

HISTORY OF ELECTRIC POWER IN BRAZIL: THE “ELECTROMEMORY” PROJECT

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Abstract

The “Electromemory Project” aims the identification, study and diagnostics of the documentary sources related to the generation, transmission and distribution of electric energy in São Paulo State, which pioneered industrialization in Brazil, ranging from 1890 to 2005.

For that purpose, field surveys have been conducted in private and public hydroelectric power dams and substations to map out the corresponding archival, librarian, museological and architectural heritages, recording their state of organization and conservation. Data gathering has been integrated with research, crossing over historical analysis with memory preservation efforts. The field results will be tabulated on the basis of a controlled vocabulary to allow for multiple connections among the different structures that have been found.

The research has as its starting point the archives of a public foundation (FES), as well as those of major electric power corporations in the state (*AES Eletropaulo*, *AES Tietê*, *CESP*, *CTEEP* and *Duke Energy*). The project has recruited senior researchers in the areas of history, archives, material culture, and documentation science, besides undergraduate students and graduate ones, and will include symposia and publications.

An interesting point is that the present electrical companies in São Paulo are the result of a series of successive regulatory and privatization waves in over a century of existence, amid several business mergers and splits, which have strongly impacted their conservation policies, with distinct results. A few of these companies remain in Brazilian hands, while the majority has been bought up by foreign investors.

“Electromemory” foresees the creation and structuring of a data basis containing the historical sources for academic research, to be managed by FES, and made available for public consultation; it is financed by the state’s research agency, FAPESP, under project number 2007/53866-4.¹

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1. General

Some preliminary results of the ongoing “Electromemory Project” – History of Electric Power in the State of São Paulo, Brazil: Documentary Sources, 1890-2005, which started in 2008, are presented in this paper. The heritages of main electric power companies has started to be diagnosed – three generators, *AES Tietê*, *CESP* (Companhia Energética de São Paulo), and *Duke Energy*, a transmission line company, *CTEEP* (Companhia de Transmissão Elétrica Paulista), and the distributor *AES Eletropaulo*. The Project has also contributed to complement the archive structuring of an energy history foundation – Fundação Patrimônio Histórico da Energia e Saneamento (FES).²

Electromemory is a joint project that assembles researchers and students of three institutions: the state Universities of São Paulo (USP), Paulista (UNESP), and FES. Since the beginning of the project integration activities have been practiced to ensure harmonic cooperation among those institutions.

The participation of FES has been valuable to promote contact among academic researchers and the power corporations, in order to facilitate data-gathering field expeditions to power generation units and substations throughout the state. One should also mention the use of FES premises, and the contribution of its researchers who were experienced with archives and document handling and gave training courses to teams of undergraduate students. On the other hand, as part of their practice, these students developed a catalogue for a series of historical documents previously provided to FES by one of the electric corporations (CESP).

A main part of the efforts during the first phase of Electromemory was dedicated to map and diagnose the documents related to the implantation and development of electric power generation, transmission and distribution.³ Given the interdisciplinary content of the project, it has been subdivided according to four interconnected axes: history, librarian science, archivology, and material culture. All of these aspects have been covered by four different teams, each under the coordination of a senior professor, mixed and integrated during the field expeditions, as well as along the project.

2. Historic Background of Electric Energy Introduction in São Paulo

The first initiatives leading to systematic use of electricity in Brazil were contemporary of, or arose immediately after, the pioneering use of this energy in Europe and the USA at the end of the 19th Century. At this moment the leading countries were living what has been called the Second Industrial Revolution, and conducted various

² The Energy and Sanitation Foundation (FES) replaced the São Paulo Energy Heritage Foundation, which in turn was based on professionals of the Historic Heritage Department, part of the then state-owned power distribution company, Eletropaulo, when this latter was privatized in the 1990's. FES Archives are located inside an operational area of that company's successor (AES Eletropaulo), and contain the company's memory since 1895 until the privatization.

