Landscape and Electrical Transmission Lines: a Cultural Approach to the International Context

Stefano Morosini, Fabrizio Trisoglio*

Energy Department, Politecnico di Milano, via La Masa 34, 20156 Milan, Italy

Abstract — **From a technical point of view, the international debate about the history of electrical transmission lines is widespread. Overhead lines and pylons, however, could be also analyzed in their cultural, aesthetic and natural meanings. In fact, they are symbols of modernity keeping the pace with the evolution of structures and technologies - since their origins until the present time. This essay is based on a comparative method, focusing on the international, historical context. At the same time, it was conceived as a multidisciplinary approach, linked to different themes: History of technology, Geography, Social and Political History, Literature and Arts.**

Index Terms **— Art, Geography, Industrial Heritage, Literature, Pylons, Supply Systems, Transmission Lines**.

I. Introduction

This article suggests some contents inspired through the method developed in the French Historical Journal "Annales d'histoire économique et sociale", founded in 1929 by Lucien Febvre and Marc Bloch. The Annals School is a radical innovation of the traditional historiography. For the first time, in fact, its contributors took all social aspects into consideration and emphasized the concept of the collective nature of mentality. Therefore, the historical events appeared as less meaningful than the mental frameworks inside which every kind of decision and practice took form. To the Annals Schools is also due the first attempt of matching historical, geographical, cultural, social and economical analysis. Landscape description was used as an extraordinary way to represent the historical evolution with all of its slow, almost imperceptible changes[1]. This method can be applied to the technical theme of electrical transmission lines, since their first appearance, and through their development. In this way, the evolution of "electrical landscape" can be described inside a cultural approach and also as a topic of the "Civilisation matérielle" as well - like taught by Fernand Braudel.

Pylons and overhead electrical lines became symbols of modernity, and innovative landmarks not only of technical, but also of cultural evolution. If technicians realized this kind of innovation, first of all, artists, writers, geographers and historians, and even ordinary people became aware of it.

Another source of inspiration is an expertise spread in Anglo-Saxon area, called "environmental history". This branch analyzes the development of the natural context, not only in wild territories, but also in anthropic areas, considering how nature has been culturally represented, and how the applied policy of environmental protection has been related to in different social context[2]. Focusing on this methodological reference, this essay illustrates with some short notes how the fictional aspect of electrical lines has been treated by technicians, geographers, environmentalist, politicians, writers and artists.

II. The development of transmission lines from technical reviews

Since their earliest application of DC cables in the first power plants of Pearl Street in New York City (1882) and of Santa Radegonda in Milan (1883), electrical transmission lines have revealed themselves not only as an important technological aspect, but also as a social and economic innovation. Their impact in the local community was a clear demonstration of this.

At the end of XIXth Century, the development of electrical lines became the source of profitable debates between different and important engineers – quoted in many specialized electro-technical reviews.

Thanks to prestige of these scientists, it is possible to realize the different phases of development of transmission lines through a wide cultural approach in an international context. Very useful and interesting, for instance, is the technical opinion expressed by Guido Semenza[3] in his business trip reports.

* We would like to thank Professor Andrea Silvestri, for his fundamental contribution to the conception and writing of this essay. In respect of the same Professor Silvestri's own will, his name is not quoted in the Authors' List.

[1] P. Burke, *The French historical revolution: the Annales School 1929-89*, Stanford: Stanford University Press, 1990.

[2] A. W. Crosby, *The Past and the Present of Environmental History*, "American Historical Rewiew", October 1995, pp. 1177-1189.

[3] Born in London in 1868, Guido Semenza graduated in electro-technical engineering at Politecnico di Milano in 1893. Very soon he became one of the most important engineers specialized in the diffusion of transmission lines all over the world. For a long time Semenza has worked as Technical Director and Advisor of the Società Generale Italiana Edison di Elettricità. Besides, he has been President of: CGS (Centimetro Grammo Secondo - a Company specialized in Electrical Instruments founded by the same Semenza in 1896, with Camillo Olivetti), AEI (Associazione Elettrotecnica Italiana) and IEC (International Electrotechnical Commission).

In early 1880s, the first power plants were built only to enlighten the city centre. Just a restricted area was supplied with electrical stations, provided through underground DC cables.

Afterwards, many further power plants were gradually installed in the main urban contexts of the world, with different tasks (enlightening, electrical traction, industrial usage, etc.). Many of them were in compliance with the concept of "isolated plant". In an AEI conference, Guido Semenza reminded the underground disorder of several American cities, which were still in part supplied through electrical cables. To quote Semenza's original words: "Il sottosuolo della grandi città come New York, Chicago si trova in tale disordine che la posa dei cavi incontra difficoltà gravissime. Tubi di gas, d'acqua e di fognatura si incrociano nel modo più bizzarro, testimoni di impianti affrettati e da nulla disciplinati"[4].

