

THROUGH THE HISTORY OF ELECTRICAL ENGINEERING IN CLUJ

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Abstract: *This paper presents the steps taken to ensure the illumination of the city of Cluj: with oil in 1827, based on gas in 1890 and finally the electrification project that began after 1904. There are rendered the steps taken in the development of electrical engineering in Transylvania, both by providing technical characteristics of the hydroelectric groups and generators used at different times, and by the descriptions of the solutions used in electricity generation and transmission. As well a significant contribution is played by the provided statistics on the growth rate of installed capacity requirements and also by the evolution of the demographic factor in Cluj area.*

It is highlighted the special contribution of Professor VASILESCU - CARPEN, rector of the Polytechnica University of Bucharest, in the development of the energetics in Cluj, as well as that of the local personalities who were part of the Joint Board of Administration, which provided management and distribution of electricity in Cluj.

Living in the spirit of Central Europe many of its personalities brought significant contributions to the development of electrification in the area.

The establishment of the Faculty of Electrotechnics in Cluj-Napoca is related to the name of Professor Liviu MANDUC, the paper presenting the stages of his career, and of that of the school of Cluj. Another personality, on which the authors insist upon is that of Professor Nicolae PATACHI, which is today at the venerable age of 92 years.

1. Introduction

Looking through the history of science, even if sometimes we feel that oblivion is stronger than the sense of measure, no question has the right to turn our actions into sand. There is a history of technique and of science that changed the dream into reality, and the one that finds merits in its pages can hope for the power to exalt the world for the better and the beautiful.

Concerns in the energy field have long existed in Cluj, but documentary confirmation only begins to have consistency in the eighteenth century. Resulting thereof, the oil lighting occurs in 1827, when the 247 lanterns shone for the first time on New Year's Eve. Then, in 1852, appeared a weekly publication seeking news presentation in this field, highlighting the perspectives of electricity, that already experienced a period of fascinating experiments and applications in the United States and Europe.

From this publication the readers in Cluj found out that in 1877, Iablocicov's "Northern Lights" created a stir in Paris and London, news that equally impressed Peles Castle. Edison's light bulb lit on October 21st, 1879 opens the "smokeless illumination" era and attracts the interest of the Department of Physics of Cluj University starting with 1880.

After 1890 the public illumination switches to gas based illumination and the extent of the application lead to the establishment of the "*Societății anonime de iluminat și transmisiune de forță*" (The Illumination and force transport anonymous Society). In its contract with the municipality after 1901 it appeared an important term consisting in the concession granting of the introduction of electric illumination until 1920, system that was used in Timisoara since 1899, where there were over 60 km of electrified network. At that time, Timișoara became famous also through the fact that on July 27th, 1889 the electric tram was inaugurated.

The issue of electricity valorization in Cluj was under prolonged conflict situations between the city administration board and the local private air gas company, this situation delaying the development in this field, compared to other cities.

2. The first Cluj hydroelectric station

Although the city's administration tried even since 1901 to take on a project of Cluj electrification, with all its benefits, only in 1904 a contract with Ganz Company was signed for the construction, on *Someșul Rece* river, of a hydroelectric station and the work began on April 12th, 1905, the commissioning taking place on July 15th, 1906. The contract with Ganz Company, signed on July 5th, 1904, really represents the beginnings of Cluj electric power station, which operated without interruption until 1948. We also noted that the construction of the hydroelectric station was entrusted to the Italian company Lenarduzzi.

The achievement of this project at 28.5 km from Cluj has proven to be a promoter of the electrical development in Transylvania. The power station had two hydroelectric groups with Francis turbines (on an horizontal axis) of 1200 hp, engaged at 420 revolutions per minute, coupled with three-phase generators (1,200 kVA, 15 kV and 42 Hz). The turbine's training was insured at a rate of 2.4 cm/s, with a fall of 50 m. The station also had a thermal group consisting of a steam engine (350 hp, 210 rev/min) coupled with a three-phase generator (300 kVA, 15 kV and 42 Hz).

