out of step operation. Clark components.

G38.92 Protective Relaying - Fundamentals of instrumentation. Design and operation of protective schemes for equipment in generation, transmission and distribution circuits. Analysis of abnormal system conditions requiring relay operation.

G38.93 Economic operation of Power Generation - Economics of the operation of power systems. Control of hydro and thermal generating units. Aspects of interconnected operation. Transmission losses and techniques for optimum economic generation. Hydro-thermal coordination problems. Fuel management for nuclear reactors.

G38.95 Advanced Topics in Power Engineering - Long lines at extra high voltage operation. Voltage and power control in interconnected systems. Series capacitors and shunt reactors. Effects of neutral grounding. Extra high voltage transmission with ac and with dc.

G38.98 Selected Topics in Electric Power Engineering - Special problems covering various phases of power systems engineering, such as system grounding, high voltage d-c transmission, switchgear characteristics. Intensive study of computer applications to important solutions of system analysis. (One credit per semester.)

T6.66 Engineering Economics - Techniques for capital investment decision making; time value of money and the concept of equivalence; multiple alternatives; replacement criteria, incremental and sunk costs; capital budgeting and cost of capital; problems of uncertainty, income taxes, and depreciation in forecasts and planning in engineering economy studies.

T38.90 Power Engineering Fundamentals - Multi-phase systems without and with neutral. Review of transformer basics. Three-phase connections and per unit quantities. Overhead lines and underground cables. Generalized circuit constants. Power Circle diagrams. Control of power flow and voltage.

T11.51 Computing - Computer programming, numerical methods for the solution of scientific and engineering problems, computer applications.

B) Elective Courses

G38.94 Power Engineering Surge Phenomena - Traveling wave principles for analysis of overvoltages. Methods of protection against overvoltages due to lightning. Ground wire shielding, system and tower grounding, lightning arresters. Dynamic overvoltages, switching phenomena and system recovery voltages. Ferroresonance. Coordination of insulation and protective devices.

G35.14 Selected Topics in Nuclear Engineering and Science - Current developments or topics fundamental to specialized work in this field. Typical of subjects treated are nuclear propulsion, direct energy conversion, special solutions of the neutron transport equation or of reactor kinetic equations, neutron cross sections, plasma physics, or radiation hazards.

G6.85 The Atomic Energy Industry and its Management - Analysis of its characteristics, growth and management against a background of technological and governmental constraints. Historical aspects of atomic energy, laws governing its control and regulation, role of the Atomic Energy Commission, problems of shared government-industry responsibility, financing, liability and insurance, secrecy, economics, technological and commercial opportunities.

T38.32 Feedback Systems - Integration of system elements into a closed loop system. Stability from root locus, Routh, and Nyquist viewpoints. Performance and design, including series of feedback compensation, multiple inputs and disturbances. Mathematical modeling of system elements. Application of linear feedback theory to the analysis and synthesis of complex systems.

Appendix II

Grade Reports, With Course Numbers and
Titles, One Sheet for Each Engineer

DATE OF BIRTH

PLACE OF BIRTH

UNIVERSITY OF RIO DE JANEIRO

ADMITTED FROM

DATE OF
ENTRANCEM. Engr.
DEGREE6/12/70
DATE

LEFT

RETURNED

July 2, 1969

DATE ADMITTED TO GRADUATE STUDY

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUAL POINTS
FALL 69 ENGINEERING ECONOMICS FEEDBACK SYSTEMS POWER SYST ANALYSIS I PROTECTIVE RELAYING TOPICS IN POWER ENG EL TOP IN ELEC POWER	35474	T 666 T3832 G3890 G3892 G3895 G3898 16	3 3 3 3 3 1	A A A A A A	12 12 12 12 12 4 64	Allowed 6 transfer credits May 1970 from the Catholic Univ. at Rio de Janeiro toward Master's degree.			
SPRING 70 COMPUTING POWER ENGR FUNDAMENTALS POWER SYST ANALYSIS II CONCEPT OF POWER GEN POWER ENG LARGE PHENOM TOPICS ELEC POWER ENGR	35474	T1151 T3890 G3891 G3893 G3894 G3898 16	3 3 3 3 3 1	A A A B A B	12 12 12 9 12 3 60				