These are not only critical thoughts of a European engineer against the uncontrolled and irrational development of the American underground supply system at the end of the XIXth century. They also show a different point of view based on rational studies rather than on the direct, typically American pragmatism.

In the 1890s, the new AC applications and the development of a universal supply system (for lighting, traction and power), promoted the first attempts to interconnections. In the meanwhile, however, the "War of Currents" (AC versus DC) had broken out. Cities had switched into a metaphoric "Battle field".

In the same years, the adoption of trolley elements encouraged the electrification of tramways[5]. Transmission lines became a new decorative element of the urban landscape, and changed its look.

This is Semenza's description of some curious features of the American primacy in electrical traction: "Il sistema di trazione più comune negli Stati Uniti è quello a filo aereo. Soltanto New York e Washington hanno il sistema a conduttura sotterranea (…) a New York per l'impaccio che i fili apportano ai pompieri nello spegnimento degli incendi così frequenti e disastrosi, a Washington per la preoccupazione di non guastare la supposta estetica di questa capitale costrutta dietro ordinazione"[6].

After the Internationale Elektrotechnische Ausstellung[7] in Frankfurt (1891) and the first long distance (175 km) transmission of hydro-electrical power in three-phases current (8,000 V), from Lauffen, power lines became for many countries not only an opportunity to improve their industry, but also a new way to reach technical primacy.

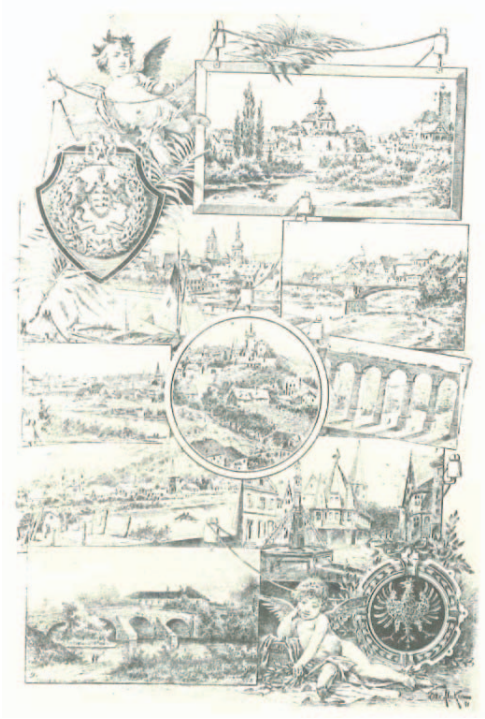

Figure 1. An artistic illustration with pictoresque scenes of the Lauffen-Frankfurt lines (1891) [4]

A new era had started. One year later, in 1892 in Italy was inaugurated the Tivoli-Rome electrical line (5,000 V - 28 km), the first AC transmission "point to point" in the world - for enlightenment and industrial purpose[8].

In 1894, Semenza visited England – mostly the London area. His report about the local supply system sounded as ironic and critic: "Le applicazioni della nuova industria si riducono all'illuminazione, a qualche raro caso di trazione (…). Usano facilmente le correnti alternanti per l'illuminazione ad incandescenza: ma la distribuzione di potenza per correnti polifasi la considerano ancora, come da noi si considerano i palloni dirigibili"[9].

[4] "The subsoil of big cities like New York and Chicago is in such disorder that cables find serious difficulties. Gas pipes, water and sewerage are crossed in a bizarre way, proof of hurried and not governed plants". G. Semenza, *Note sulle industrie elettriche negli Stati Uniti*, in "Atti della Associazione Elettrotecnica Italiana", March 1901, p. 17.

[5] A. Giuntini, *I trasporti e il paradigma elettrico dalle prime esperienze ottocentesche all'introduzione dell'Alta Velocità*, in [11], pp. 173-189.

[6] "In the United States overhead lines is the most common traction system. Only Washington and New York City have underground traction (…) in New York to protect firemen from the hindrances caused through wires, while extinguishing the very frequent, damaging fires; in Washington not to trouble the aesthetic aspect of the city". G. Semenza, *Note sulle industrie elettriche negli Stati Uniti*, in "Atti della Associazione Elettrotecnica Italiana", March 1901, pp. 24-25.

[7] International Electro-Technical Exhibition.

[8] Transmission lines supplied power to Rome with two-phases current. Only in 1899 Tivoli plant adopted three-phases current. See also: U. Ratti, *CX Anniversario della linea elettrica Tivoli-Roma, 1892-2002*, Roma: Università degli Studi di Roma "La Sapienza", 2003.