The electricity transport to Cluj was done at a rate of 15 kV, with a line made of 6 copper wires (6 mm in diameter), mounted on oak pillars, except for the national road crossing area and in the vicinity of the Cluj station, where there were used metal poles. In 1906, the city's electricity network had a total length of 75 km, of which 70 km were aerial and 5 km were of underground electric cable. The second stage of the station's amplification is completed in 1909, with the commissioning of the reservoir (40,000 cubic meters of water) and of the third hydro group, similar to the first two, along with another 520 kVA (15 kV and 42 Hz) three-phase thermal group.

Due to the rapid growth of the peak load (460 kW in 1906; 1040 kW in 1909 and 1315 in 1910), Ganz concessionaire company built a new station in Cluj with two Lietzenmeyer-Diesel groups (of 600 hp each, at 157.3 rev/min) and three-phase Ganz generators of 600 kVA (3 x 3.1 kV at 42 Hz). The first transformer station operated in the current Hungarian Theatre piazza near the Faculty of Electrical Engineering, which until 1914 accomplished the required transition to 3 kV, in order to supply the public lighting system, that had 900 lamps along with 9 other electric arc light sources.

3. The extension of electrification in Cluj

In this context we can say that the electrification in Cluj was concomitant with that of the major European cities at the beginning of our century. Moreover, the growth rate of installed power requirements determined in 1907 the commissioning of a new 1200 hp turbine and of a new 550 hp thermo-energetic group. At the same time an approximately 40.000 cubic meters accumulation lake, that provided an energy equivalent to 4000 kWh, was set up. This became operational in 1909, when the number of city's electric lamps for public illumination increased with 500. It is worth mentioning that the dam on Somesul Rece river is in perfect condition even today, and the station was closed only in 1974, due to the development of Tarnița hydroelectric complex.

In energy, the demographic factor has an important role. Cluj population in 1864 was of only 26,683 inhabitants, in 1910 it reached 60,808 inhabitants, and as a result the Somesul Rece hydroelectric station, working to its full potential, it proved insufficient. Therefore, in 1911 Ganz company develops a Diesel engine power station running on Ilie Macelaru street, and two years after there are commissioned two others 600 hp Diesel engines, the terminal of the 15 kV line is moved from the front of the current Hungarian Theatre, in the courtyard of the thermal station and the urban distribution network system is carried out in low voltage (150 V) three-phase system. Electricity usage issues became increasingly important, and in the field personnel specialized in Brussels, Budapest and Vienna, while Cluj schools taught increasingly more electricity concepts.

In 1917, to increase profitability, the city terminated the contract with Ganz company, but signed another one, more beneficial (72% royalty versus 50% as the old one stipulated) for a 5 years period and at its expiry, in 1923, the contractor took over the facilities for its own, relying on future specialists of the first electromechanical engineers school in Romania, that was then founded. They actually participated in the third stage of the energetic development, that took place after 1927, when the Cluj station is equipped with two Diesel-Gratzer engine groups of (850/1000 hp, 180/214, 3 rev/min at 42/50 Hz), coupled with 1000 kVA (3.15 kW) three-phase generators, manufactured by "*Uzinele de Fier și Domeniile Reșița*".

We may say that then we lived in Central European spirit and the values of science and technology were assimilated through intelligence and tradition. Once it had happened, it will surely repeat, and such thinking encourages us to hope and look after what can be found within our reach and we haven't seen yet. Energy is responsible for all the motion and development, but it also represents the means to overcome the obstacles that inertia and cowardice rose to knowledge. Namely, in the end, it's all about people and how society values are discovered and made operable.

Cluj had 83.000 inhabitants in 1920, in 1930 reached 106,295, while in 1938 exceeds 115,000 inhabitants. The interest in electricity and its many applications is attested by the fact that at this stage came into being the "*Electromechanical engineers School*", the only one in the field, in Romania, being the precursor of the Polytechnic Institute and of the Technical University of today. The energy requirements became

stringent and in 1923 the first restrictions on electricity consumption appeared, even if several factories such as: "Atelierul CFR", "Uzina de apă" or "Fabrica de pielărie Rener" build their own power sources.