³ The importance of the documentary approach for a project like this is discussed in BELLOTTO (2004) and PAZIN (2005).

experiments with the new energy source to create devices, machines and systems immediately applicable to the productive process. The improvement of mechanical processes of generation, the invention of motors, more efficient electric light, and power transmission and distribution systems opened up the economic use of electricity. The social and cultural transformations brought about by electricity, and later electronics, were about to begin and the fast spreading of electric applications attracted the industrialized nations – foremost Great Britain, USA, Germany and France. The less developed areas of all continents were a sizable market to invest the capital accrued by the fast growth of industrialization.

Electricity came into the Brazilian daily life at the decline of the Empire and sped up fast during the first years of the Republic, after 1889. People were at first curious about the novelties imported from Europe and North America, such as the telegraph and telephone, railways and, of course, electric energy. The public interest meant also the possibility to invest in this the gains resulting from coffee exports. Local capitalists felt that electricity was an opportunity to participate in a market which was fast becoming an indispensable part of the production system of the contemporary world.

It is not surprising however that the arrival of electricity sounded as a prelude to what became a continuous polemic within the new Republican regime: the fight around the belated industrialization of the country, which forcefully needed energy, and for that matter a dominant role would have to be played by electrification. The new “power and light” companies were in a country that was industrially poor in relation to the economically central ones and still debated its supposed “agrarian fate”, as a conservative oligarchy believed to be the country’s natural vocation.

There had been a considerable capital inflow to Brazil since the Portuguese crown transferred its administrative center from Europe to Rio de Janeiro in 1808, and this capital (mainly British) was directly or indirectly applied to inland and external commerce, as well as some types of manufactures and in urban services, including transportation. The tradition from the part of the small national bourgeoisie was that there was little interest to invest in areas other than land products and cattle. It was in this context that during the first two decades of the 20th Century the first local companies that provided public electric illumination and distributed electric power to private owners ended up incorporated by foreign investors. ⁴ This happened most conspicuously in the fast industrializing southern state of São Paulo, where the largest cities were its capital, São Paulo City, the harbor city of Santos and their surroundings, all in the eastern part.⁵

São Paulo City, followed by smaller cities and towns, adapted soon to the novelty, at first only for industrial machines and streetcar traction. ⁶ By substituting oil lamps in the house rooms and gas in the streets, electric light gave the air of modernity - electricity

⁴ DE LORENZO (1997), p. 159-184.

⁵ DIAS (1988)

⁶ SILVA (2008)

became an “object of desire” for the entire population. New working and leisure hours were thus introduced, and new habits were created.

During the first (“Old”, 1889-1930) Republic, Brazilian experts succeeded in assessing the possible new electric energy sources.⁷ The state of São Paulo was endowed with the famous “white coal”, as river basins were then called, as recently established by the State Geographical and Geological Commission. It should be noted that before this period a large portion in the middle and western parts of the State’s inland was uninhabited, uncharted, and the hydro resources were poorly known. The ensuing scientific and engineering effort in a westward pioneering fashion resulted in the future energy generation. Starting in the 1920’s, besides its rich coffee plantations, São Paulo became the most important Brazilian industrial hub, backed up by an electric capacity equal to half of all the country’s power production.

There were two types of companies marketing electric power in São Paulo state up to the 1930’s. The greater number corresponded to small companies which were either municipal or regional, organized by local farmers or businessmen. The second group was smaller but far more powerful in their investment capacity, made up of foreign companies which originated in the international finance system.

The demand for electric energy in São Paulo at first was spurred by the fast diffusion of public illumination services everywhere, including small towns and villages. In the medium-sized cities and the capital, besides street illumination, the streetcar service also enhanced the market growth. Following that, electricity participation as an industrial energy source grew rapidly, bringing the need for new and intensive investment to increase the supply. The small companies were unable to meet the fast demand growth, so they were bought up and power production became concentrated in ever wider corporations, in terms of concession areas, which meant that the international financial capital increased their participation. The American group *Bond & Share* (later *American and Foreign Power - Amforp*) bought the local *Companhia Paulista de Força e Luz (CPFL)*, and became responsible in 1927 for supplying electricity to 1/3 of the state area. On the other hand, the Anglo-Canadian *Light & Power Corporation*, which had existed since 1890, bought up a series of companies along the Paraíba Valley, in Sorocaba, Itu and Santos, and so became responsible for supplying power to the fastest-growing region in the country.⁸

This period of the electric sector history should be analyzed not only from the viewpoint of the supply crisis faced by companies and consumers, but also taking into account the ideological and cultural questions aroused by nationalist ideas, then defended by several social sectors, with different hues. The publication of the federal Water Code in 1934 is considered as the first decisive Brazilian state intervention in the electric area.⁹ At the end of the 1940’s the Inspectorate of Public Works (Inspetoria de Serviços Públicos –

⁷ MAGALHÃES (2000)

⁸ DINIZ (1996)

⁹ Cf. BARBALHO (1987), LIMA (1995).