FIRST BACHELOR'S DEGREE Electrical Engrg., November 1967, Fed
University of Rio de Janeiro, Brazil

OTHER COLLEGES ATTENDED

OTHER DEGREES

LANGUAGE REQUIREMENT

CANDIDACY EXAM

DATE OF BIRTH

PLACE OF BIRTH

ADMITTED FROM

DATE OF
ENTRANCEM. Engr.
DEGREE6/12/70
DATE

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July 2, 1969

DATE ADMITTED TO GRADUATE STUDY

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINT	
FALL 69	14240				Allowed 6 credits May 1970 toward Master's degree from the Catholic University of Rio de Janeiro. NO ENTRIES BELOW THIS LINE					
ENGINEERING ECONOMICS	T 666	3	C	6						
GMT ATOMIC ENERGY IND	G 685	3	C	6						
POWER SYST ANALYSIS I	G3890	3	A	12						
PROTECTIVE RELAYING	G3892	3	A	12						
ADV TOPICS IN POWR ENG	G3895	3	B	9						
REL TOP IN ELEC POWER	G3898	1	B	3						
		16		48						
SPRING 70	14240									
COMPUTING	T1151	3	B	9						
POWER ENGR FUNDAMENTLS	T3890	3	A	12						
POWER SYST ANALYSIS II	G3891	3	A	12						
CON OP OF POWER GEN	G3893	3	B	9						
POWER ENG SURGE PHENOM	G3894	3	B	9						
TOPICS ELEC POWR ENGR	G3898	1	B	3						
		16		54						
NO ENTRIES BELOW THIS LINE										
					FIRST BACHELOR'S DEGREE Electrical Engrg., January 1967, Poly Sch. of the University of Sao Paulo, B					
					OTHER COLLEGES ATTENDED					
					OTHER DEGREES					
					LANGUAGE REQUIREMENT					
					CANDIDACY EXAM					

RECORD OF GRADUATE STUDY
 MUM ELECTRIC POWER ENGRG.

LAMPARI, BRAZIL CATH UNIV RIO DE JANEIRO 09/69

DATE OF BIRTH

PLACE OF BIRTH

ADMITTED FROM

DATE OF
ENTRANCE

M. Engr. 6/12/70
 DEGREE DATE

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July 2, 1969

DATE ADMITTED TO GRADUATE STUDY

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	
FALL 69 27268					Allowed 6 transfer credits May 1970 from the Catholic University at Rio de Janeiro toward Master's degree.					
ENGINEERING ECONOMICS	T 666	3	A	12						
FEEDBACK SYSTEMS	T3832	3	A	12						
POWER SYST ANALYSIS I	G3890	3	B	9						
PROTECTIVE RELAYING	G3892	3	C	6						
ADV TOPICS IN POWR ENG	G3895	3	B	9						
REL TOP IN ELEC POWER	G3898	1	B	3						
		16		51						
SPRING 70 27268										
COMPUTING	T1151	3	B	9						
POWER ENGR FUNDAMENTLS	T3890	3	A	12						
TOPICS NUCL ENGR & SCI	G3514	3	A	12						
POWER SYST ANALYSIS II	G3891	3	A	12						
CON CP OF POWER GEN	G3893	3	B	9						
TOPICS ELEC POWR ENGR	G3898	1	B	3						
		16		57						

FIRST BACHELOR'S DEGREE Electrical Engrg., February 1967,
 Electrotechnical Inst. of Itajuba, Br

OTHER COLLEGES ATTENDED

OTHER DEGREES

LANGUAGE REQUIREMENT

CANDIDACY EXAM

NUM ELECTRIC POWER ENGRG.