In 1927 energy restrictions were removed, despite the 30% losses of the produced energy, but the municipality experts analysed the perspective and began the efforts to obtain a one million dollars loan from a US-German firm. The global financial crisis and the New York Stock Exchange collapse made this idea inoperative, but the issue is resumed once with the 1929 "Ardealul" coal mines offer to which adhered the Belgian company "Electrobel", from Brussels. The tenderer proposed a thermal power station building in Aghireş (based on Sorecani coal resources) with an output of up to 50 MW and the energy transportation to be ensured through a line of 60 kV. On this occasion it was foreseen a new transformer station along with the new complex of necessary works in order to shift from 3 x 150 V and 42 Hz supply to the 3 x 380/220 and 50 Hz system. Electrification development prospects led to installations upgrading (the switch to 380/220 V and 50 Hz) and from an administrative point of view, the communal Electrical station became the "Uzinele Electrice în Regie Mixtă" through association with Electrobel SA from Brussels", that participated with a liquid capital of 30%. The new company signed a contract with Sorecani SA power station, built in 1931 near Aghireş, that provided annually at least 10 million kWh for Cluj requirements, transported on a 60 kV power main.

In the works carried out under the new contract an important role was played by the expert, professor and engineer Nicolae Vasilescu-Karpen, the Rector of the Polytechnic University of Bucharest.

Through an approval of the Council of Ministers (No. 396), supported by a Royal Decree (886/1930), it was founded a Joint direction that brought together the municipality with the tenderers and on October 15th, 1931 the first phase of the power station construction comes to an end. As a result 8.4 MW was ensured via modern technology: BBC (turbines), Ganz (generators) and ASEA (transformers), the line being built in its full length of 30 km on metallic pillars. Now, for the first time, the contract between the station and the coal mines was valid, namely in the purchase-sale contract the parties provided kilocalories marketing and not tons of coal!

At the same time, the Somesul Rece station proceeded to turbines replacement and generators rewinding, assuring thus the transition to 50 Hz. Then, in Cluj, 7500 electric meters were installed and in 1931 Siemens introduces the automatic system for public illumination ignition and quenching. In that time, the pillars had some metal cases with a glass screen, equipped with a fire alarm button. Therefore, in case of emergency, pressing the button submitted, in Morse code, a substation of the area where the fire was reported and afterwards firefighters were alarmed by phone.

In 1938, the energy produced by the stations that served Cluj was of 12.5 million kWh, the city having 16,749 subscribers and an annual consumption of 100 kWh per capita. This lead to the increase of the importance of the electromechanical engineering School, the graduates working in Turda station (founded in 1907) of the cement factory. They also had the task of solving transport technical problems from Sorecani

SA (October 1935). After 1948, the same station also fed Cîmpia Turzii, where in 1942 there were 2351 subscribers, who consumed 1.3 million kWh.

At that time, on the first Board of Directors of the Joint Administration, there were personalities such as: Professor Julius Hațieganu PhD (president, elected by the shareholders), engineer Henri Sarolea (Electrobel manager), Richard Tufli (vice-mayor appointed by the municipality) Manoilescu Grigore (coal mines manager) and the engineers Ricardo Cortazzi and Augustin Maior, that were appointed by the shareholders. On the steering committee the record for longevity was held by Eugen Munteanu, who even since 1927 was general manager, and also by Dimitrie Negru PhD who was appointed by the city administration as managing director. Trying to overcome the tough times that followed 1933, they intelligently contributed to the construction of the 15 kV line that linked Cluj and Turda.

4. Cluj region electrification

In Dej and Gherla area the electrification system was common and began even since 1908, only that the first stations installations were commissioned in 1910. Then it was built, on Somesul Mic, the concrete dam (30 m long and 3.8 m high) with open feeder (350 m) and an open drainage, 300 meters long. The station built near Mănăstirea village had a 450 hp hydrogroup (106 rev/min, 400 kVA, 6 kV and 42 Hz, three-phase) with a Diesel-Lietzenmeyer thermal group (400 hp, 350 kVA, 6 kV and 42 Hz, three-phase).