ISP) was created in the state of São Paulo, subordinated to the Secretary of Roadways and Public Works.¹⁰ In the beginning of the 1950's, when Lucas Garcez took over the office of São Paulo State Governor, the first state power companies were created, and so began the construction of higher-capacity power plants that became the largest generation complex in the country, even though several of them were recently handed to private owners.

The year 1950, besides representing the paramount crisis of electric energy which entailed dramatic electric energy shortage in the following years, was also the beginning of the studies for the new Barra Bonita hydroelectric plant: two milestones of a new power era in São Paulo. The first one symbolizes and reflects the exhaustion of the previous model of both smaller local national capital companies and larger foreign companies. In both cases these companies had built only isolated systems, and in technical and planning terms this led to their stiffening with the demand increase beyond their possibility or willingness to expand.¹¹ The second one, Barra Bonita, is a plant designed, built and operated by staff and companies belonging to the new São Paulo State electric power structure, following a plan that had been previously set up, and it came to conclusion in January 1956.

From then on the state intervention and participation increased, with the creation of a Water and Energy Department (Departamento de Águas e Energia - DAEE), in 1951, and subsequently several state power companies: Paranapanema River Basin Electric Plants (*Usinas Elétricas do Paranapanema - USELPA*), in 1953; Pardo River Hydroelectric Corporation (*Companhia Hidrelétrica do Rio Pardo - CHERP*), in 1955; and finally São Paulo Electric Plants (*Centrais Elétricas de São Paulo - CESP*), in 1966, which incorporated the previous ones as well as most of the smaller private companies. The foreign companies were bought by the government, and so *CPFL* (in 1975) and *Light & Power* (in 1979) also belonged to the State of São Paulo, which could provide the whole chain of generation, transmission, and distribution (“vertical” power). These state companies allowed planning and constructing the plants that up to now build up the backbone of the state’s electric generation: Bariri, Ibitinga, Caconde, Euclides da Cunha, Limoeiro, Barra Bonita, Jupia, Ilha Solteira, Porto Primavera, Promissão, Avanhandava, Água Vermelha, Taquaruçu, Rosana, Capivara, Canoas, Xavantes, Jurumirim, Paraibuna, Jaguari.¹² An important aspect of the process was the simultaneous development of national engineering capacity for hydroelectric works, a basis for the future Brazilian consulting and design companies that gradually substituted foreign experts who had traditionally been in charge of this service – these new companies later contributed to the country’s economic development in the petrochemical and industrial projects in general.

During the military dictatorship which ruled Brazil (1964-85), energy planning and technical integration among the various state and regional systems were enhanced, resulting in their joint operation and supervision, controlled by a federal agency, Eletrobrás. That

¹⁰ The state’s Secretary of Roadways and Public Works was then under engineer Lucas Nogueira Garcez, who in the future (1966) would become the first president of the state-owned power company CESP, and ISP was run by engineer Catulo Branco, a staunch defender of electric power state control – cf. BRANCO (1975).

¹¹ MARANHÃO (2002), p. 381-408.

¹² PAIXÃO (1988)

was also a period of great hydroelectric projects, like Itaipu in Paraná State and Ilha Solteira in São Paulo, constructed with external financing, burdened by questionable political decisions of international institutions such as the IMF and World Bank, which resulted in heavy debt services, while the government's National Economic and Social Development Bank (BNDES) imposed rules that practically made electric investments prohibitive. It is important to recall that from the 1980's onwards the world lived the effects of a neoliberal wave, which preached deregulation and defended the advantages of handing over state companies to private initiative. The more recent presidential terms of Collor de Mello (1990-92) and Fernando Henrique Cardoso (1995-2002) made this process possible at the national level, while São Paulo Governor Mário Covas carried it on at the state level with much greater success, so that at the end of the 1990's several of this state's public services, including energy, were privatized.