RIO DE JANEIRO PONT UNIV CATOLICA

09/69

DATE OF BIRTH

PLACE OF BIRTH

ADMITTED FROM

DATE OF ENTRANCE

M.Engr. 6/12/70
DEGREE DATE

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July 2, 1969
DATE ADMITTED TO GRADUATE STUDY

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS
FALL 69 27443					Allowed 6 transfer credits May 1970 from the Catholic University at Rio de Janeiro toward Master's degree.				
ENGINEERING ECONOMICS	T 666	3	A	12					
FEEDBACK SYSTEMS	T3832	3	B	9					
POWER SYST ANALYSIS I	G3890	3	A	12					
PROTECTIVE RELAYING	G3892	3	A	12					
VARIOUS TOPICS IN POWER ENGR	G3895	3	A	12					
LAB TOP IN ELEC POWER	G3898	1	B	3					
		16		60					
SPRING 70 27443									
COMPUTING	T1151	3	B	9					
POWER ENGR FUNDAMENTALS	T3890	3	A	12					
POWER SYST ANALYSIS II	G3891	3	A	12					
CONCEPTS OF POWER GEN	G3893	3	B	9					
POWER ENGR SURGE PHENOM	G3894	3	B	9					
TOPICS ELEC POWER ENGR	G3898	1	B	3					
		16		54					
<p>FIRST BACHELOR'S DEGREE Electrical Engrg., December 1967, Fed Univ. of Rio de Janeiro, Brazil</p> <p>OTHER COLLEGES ATTENDED</p> <p>OTHER DEGREES</p> <p>LANGUAGE REQUIREMENT</p> <p>CANDIDACY EXAM</p>									

DATE OF BIRTH

PLACE OF BIRTH

ADMITTED FROM

DATE OF ENTRANCE

M.Engr. 6/12/70
DEGREE DATE

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DATE ADMITTED TO GRADUATE STUDY

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	
FALL 69 59113					Allowed 6 credits May 1970 toward Master's degree from the Catholic University of Rio de Janeiro.					
ENGINEERING ECONOMICS	T 666	3	B	9						
FEEDBACK SYSTEMS	T3832	3	B	9						
POWER SYST ANALYSIS I	G3890	3	A	12						
PROTECTIVE RELAYING	G3892	3	B	9						
ADV TOPICS IN PCWR ENG	G3895	3	B	9						
REL TOP IN ELEC POWER	G3898	1	A	4						
		16		52						
SPRING 70 59113										
COMPUTING	T1151	3	C	6						
POWER ENGR FUNDAMENTLS	T3890	3	A	12						
POWER SYST ANALYSIS II	G3891	3	A	12						
CON CP OF POWER GEN	G3893	3	C	6						
POWER ENG SURGE PHENOM	G3894	3	B	9						
TOPICS ELEC PCWR ENGR	G3898	1	B	3						
		16		48						
					FIRST BACHELOR'S DEGREE	Electrical Engrg., January 1964, Pontific Catholic Univ. of Rio De Janeiro, Bra				
					OTHER COLLEGES ATTENDED					
					OTHER DEGREES					
					LANGUAGE REQUIREMENT					
					CANDIDACY EXAM					

DATE OF BIRTH

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DATE OF ENTRANCE

M.Engr.
DEGREE

6/12/70
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July 2, 1969

DATE ADMITTED TO GRADUATE STUDY

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS
FALL 69 ENGINEERING ECONOMICS EDBACK SYSTEMS POWER SYST ANALYSIS I PROTECTIVE RELAYING NEW TOPICS IN POWER ENG L TOP IN ELEC POWER	74088 T 666 T3832 G3890 G3892 G3895 G3898	3 3 3 3 3 1	C A A A B B	6 12 12 12 9 3	Allowed 6 credits May 1970 toward Master's degree from the Catholic University at Rio de Janeiro.				
		16		54					
SPRING 70 COMPUTING POWER ENGR FUNDAMENTLS POWER SYST ANALYSIS II CON CP OF POWER GEN POWER ENG SURGE PHENOM TOPICS ELEC POWER ENGR	74088 T1151 T3890 G3891 G3893 G3894 G3898	3 3 3 3 3 1	B B B B B B	9 9 9 9 9 3					
		16		48					
					FIRST BACHELOR'S DEGREE Electrical Engrg., February 1967, Electrotechnical Inst. of Itajuba, Braz				
					OTHER COLLEGES ATTENDED				
					OTHER DEGREES				
					LANGUAGE REQUIREMENT				
					CANDIDACY EXAM				