In 1913 the station was equipped with another thermal group, identical with the previous one, and in 1920 it was installed a Leobersdorf Diesel group (600 hp, 530 kVA) and are commissioned two new lines of 6 kV on Mănăstirea –Dej direction. Later on, a second Francis turbine hydrogroup was installed (250 hp, 250 kVA, 6 kV at 42 Hz) and a Lietzenmeyer engine was replaced by a 600 hp Sulzer Diesel engine. In Huedin city in 1941 there were 26 subscribers, the feeding being made through a 15 kV line from the Aghireș power station and the 220 V internal distribution network was ensured by a line with a total length of 6 km. The number of subscribers reached 300 in 1943, 400 in 1947 and over 600 in 1950.

The chronicles mention that in the geographical areas mentioned above, the works were made with the contribution of Cluj electromechanical subengineers. They also worked in the industrial power stations of the current Cluj county.

To illustrate the power use area in Cluj county, it is worth mentioning that by the year 1945 Aghireș, Băița, Cîmpeni, Ciucea, Codor, Cuzdrioara, Mănăstirea, Miza, Mintiul Gherlei, Ocna Dejului, Reteag, Galatiu, Urișor, Bagara și Inucu villages were electrified and during 1946-1950 electrification was extended to Baci, Bucea, Dîncu, Dorolț, Feleacu, Florești, Gilău, Iara, Macău, Mihai Viteazul, Nădășelu și Viștea.

By consuming energy people travel faster, light up the dark or build skyscrapers, similar to the pyramids. This energy consuming world teaches us that everything has its price in a universe where we have to go all the way for any hope, and also not to waste any of the gifts we received working. One mustn't go only to the end of hope, but also to the end of lucidity, because we can't exist for waivers.

Time is a fleeting appearance in terms of day and night, like a host that shakes the hands of a leaving friend and outstretches his arms to enclasp the newcomer. It may only be our imagination, a word, a review or a remembrance, a way of conceiving the existence of things, helping us separate what we do and do not know. But one can only forget time by making use of it.

5. Electrical Engineering College Precursors

During school time one realizes better than anytime that man represents a series of ideas that can't be interrupted, each being the shade of everybody else, and fully understands that there aren't any omniscient man, but only man that are always getting educated and learn permanently. Such a man was the engineer Albin Morariu (1905-1974) that was Born in Cluj on July 30th, 1905, a graduate of the class of 1924 of the School of technical conductors, the electromechanical specialization. After graduation he was employed as head of a workshop at the Institute of general Physics, where he worked until 1929. After 1930, he worked for 32 years in the Electricity Enterprise of the administration, playing an important role in solving regional electrification problems, where he involved students in electromechanic in the practical-productive activities. They got skills in their chosen profession by participating during summer practice at the upgrading of electrical installations, works occasioned by the switching to 50 Hz.

During the 1940-1944 war, Albin Morariu being the technical manager of the Somesul Rece station participated in the battles against the troops that had to destroy this objective, obtaining for his courageous actions the medal "*Virtutea Ostășească*" first class. Following the war, being engaged in the change of electrical installations from 3 to 6 kV and Cluj-Turda 15 kV line restoration, he maintained the same close relations to the Sub-engineers school. After 1949, A. Morariu is detached to the new *Electromontaj* Enterprise, which had as main priority, in zonal premiere, the building of the 110 kV line between Cluj and Câmpia Turzii. Afterwards, he returned to the station, and from 1950-1962 served as head of the Cluj Electricity sector.

Throughout all his professional activity he revealed competences won during its studies in the Cluj Electromechanical School, and as a man Albin Morariu made himself conspicuous in sports, being a great Romanian gymnastics champion, dominating this field with authority during 1926 - 1932, when he gained a major European competition held in 1932 in Prague. A multilateral sportsman Albin Morariu was also the captain of the table tennis national team in the Prague world championships in 1936, in 1939 Cairo and in 1946 Sofia, in 1963 he was awarded the title of "*Maestru emerit al sportului*".