The first change occurred in 1997 when VBC, a consortium formed by private groups Votorantim (cement, aluminum), Bradesco (banking) and Camargo Corrêa (civil construction), acquired from São Paulo State the control of *Companhia Paulista de Força e Luz (CPFL)*, thus beginning the privatization of the sector. The previous model of almost total control of the electric sector by state companies was substituted by a model where the businesses of generation, transmission, and distribution, which were vertically provided by the same authority, were subdivided and mostly transferred to private hands. In São Paulo, where most of the electric power was supplied by three state companies (*CESP*, *Eletropaulo*, and *CPFL*), foreign-controlled and private companies appeared again in the scene, such as *AES Tietê* and *AES Eletropaulo* (both belonging to *AES Corporation*, from the USA), *CTEEP* (Colombian *ISA*), *Duke Energy* (USA) and others, coexisting until this moment with a still relevant part of the state-owned *CESP*, though reduced to only a fraction of its former generation capacity.

The absence of public policies dedicated to electric technology, as well the dominance of loosely controlled foreign capital, add a counterpoint to the so often frustrated attempts made by the Brazilians to find their own way towards development.¹³ Many of the issues raised during this period of over a century are again in the agenda at the beginning of the 21st Century, at a time when privatization goes together with the lack of public infrastructure investments, and when the much-feared ghost of blackouts has reappeared. It is in this context that the Electromemory Project began its work of surveying the electric heritage of São Paulo.

3. The Field Surveys

The field surveys and the work with document series have provided material for 14 undergraduate and 4 graduate research projects in history and archivology.

The following map shows the regions of São Paulo State where the field surveys were conducted during the first year, at the plants of *CESP* (Paraná River and Upper Tietê River), *Duke Energy* (Parapanema River) and *CTEEP* transmission substations. For the latter, units were chosen which were more significant from the historical, archival and

¹³ BRANCO (2002), p. 117-225.

material culture viewpoints (Assis, Cabreúva and the Operations Center at Bonjardim/Jundiá).¹⁴

For the second year, the field trips included the power plants of *AES* (Tietê River and Pardo River Basins) and a substation and Control Center of *CTEEP* (Bauru). Preliminary results were presented at the Electromemory Symposium, University of São Paulo in February 2009.¹⁵

During the first year several meetings were held with board directors and managers of the companies whose memory is being surveyed - *CESP*, *Duke Energy*, *CTEEP*, *AES Tietê* and *AES Eletropaulo* -, to clarify the intended results, and obtain permission for the visits. It should be noted that both the private companies and the public one were worried about the confidentiality of information that might be deemed strategic, especially when they granted permission to access archives at the companies' centers of corporate documentation. Even taking this difficulty into consideration one can say that the results have been positive, although they took longer than it was initially forecast.

A very significant result was the cession to Electromemory Project of a mirror copy of the general list of documents of *Duke Energy*, originally kept at their Operations Center (at the Xavantes power plant). The corresponding documents include reports and many pictures, and date back to the building period of the parental *CESP* plants, they are organically structured and well kept at *Duke's* Central Archives, and are especially informative in regard to the recent privatization process.

A greater effort was necessary to obtain the equivalent list of *CESP* documents, due to the higher organizational complexity of this state company, which originated all the other privatized ones and is still responsible for energy generation at the Paraná, Upper Tietê and Paraíba/Paraíba River Basins. Negotiation to access this material had to go through several members of *CESP's* board of directors at a delicate moment, for there was an official expectation (that resulted frustrated) that the last state power company was about to be privatized.¹⁶ The remaining task is enormous given the size of the archive: around 52,000 boxes; over 50,000 technical reports; 334,000 drawings; 620,000 microfilms; 18,000 film rolls; 2,500 35mm-film rolls; 19,000 accounting books. To evaluate all this mass is not feasible with the present teams, so this will be done by sampling the material. It will then be possible to integrate knowledge to be acquired from this archive with the documents already transferred to FES on occasion of the previous privatizations that split up the original *CESP*.