M. ENGR. DEGREE

6/12/70
DATE

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DATE ADMITTED TO GRADUATE STUDY

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUAL. POINTS	
FALL 69 ENGINEERING ECONOMICS FEEDBACK SYSTEMS POWER SYST ANALYSIS I PROTECTIVE RELAYING ADV TOPICS IN POWER ENG ELEC TOP IN ELEC POWER	77780	T 666 T3832 G3890 G3892 G3895 G3898	3 3 3 3 3 1	C B A A B B	6 9 12 12 9 3	Allowed 6 transfer credits May 1970 from the Catholic University at Rio de Janeiro toward Master's degree.				
		16		51						
SPRING 70 COMPLTING POWER ENGR FUNDAMENTLS POWER SYST ANALYSIS II ECON CP OF POWER GEN POWER ENG SLRGE PHENOM TOPICS ELEC POWER ENGR	77780	T1151 T3890 G3891 G3893 G3894 G3898	3 3 3 3 3 1	C B C B C C	6 9 6 9 6 2					
		16		38						
<p>FIRST BACHELOR'S DEGREE Electrical Engrg., December 1966, Fed Univ. of Minas Gerais, Sch. of Engrg., Brazil</p> <p>OTHER COLLEGES ATTENDED</p> <p>OTHER DEGREES</p> <p>LANGUAGE REQUIREMENT</p> <p>CANDIDACY EXAM</p>										

DATE OF BIRTH: 6/12/70 PLACE OF BIRTH: RIO DE JANEIRO ADMISSIONS FROM: U.S. DEPARTMENT OF EDUCATION DATE OF ENTRANCE: 07/07

DEGREE: M. Engr. DATE: 6/12/70 LEFT: RETURNED: DATE ADMITTED TO GRADUATE STUDY: July 2, 1969

COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	COURSE TITLE	CAT. NO.	CREDIT	GRADE	QUALITY POINTS	
FALL 69	92287				Allowed 6 credits May 1970 toward Master's degree from the Catholic University of Rio de Janeiro.					
ENGINEERING ECONOMICS	T 666	3	B	9						
FEEDBACK SYSTEMS	T3832	3	A	12						
POWER SYST ANALYSIS I	G3890	3	B	9						
PROTECTIVE RELAYING	G3892	3	A	12						
ADV TOPICS IN POWER ENG	G3895	3	A	12						
LAB TOPIC IN ELEC POWER	G3898	1	A	4						
		16		58						
SPRING 70	92287									
COMPUTING	T1151	3	B	9						
POWER ENGR FUNDAMENTALS	T3890	3	A	12						
POWER SYST ANALYSIS II	G3891	3	B	9						
CONCEPT OF POWER GEN	G3893	3	A	12						
POWER ENG SURGE PHENOM	G3894	3	B	9						
TOPICS ELEC POWER ENGR.	G3898	1	B	3						
		16		54						
					FIRST BACHELOR'S DEGREE Power Engrg., December 1966, Pontifical Catholic Univ. of Rio de Janeiro, Brazil					
					OTHER COLLEGES ATTENDED					
					OTHER DEGREES					
					LANGUAGE REQUIREMENT					
					CANDIDACY EXAM					