In Transylvania, a true energetic pioneer was also the engineer Sigismund-Georg Dachler (1872-1951). Originating in a family that owned several operated by water mills, Dachler was impressed by the fact that Ganz company turned a water mill into a power station destined to supply, in 1889, with electricity the city of Caransebes. As a result, Dachler abandons Vienna Commercial Academy and entered the Polytechnic in Budapest and he obtained his electrical engineering degree in 1895 from the Technical

School in Winterthur (Switzerland). His professional debut takes place in Geneva at "*Compagnie de l'Industrie Electrique*", where he worked on high voltage transport lines and electrified railways realization. Making his self known, upon his return home he was recommended by engineer Oscar von Miller (designer of the power station in Sibiu) to lead Sibiu station (November 1st, 1897), and starting with 1905 he was Director of the Sibiu Electricity Company. Persevering, Dachler gets appointed, in 1928, General Manager of "SETA", one of the largest electricity companies in Romania. His links to Cluj and its electromechanical engineers dates from 1922, when he proposed an ample Transylvania electrification project with the financial participation of a Swiss consortium. As manager, he employment primary electromechanical engineers trained in Cluj and his statistics on electricity in Transylvania between 1910 and 1917 were materials used by the electrotechnique teachers in Cluj.

In 1920 he founded "*Asociația centralelor electrice din noile provincii ale României*" (The association of electrical power of the new provinces of Romania), which in 1931 merged with the "*Asociația Producătorilor și Distribuitorilor de Energie Electrică din România*" (APDE) (The Romanian Producers and Distributors Electrical Energy Association) and developed a statistical and information system to which contributed specialists from Cluj, from the Electrical station and from the School of sub-engineers.

Another personality, with significant implications in energy development was engineer Karoly Knizsek (1880-1968). Born on November 27th, 1880 at Brogyan, in the Czech Republic, he attended Triencin high school and afterwards the Kosice Superior Technical School, where he obtained his electrical engineering degree. His professional debut takes place at Ganz company in Budapest and from 1909 he is mandated to build the hydroelectric station from Mănăstirea village, near Dej. He supervised Dej, Gherla Beclean and Reteag electrification works, activating until his retirement in 1944. Being devoted to his profession, he returns after his retirement to eliminate the traces left by the war in the electrical installations and celebrated 50 years of activity within the same company. He doesn't stop on this occasion, in 1959, but worked as a project supervisor at the Cluj-Baia Mare 110 kV line and to the village transformation station. He represents the true man and a veritable example.

6. Founders of the Faculty of Electrical Engineering in Cluj-Napoca

If all those we have mentioned so far have contributed to electrotechnics and energetics development in Transylvania, no doubt the name of Professor Liviu Manduca Eng is identified with the establishment of the Faculty of Electrotechnics in Cluj-Napoca. He was born at Vista de Sus, in Fagaras County, on September 15th, 1909. He followed the courses of the elementary school in Racovița village (Sibiu) and between 1919-1927 "*Gheorghe Lazar*" high school in Sibiu. Then, attracted by science he became a student of the Faculty of Mechanics and Electricity within "*Regele Carol al II-lea*" Polytechnic, in Bucharest, where in 1940 he obtained his university electrical engineering degree. He undertook the position of engineer (head of department) in

Mârşa (Sibiu) weapons factory and beginning with 1943 he serves on the front, enduring years of imprisonment until the end of the war. Upon his return home, he was appointed chief engineer in SETA, Sibiu, in 1947, occupying the same position in *IRE* Sibiu and Cluj (1948), afterwards working as chief engineer at *Electromontaj* Bucharest and from 1951-1953 he became Deputy Minister and General manager in the Ministry of Electrical Engineering and Electrotechnics.

Between 1954-1957, engineer Alan Manduca is an expert and head of the Romanian delegation to the *EEC*, within the UN Economic Commission for Europe, in Geneva. From 1951 to 1960 he is also a part of the Romanian electrification Government Commission and starting with 1970 he is part of the national electrification system analysis State Commission. The period between 1953-1957 is characterized by a complex and rich professional activity, when he led *Electromontaj* Cluj. He became director of *IRE* Cluj between 1957 and 1962, position that he left for that of professor of the Polytechnic Institute of Cluj, in 1962, with the intention to start a Faculty with an electrical profile. In his youth professor Manduc believed strongly in consistent energetics study climbing the stairs of his career through intellectual merit and performance. He is the only professor of the Technical University of Cluj-Napoca, who was dean of two Faculties, in Mechanics (1963-1964) and Electrotechnics (1964-1972).