¹⁴ *CTEEP* substations were also surveyed, where they were incorporated to the hydroelectric power stations, or were close to them (as in Jupia, Ilha Solteira, Salto Grande).

¹⁵ Electromemory Project has a *site*, periodically updated with information and photos of its main events, including the Symposium of February 2009, as well as research abstracts; it can be accessed at the address: http://www.fphesp.org.br/projeto_fapesp/projeto_fapesp.html

¹⁶ This archive is located at Alphaville, in the Greater São Paulo, in a private depot.



AS Tietê

- 1 UHE Nova Amadurecida 217,7 MW
- 2 UHE Itaipava 202,5 MW (Promissão) 202,5 MW
- 3 UHE Alvaro de Souza Lima (Barr) 143,1 MW
- 4 UHE Serra Bonita 140,6 MW
- 5 UHE Mogi Guaçu 127,8 MW
- 6 UHE José Estrela de Moraes (Fogão Verde) 123,62 MW
- 7 UHE Guaiçaba 121,3 MW
- 8 UHE Euclides da Cunha 108,8 MW
- 9 UHE Caramuru 86,4 MW
- 10 UHE José Estrela de Moraes (Fogão Verde) 123,62 MW

CESP

- 1 UHE São Carlos 304,8 MW
- 2 UHE São Carlos 302,5 MW
- 3 UHE Itaipava 202,5 MW
- 4 UHE Carlos de Campos 182,5 MW
- 5 UHE Itaipava 202,5 MW
- 6 UHE Itaipava 202,5 MW
- 7 UHE Itaipava 202,5 MW
- 8 UHE Itaipava 202,5 MW
- 9 UHE Itaipava 202,5 MW
- 10 UHE Itaipava 202,5 MW
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- 14 UHE Itaipava 202,5 MW
- 15 UHE Itaipava 202,5 MW
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- 17 UHE Itaipava 202,5 MW
- 18 UHE Itaipava 202,5 MW
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- 21 UHE Itaipava 202,5 MW
- 22 UHE Itaipava 202,5 MW
- 23 UHE Itaipava 202,5 MW
- 24 UHE Itaipava 202,5 MW

AS Eletropaulo

Área de Concessão - Distribuição

24 municípios da região metropolitana de São Paulo

1. São Carlos
2. Cajamar
3. Carapicuíba
4. Diadema
5. Itaquaquecetuba
6. Jandira
7. Jupiá
8. Itapetininga
9. Itaquaquecetuba
10. Jandira
11. Jupiá
12. Jupiá
13. Jupiá
14. Jupiá
15. Jupiá
16. Jupiá
17. Jupiá
18. Jupiá
19. Jupiá
20. Jupiá
21. Jupiá
22. Jupiá
23. Jupiá
24. Jupiá

Duke Energy International

- 1 UHE Itaipava 202,5 MW
- 2 UHE Itaipava 202,5 MW
- 3 UHE Itaipava 202,5 MW
- 4 UHE Itaipava 202,5 MW
- 5 UHE Itaipava 202,5 MW
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- 7 UHE Itaipava 202,5 MW
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- 11 UHE Itaipava 202,5 MW
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OCEANO ATLÂNTICO

4. Research in History of the Electric Sector

The material presently housed at the FES Archive is basically the historical documentation of *Light & Power* (since the 1890s until 1979) and its successor *Eletropaulo* (from 1979 to 1998), as well as some of *CESP*'s and its predecessors' documents. The heritage contains various types of company reports, technical works, labor lawsuits, press news about the company and the energy sector in general, besides an important photography and film archive, oral history recordings, cartographic surveys and some material culture components related to electric energy supply and illumination.

Initially some research guidelines were defined to let the undergraduate and graduate students choose their subject within the already existing FES Archive, to be possibly complemented by future material gathered during the programmed field surveys:

- Electric power and the economic development of São Paulo State: agriculture, industrialization, and long-distance transportation (railways and harbors).
- Urban landscape transformation as influenced by electrification, including transport and public illumination.
- Electric energy and daily life impacts, including appliances and electronics.
- Environmental, social and economic transformations at the river basins, due to construction of hydroelectric dams.
- History of electric companies and their corporate culture, including relationship with public.
- Energy crises, conflicts of privatization x state ownership, national x international capital of power companies, including costs and electricity prices.
- History of electric generation: dams and hydroelectric plants, thermoelectric plants.
- History of electric transmission systems, including towers, power lines and substations.
- History of urban electric distribution systems, including poles and lines.
- History of electrical technology and its applications, including Brazilian contribution where applicable.
- History of electric material manufacturers in São Paulo, including their advertising.
- Electric labor memory, including oral history of technical and administrative personnel, dealing with social and economic issues (including demands and strikes), and technical aspects (tools, instruments and methods).