Appendix III

Inspection Trips by Engineers in CESE-3

1. General Electric Co., Pittsfield, Mass., Power Transformer and Distribution Transformer Shops.
2. Edison Electric Institute Project UHV (Ultra High Voltage Research), Pittsfield, Mass.
3. Montreal Engineering Co., Ltd., Engineering Dept., Montreal, Canada
4. Hydro Quebec, Engineering Design and Operation Dept., Montreal, Canada.
5. 735 kV Substation, Boucherville, Quebec, Hydro-Quebec
6. Winter Power Meeting IEEE, New York, N.Y.
7. Systems Operation Center, Consolidated Edison Co., New York, N.Y.
8. Ravenswood Generating Station (1000 MW Generator), Consolidated Edison Co., New York, N.Y.
9. Systems Operations Center, Long Island Lighting Co., Long Island, N.Y.
10. Multi-Amp Institute (Relaying practices), Cranford, N.Y.
11. Phelps Dodge Extra High Voltage Test Facility.
12. Large Turbo Generator Shops, General Electric Co., Schenectady, N.Y.
13. Large Motor-Generator Shops, General Electric Co., Schenectady, N.Y.
14. Small A-C Motor Shops, General Electric Co., Schenectady, N.Y.
15. 345 kV Substation at New Scotland, N.Y., Niagara Mohawk Power Corp.
16. Rotterdam Substation 230-115-...kV and Synchronous Condenser, Niagara Mohawk Power Corp.
17. Leeds and Northrup Co., Philadelphia, Pa. (one week course).
18. Training from June 22 until departure for Brazil, in computer technology applied to electric power systems problems in engineering offices of electric power utility organizations; five engineers at Bonneville Power Administration, the other five at five different private utilities.



ELETROBRÁS
CENTRAIS ELÉTRICAS BRASILEIRAS S.A.

Letter 12/22/70

ESCRITÓRIO CENTRAL: AV. PRESIDENTE VARGAS, 042 - 10ª - CAIXA POSTAL 1839 - ZC-00 - RIO DE JANEIRO, GB - BRASIL

A.I.D. Loan nº 512-L-070

ELETROBRÁS POWER TRAINING AND TECHNICAL ASSISTANCE PROJECT

TRAINING REPORT Nº 3/4

THIRD GROUP OF ENGINEERS

1. SCOPE

This report is presented in accordance with USAID/BRASIL Implementation Letter nº 5, of July 17, 1968, and follows instructions presented in "d", page 2 of that Implementation Letter.

The report covers the second semester in the U.S. University and Practical Training in the United States. It is the final report on this Third Group of Engineers.

Three other reports concerning this Group of Engineers were previously sent to USAID/BRASIL by the President of ELETROBRÁS:

- Training Report nº 3/1, sent with letter pre-212/69, of April 15, 1969;
- Training Report nº 2/3, sent with letter pre-680/69, of October 7, 1969;
- Training Report nº 3/3, sent with letter pre-437/70, of June 15, 1970.

2. TRAINEES

The Third Group included the following engineers:

- Carvalho Netto, Manoel Joaquim de (CESP)
- Ferreira, Aloisio (FURNAS)
- Ferreira, Celso (CAMEB)
- Figueiredo, Erli Ferreira (FURNAS)
- Guimarães, Carlos Eduardo Caroli (FURNAS)

- Melo, Ednardo d'Ávila (ELETRORÁS)
- Riêra, Luzimar Silva (CEMIG)
- Salgado, Fedro de Araujo (CEMIG)
- Santos, Fernando Antonio Sarmiento (CEMIG)
- Vieira Filho, Xisto (CAEEB)

Trainees' personal data, education background, company position, have been presented in Training Report nº 3/1, which covered the training program accomplished in Brazil, started in March 3, 1969.

The Brazilian part of the training program was covered in Training Report nº 3/2.

The first semester in the Rensselaer Polytechnic Institute was covered in Training Report nº 3/3.

The Engineers of the Third Group returned to Brazil in September, 1970.

3. EVALUATION OF TRAINING AND PARTICIPANT'S ACCOMPLISHMENT

Professor Eric T.B. Gross covers in Annex 1 the educational program for the Third Group of Engineers at the Rensselaer Polytechnic Institute, the performance of the students and the practical training program.

The ten trainees were awarded the Master of Engineering degree.

4. STUDENT'S REPORTS

Three series of individual reports have been presented by the Trainees of the Third Group.

The first series of reports, in Portuguese, covered the courses given in Brazil and during the first semester at the Rensselaer Polytechnic Institute. These reports have been reviewed in Training Report nº 3/3.