Through his effort of founding energetic higher education professor Manduca helped us to better understand that the true essence of man lies in his ability to think, to understand reality as well as in the power to change it for the better. Professor Liviu Manduca argued throughout his university career that through education man is prepared for a universal society, that warns him that he must know other systems than the ones surrounding him, and understanding them gives man the opportunity to appreciate and express a valuable judgment. He was a titular of the discipline "*Electrical energy generation, transport and distribution*", which he dedicated his life to, leaving behind appreciated lectures and scientific papers. Professor Manduca had a primary merit in the establishment of the Faculty of Electrotechnics and if we would not appreciate his work in this paper it would be like taking a handful of sand and throw it in the front of the mutilated Sphinx. And it will ignore it with bleary sand eyes, defying time and arrogance of those who believe only in the desert within themselves.

Another personality who linked his name to the beginning and completion of the Faculty of Electrotechnics, is Professor Nicolae Patachi. Born in 1920 in Dej, he attended *Andrei Muresanu* High School and then became a student of the Polytechnic of Timisoara, that he graduated from brilliantly in 1944, with the distinction "*Magna cum Laude*". He had mentors such as Plautius Andronescu, Remus Răduleş, Nicolau and Bakony or Ghermănescu, Tino and Bărglăzan, to name just a few of the elite time.

Accomplishing intellectual greatness, he did not to lose his inner child and went on the thin path between utopia and revolt, understanding that the targets that are the most important are the ones within our hearts and even if we do not reach them, they guide us.

From January 1953 he was an employee of the Polytechnic Institute, as Laboratory Chief of the Metals Technology Department, under the emeritus professor Alexandru Domşa.

Throughout the time professor Patachi served the faculty's interest as vice-dean, head of department or Senate and Faculty council member and as teacher of the beginnings he organized the first specialized laboratories. He published 33 books and academic manuals, over 100 scientific papers in the country and abroad, carrying out numerous inventions and innovations that have materialized his creative thoughts. Professor Nicholas Patachi made his debut in power engineering at Sibiu SETA company, in 1946, then activated in the *CFR* (Romanian Railways) Regional Telecommunications Service VII, where he designed electrical installations and power supplies. Afterwards he was transferred to *IPOCHIM* Cluj, where he developed power supply projects, electrical installations, water supply to a number of industrial enterprises (Ocna Mures Caustic Soda factories, Fagaras Explosives Factory and so on).

Over the time, professor Patachi led or was involved in 17 energy projects of national importance, most of which were included in the national strategy for the electrification of Romania. Professor Patachi remains not only a great teacher but also a versatile intellectual and a great scholar. His music and lyrics, his knowledge of foreign languages and spoken conversation, or his unmistakable allure among students in class or cultural club could not stand indifference and seemingly undiscovering time, he lived within, with a great detachment.

He is the founder of the instrumentation and metrology schools in Cluj, but as a teacher, Nicolae Patachi left students more than knowledge, more than books, he gave them a lesson. And amidst this moral is the today and the way towards the future. All those who have established in their memory a criterion, know that only bearing it in mind one can choose. Professor Patachi memories did not separate him from the world, but brought him closer, being convinced that wisdom does not need a museum, but a heart. He considered that man has every reason to transform into hope what he earned in school. Because the time we live in is the only one that really belongs to us, and depends on man the way it will look like. Professor Patachi fought with bare hands against sadness, but refused consolation. The laws of melancholy had always pushed him towards confessions and his culture rested on a sense of order that existed behind appearance. And for professor Patachi the duty to the school was similar to an omnipotent god that accepted no atheist.

Bibliography

1. **Dinculescu C.** (coordonator). *Istoria energiei și electrotehnicii în România*. Editura Tehnică, București, 1981 (vol.1)
2. **Ruga M.G., Feneșan-Maniu I.** *Oamenii rețelelor electrice din "Electrica" Transilvania Nord*. Date, amintiri, relatări, fapte. Vol.I, II și III, Editura Alma Mater, Cluj-Napoca, 2007
3. **Munteanu R.** *Condiționări și raportări istorice între civilizație și energetică*. Editura Mediamira, Cluj-Napoca, 1996 (în colaborare)
4. *Who's Who în domeniul energiei din România*. Editura IRE, București, 2006