- History of electrician training and electrical engineer schooling.
- History of architectural heritage and cultural material associated to electrification.
- Memory preservation in the electrical companies.
- Interaction of power companies with governmental energy institutions.

A common denominator passing through all these topics was defined as the main theme to be exploited at the international congress foreseen at the end of the Project: the history of the present energy crisis within the context of planning, state ownership and privatization of the sector.

5. Archivistics

Researchers and technicians specialized in archive conservation have created instruments for Electromemory Project to diagnose the archives of the participating power companies. For that purpose, forms were elaborated for observing and registering information about the heritage preservation conditions. With this diagnosis it is hoped to:

- Identify the state of conservation and the conditions of the documents' archive.
- Evaluate the environmental necessities for preserving the heritage.
- Define intervention priorities.
- Propose improvements for heritage management.

In order to achieve such objectives, the designed evaluation instruments map out the information regarding the heritage composition in terms of support and document types, use and users of the heritage as well as its access, archive and consulting environment, deterioration factors and risks, and damage intensity verified during the surveys.

The different forms used for diagnosis were filled out in paper and later converted to electronic sheets; they enable the identification from the macro space where the archive building is located, down to the document analysis level. There is then a first form for archive site identification, then further forms concerning the building where the archive is housed, the archive room conditions, and finally a form to identify the documents' condition in the room.

The privatization processes in the power companies during the 1990's created an interesting situation from the viewpoint of Archivistics. In the new concession (privatized) companies, the documents became part of two sets - private in terms of ownership, and public due to the public service rendered by the private owners. An ongoing consequence of this heritage fragmentation which will become ever more complex is the loss of organic

content of the power companies' archives.¹⁷ The documents kept at those companies are essential to study their administrative paths and can be arranged to allow the historical understanding of the subordination or commercial relationships among companies within the same group or in different groups, as well as the formation of well known monopolies, holdings and trusts.

During the expeditions to the plants the archivist situation was clearly perceived; in some places the state of the documentation is critically deteriorating because of bad conservation, and most of the top administrators show no understanding or interest about the accumulated documentary mass. They keep the documents, but don't use a lifetime table, or periodically dispose of them; moreover, there is little or no control of existing documents. Document consulting is minimal, and when necessary they have to resort to the memory of an older employee, or else to tediously manipulate document by document.

The documents registered in the first surveys showed to be important as historic information sources, and have various formats – texts, maps, pictures – covering an important life period of the companies. Because of the documents' dispersion and lack of control, several copies of original documents locally stored at the power plants became the only extant version, as for example plant construction drawings, since very often the present administrators don't know the location of the original drawings in their head office central archives.

The absence of a policy in the area of archives and the privatization process of these companies favor and deepen the document dispersion and break up the original organic organization. It is therefore urgent to discuss the destination of this documentation, as a great part has already lost its primary value but remains a valuable secondary source for research and history.

6. Librarianship

The document heritage of São Paulo State's power sector is nowadays under the custody of the Foundation for Energy and Sanitation (FES) and of different concessionaires, including the companies that are the object of Electromemory Project: *AES Eletropaulo*, *AES Tietê*, *CESP*, *CTEEP*, and *Duke Energy*. This heritage has been given diverse document treatments, not only at the several institutions that keep it, but also within a single institution, due to their different types, such as papers, books, pictures, museum pieces, etc., what makes it difficult to recover the documents and consequently produce historiography based on it.

The general objective of the librarianship component in this Project is to make compatible the different vocabularies of the various heritages to guarantee the creation of a social memory of electricity in the State of São Paulo, and so fulfill the goal of making it available to society through a consolidated data base for the purpose of recovering information. To make public the information content of Electromemory Project, a controlled vocabulary has been elaborated to represent, treat, and recover those heritages.