The second series of reports, in English, covered the practical training in the United States. These reports were sent by the Trainees to Mr. F.J. Huber who forwarded them to Brazil.

The third and final series of reports, in Portuguese, covered the second semester at the Rensselaer Polytechnic Institute.

A digest of the second and third series is presented below.

5. COURSES AT THE RENSSELAER POLYTECHNIC INSTITUTE

As a whole the second semester at the Rensselaer Polytechnic Institute was found useful by the trainees. Some courses were found very good.

For the first time in this Power Training Program good instruction on Computer Applications to Electric Power Systems has been provided.

Criticism was directed to T38.90 - Power Engineering Fundamentals which most of the students rated as too elementary (indeed this course is of undergraduate level). It is worth to note that for this 3rd Group of Trainees, course G38.90 - Power System Analysis I (taught in the first semester) was found a good course, while for the 2nd Group G38.90 was rated as deficient and T38.90 as excellent. It seems that for the 2nd Group the deficiencies of G.38.90 were covered in T38.90; for the 3rd Group G38.90 was better taught and T38.90 was rather unnecessary.

With reference to G38.90 - Power Generation Operation and Control, no restrictions were made to the Professor competence but to his capacity to make himself understood.

A resume of the student's remarks on the 2nd semester courses is presented below.

T11.51 - COMPUTING

Very good course, necessary to Electrical Engineers.

Very competent professor (E.H. Rogers).

G35.14 - SELECTED TOPICS IN NUCLEAR ENGINEERING

Very good.

Professor very interested in the course (which was taken by only one of the trainees of the Power Training Program).

T38.90 - POWER ENGINEERING FUNDAMENTALS

This course of undergraduate level includes in a somewhat elementary way a few topics already dealt with in the first semester under Power System Analysis I.

Much time was allocated to Circuit Breakers and to visits to Industrial Installations.

Some basic concepts have been stressed which otherwise could have been missed.

G38.91 - POWER SYSTEM ANALYSIS II

More emphasis should be given to Stability.

G38.93 - POWER GENERATION OPERATION AND CONTROL

The course was directed mainly to Thermal Generating Stations and little was given on Hydraulic and Mixed Systems, which are important to Brazil.

While recognizing the competence of the Professor, all the trainees stressed his difficulty to convey his knowledge (poor didactic qualities).

The textbooks were not followed closely.

G38.94 - SURGE PHENOMENA IN POWER ENGINEERING

A very good course, probably the best of the 2nd semester.

The willingness of the Professor to help the students and to supply reading material was remarked by most of the trainees.

The only suggestion to improve the course is to allocate more time to Insulation Coordination.

G38.98 - SELECTED TOPICS IN ELECTRIC POWER ENGINEERING

The best part of this course was that devoted to D.C. Transmission.

Special - COMPUTER APPLICATIONS TO ELECTRIC POWER SYSTEMS

This special course lasted two weeks, 2 hours per day.

The course received general applause from all the students, being rated as perhaps the best of the 2nd semester.

Professor H.E. Brown was found excellent.

6. PRACTICAL TRAINING

6.1 After the second semester at Rensselaer Polytechnic Institute all the ten trainees of the 3rd Group attended a special course at Leeds & Northrup, North Wales, Pennsylvania, on Power-Frequency Control in Interconnected Systems, from June 15th to 19th.

The high standard of the course and the courtesy of Leeds & Northrup staff received unanimous praise from the trainees, and it was suggested that for the 4th and 5th groups two or three additional days should be provided for this course.

6.2 The trainees were afterwards distributed among the utilities listed below.

Bonneville Power Administration, Portland, Oregon

Aloisio Ferreira - FURNAS

Erli Ferreira Figueiredo - FURNAS

Fernando Antonio Sarmiento Santos - CEMIG

Luzimar Silva Riêra - CEMIG

Pedro de Araujo Salgado - CEMIG

American Electric Power Service Corp., New York, N.Y.