¹⁷ BELLOTTO (2004)

The intended terminology control aims to guarantee the presentation of terms and their interpretation, from the viewpoint of the chosen universe of electric energy.¹⁸ The underlying principle of this proposal is that the structured organization of terms, anchored in the network of logical and semantic relationships defined from the terminology of the domains which compose the vocabulary is one assurance of control of vocabulary meaning, provided the terms befall the form/content of the descriptors, differently from what occurs in an exclusively alphabetical list.

Together with the logical and semantic relationships among the preferential units – the descriptors – another relationship imposes itself in response to the economy principle, which belongs to all vocabularies, exerting functions derived from the notion of equivalence. The principle of economy pertaining to the words means: linguistic units with nearby meanings (synonyms, quasi-synonyms, specific terms) will integrate a single descriptor, reducing the number of units to be logically and semantically related. This resource at the same time makes it possible to access the system because it establishes a network among descriptors and non-descriptors, which is necessary for the arrangement between common language and terminologies.

The work of the librarianship team of Electromemory Project has also dealt with the consolidation of three different data bases used by FES, since each data basis has a different table of contents to represent and recover the documents that are inserted into the system.¹⁹

The controlled vocabulary phases already developed and those under preparation are:

a) Assembling the descriptor files; 10,048 descriptor groups were identified after the initial document analysis.

b) As the objective of the work is to map the historical heritage of São Paulo's electric sector through the use of an energy-controlled vocabulary, 266 descriptors of the "Energy" knowledge area have been selected to initiate the structuring of the semantic kernel through relationships established among them.

The thesaurus construction uses an electronic tool, free software TheW32, which subsidizes the creation, edition and printing of the alphabetical and hierarchical reports. After analyzing TheW32 data, there resulted 305 descriptors with 496 relationship insertions among them.

7. Material Culture

¹⁸ Cf. TÁLAMO (1997); BUCKLAND (1999).

¹⁹ These three bases are called Enerdoc, Enerbiblio, and Enermuseu, containing respectively document, bibliography, and museological data.

The material culture group has handled the concepts of heritage associated with objects and constructions of historical and cultural value, to be also treated as documents. The collected information will serve, in a later phase, to elaborate several cultural actions, including touristic tours to visit this electric energy industrial heritage.

The group has consequently focused on the conceptual definitions about how should the data gathering work be, including the discussion on what should be gathered. The main conclusion was that the industrialization profile would be used, based on the industrial heritage concepts of TICCIH.²⁰ Therefore only objects directly connected to the generation, transmission, and distribution of electric energy will be contemplated.

Concerning the architectural heritage, a paper/electronic form was worked out for the field survey that could be integrated with information from archives and libraries.²¹

The group also participated in the field surveys, which helped to consolidate the concept about museological perspectives and studies related to the power system's industrial architecture. The next tasks include the use of gathered data in the field for displaying the architectural heritage and the definition of how to treat the museological objects so far found.

8. Some Preliminary Results

The field expeditions were a rich source of information on history, archives, and material culture.

A first assessment resulting from the trips is that the corporate transformations imposed by the privatization and breakup of power supply formerly in charge of a vertical state organization forced a drastic downsizing in the companies' staff, with incentive plans for voluntary quitting, and the subsequent introduction of remote supervision, control and maintenance. On the other hand, even with the complete reformulation of the sector, in the new companies there still remains a unifying culture, attributable to *CESP*, the state company that was responsible for vertical power generation, transmission, and distribution throughout São Paulo State before privatization. This can be justifiably called "*CESP* culture".²² This trace allowed the identification of quite a number of people, both active and retired, who may subsidize oral history testimony in a future phase. A large amount of historical documents was locally collected as well, such as manuscripts, photos, films and

²⁰ Declaration of Nizhny Tagil.

²¹ The form was devised taking into account the inventories developed by: Portugal's Institute for Housing and Urban Rehabilitation; IPHAE/RS – Institute for Historical and Artistic Heritage of Rio Grande do Sul State (Brazil); and IPAC – Cultural Heritage Protection Inventory – Bahia, Brazil (elaborated in 1988 by several institutions, like the Secretary of Industry, Commerce and Tourism of Bahia; SPHAN- National Historical and Artistic Heritage Service; IPACB – Institute of Artistic and Cultural Heritage of Bahia). See also SCHLERETH (1985).

²² NOVA (2000)

texts, which only personal contact could account for. Even though at this point these documents are isolated, i.e. they aren't organically connected to an archive, they will help the effort to reconstitute the sector's memory.

In general one supposes that the document centralization, which is practiced both by state and private companies, would lead the remote administrative sites to have only a tiny part, or at most a mirror of the centralized documents. Places like substations and plants however keep documents with unsuspected historical value, a fact unknown to the central administration. An important item which is not always treated with due care are photographs, so often piled up in inadequate spaces and with no identification. There is an enormous difference between the archive accessibility of companies which can already count on a professional structure that implements modern archivist procedures (this is the case of *Duke*), and the other companies.²³ An important achievement during the surveys was the chance to deal an agreement with *Duke Energy* to receive a copy of all the company's list of documents kept at their Documentation Center in Xavantes.

One common denominator to the privatized companies is that there are documents, and sometimes also equipment belonging to another company, again a consequence that all of them belonged to *CESP* in the near past. Not always do the new companies, or for that matter neither does *CESP*, have the knowledge of this fact, which extends beyond operational and administrative documents of permanent value, to include other ones, e.g. log books and reports on flows and floods.

Some of the most important documents that were found during the field surveys, and which are in danger of going astray include the first Jupuíá Power Plant design (made in Italy by the Politechnical School of Milan em 1959) and Pardo River Basin projects (1957). They are particularly important because these were the first developments entirely taken up by Brazilian engineering. The boxes with Jupuíá's Project were indeed threatened to be cast away in a past "cleaning up", and it is now in a completely inadequate archive under bad environmental conditions, and difficult to access, in a depot outside the plant. The Italian project was taken over and totally redone by the first truly Brazilian engineering company, THEMAG, created during Governor Lucas Nogueira Garcez' term to design São Paulo's hydroelectric dams and made up of professors from the University of São Paulo's Politechnical School. The other document mentioned above, the dust-covered initial studies for the Pardo River plants lie now under very poor conditions next to a cleaning material shelter, at *CTEEP*'s Operational Center in Jundiá-Bonjardim.

In the case of the *CESP* power plants, the expeditions verified there is still a large amount of documents that remain decentralized, relative to environmental control, dam edge control, and lawsuits.

As to the plants' architecture, the teams checked the main styles adopted during the sector expansion which took place from the 1950's onwards, as well as the heavy solutions (as in Jupuíá) idealized by the military regime after 1964 to ensure high resistance against military and terrorist attacks. At *CTEEP*'s transmission substations there was a complete

²³ SCHELLENBERG (2004)

architectural remodeling after privatization; in this portion of the power system one sees the greater effect of area and personnel downsizing, thanks to the substitution of older technology using analog and discrete digital components for newer microprocessor-based ones with very compact space dimensions. There were also significant transformations in residential villages built for workers and supervision during the plant construction; the most conspicuous case is Ilha Solteira, but the phenomenon was observed also in internal buildings in other plants and substations – they have assumed other functions or have just been abandoned (as in Cabreúva).

Lastly, in terms of material culture objects, there is a multitude of situations, ranging from old equipment still in use but scheduled to be replaced in the future, as well as old large-sized equipment stored in warehouses, open yards and maintenance shops, to rich collections of old electric measuring instruments, some of them in use and others about to be sold as scrap. Because of the latter situation contacts were established by the project coordination that might help to rescue some of these items, and let them go to future collections of FES or another institution.

9. Final Remarks

During the expeditions, it was verified that in the surveyed power plants and substations there is an enormous and significant document and iconographic heritage, largely unknown by the respective administrations and memory centers. Technicians and engineers who work at these companies still show the marks of the pre-privatization verticalized culture, and they may contribute to oral history sessions. It is still possible through this array of documents and people to retrace the technological and corporate transformations of the last 50 years. What was found may in the future complement and integrate the archive kept by FES, provided there is a joint effort in this direction made by the companies.

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