Carlos Eduardo Caroli Guimarães - FURNAS

Commonwealth Edison Co., Chicago, Ill.

Celso Ferreira - CAEEB

Detroit Edison Co., Detroit, Mich.

Ednardo d'Avila Melo - ELETRORÁS

Consumers Power Co., Jackson, Mich.

Manoel Joaquim de Carvalho Netto - CESP

Pennsylvania Power & Light Co., Allentown, Pa.

Xisto Vieira Filho - CAEEB

Training in every utility was found very useful and profitable, lasting from June to the end of August, with the exception of Bonneville, where the trainees remained for six weeks.

6.3 In accordance with instructions received from the Brazilian Power Companies, the three CEMIG engineers returned from Bonneville to Brazil. The two FURNAS engineers were sent to the Bureau of Reclamation, in Denver, Colorado, where training was found less useful. It was suggested that no other trainees should be sent to the Bureau of Reclamation.

7. OVERALL TRAINING EVALUATION

Under the guidance of Professor Eric.T.B. Gross the students of the 3rd Group of the Educational and Training Program had a better course than the two preceding Groups and met no special problems. During all the time spent in the United States the students could always rely on the assistance of Mr. Fred J. Huber.

As stated before, there was a definite improvement on the teaching of Computer techniques.

Suggestions for the improvement of the Brazilian part of the Program were reported in Training Report nº 3/3, in which the courses given at the Pontificia Universidade Católica do Rio de Janeiro were discussed. Most of these student's suggestions, approved by Prof. E.T.B. Gross, were followed for the 4th Group.

As may be seen from Training Report nº 3/3, five of the seven courses given to the 3rd Group at the Rensselaer Polytechnic Institute were found very good. Two courses met some criticism:

G6.85 - The Atomic Industry and its Management

T6.66 - Engineering Economics

G6.85 was taken by one student only of the 3rd Group, and it is indeed a course of very restricted interest to Brazilian engineers. This course will not be included in the programs for the 4th and 5th Groups of Engineers.

The main difficulty met with T6.66 (which was taken by the ten trainees of the 3rd Group) was found in understanding the lessons. Difficulties with the English Language, common to all the courses taken by foreigners, were aggravated by the use of special economic words and expressions, with which the trainees were not acquainted. As stated in Training Report nº 3/3, the Professor did the best he could to help the students.

After discussions of the Brazilian Coordinator with Professors E.T.B. Gross and W.D. Karger and with Mr. F.J. Huber, it was decided to take a few steps in order to improve this situation for the 4th Group: the new trainees were to be supplied, in Brazil, with a Glossary of Engineering

Economics and with some reading material on Economics. These steps were taken for the 4th Group. A few conferences on Economics were also provided for the 4th Group.

As stated in this Training Report nº 3/4, six of the eight courses taken on the Second Semester at the Rensselaer Polytechnic Institute were found very good, while two courses received criticism:

T38.90 - Power Engineering Fundamentals

G38.94 - Power Generation Operation and Control

As explained before, it seems that T38.90 is unnecessary provided G38.90 - Power System Analysis I, given in the First Semester is satisfactory. Therefore, it is very probable that T38.90 will not be taken by the Trainees of the 4th and 5th Groups.

G38.94 offered to the students of the 3rd Group difficulties similar to those met with T6.66 on the First Semester, but with higher intensity.

It is hoped that G38.94 will be more profitable for the 4th Group than for the 3rd, due to better preliminary preparation in Economics, to better knowledge of English. Better communication and understanding between the Professor of G38.94 and the students is certainly desirable.

As reported above, Practical Training after the university courses was very useful and profitable, with the exception of the short training taken by two engineers at the Bureau of Reclamation. It must be noted that this training was arranged at the last hour, after it was known that training at Bonneville would last only six weeks.

There is no question that the engineers of the 3rd Group of the Educational and Training Program received good courses and good training.

Rio de Janeiro, December 1970



Ernani da Motta Rezende
CESE Coordinator

EMR/yvg

cc:Annex 1 - Report by U.S. Course Supervisor