[9] "Enlightening, and in some occasional cases of traction are actually the only one form of application of the new industry (…). AC is used for incandescent enlightenment, whilst the power transmission through polyphase currents is still being considered like dirigible balloons are considered here in Italy". G. Semenza, *Le industrie elettriche a Londra*, in "Il Politecnico", November 1894, pp. 700-701.

In 1898, a few years later, Semenza was commissioned by Società Edison to project a transmission line for a new hydro-electrical plant in Paderno d'Adda. The aim was to supply power to Milan tramway system, in course of electrification.

The transmission line consisted of two parallel pilings[10] to lower the risk of accidental interruptions. For the first time were used metal pylons, manufactured by the by Officine Savigliano.

At that time, the one of Paderno d'Adda was the first most powerful hydro-electrical plant in Europe, and the second most important one in the world – after the Niagara Plant (1895). Actually, however, it was more innovative – as the transmission at 13,500 V over a distance of 32 km had not been tried yet.

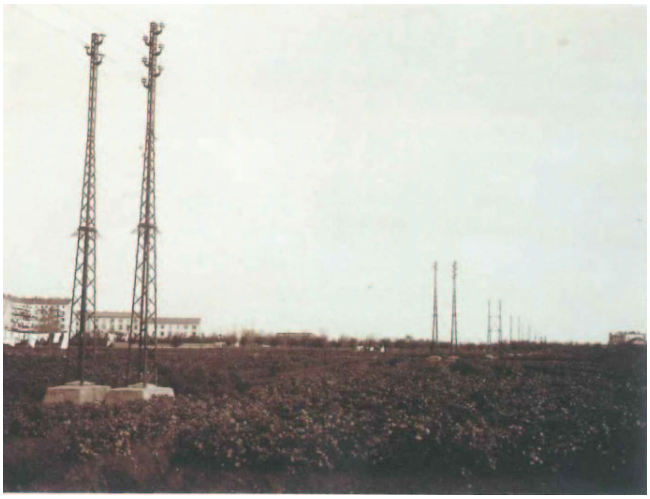

Figure 2. The Paderno-Milano transmission lines (1898) [8]

Comparing the Niagara's electrical line (11,000 V, 35 km), Semenza celebrated the italian primacy in transmission lines: "Gli americani sono superbi della linea Buffalo-Niagara, noi europei non possiamo dividere i loro entusiasmi. È una linea qualunque su pali di legno più o meno storti montati col sistema delle traverse orizzontali: sistema che (…) obbliga a tenere i pali molto ravvicinati e a far di tanto in tanto degli incroci di fili, i quali sono per lo meno poco estetici. (…) Non è certamente un giudizio partigiano il dire che da noi, nel vecchio mondo, le trasmissioni elettriche sono fatte meglio e funzionano in modo più soddisfacente delle americane. (…) Nelle cose in cui è d'uopo pensare molto, andar cauti, studiare con calma, la fretta americana porta conseguenze funeste"[11].

When he talks about the differences between Italy and other countries, Semenza says: "Le linee aeree, che pur rappresentano la parte più delicata delle linee di trasmissione, in generale sono progettate ed installate coi semplici criteri di una pratica consuetudinaria: pali in legno a 30 o 40 metri di distanza fra loro e fili tesi ad occhio: il tutto dominato dalla preoccupazione dello spendere il meno possibile nell'impianto. E questo non è metodo particolarmente italiano (…) anzi, se vi è qualche esempio di novità nelle linee, si riscontra appunto in Italia; (…) sono così poche le caratteristiche prettamente italiane dell'industria elettrica, che val la pena d'insistere perché queste cose vengano conservate e perfezionate"[12].

The innovative quality parameters enunciated by Semenza were primarily related not only to materials and components (insulators, overhead lines, iron pylons, etc.), but also to a rational study of all technical variables - like route, wind pressure and length of crossing.

In spite of all, Semenza summarized prophetically: "una delle precipue differenze fra il lavoro degli americani e il nostro è questa: che noi facciamo molte cose meglio e con maggior garbo; ma facciamo poco: gli Americani fanno forse meno bene ma fanno molto, incompatibilmente molto più di noi"[13].

Later, with the creation of the Californian transmission lines at 150,000 V (Big Creek-Los Angeles, 386 km, 1911-1913), the Americans showed to have learned the Italian lesson and their power lines became an international model of efficiency and technique.

In 1921 Semenza wrote a new report about the Americans transmission lines. The purpose, now, was to show "le ragioni del rapido progresso di quel paese nell'arte nostra"[14].

[10] The insulators, produced by Richard Ginori, were specially designed and were called the "Paderno" type.

[11] "The Americans are proud of Niagara-Buffalo's line, but in Europe we can't share their enthusiasm. The Niagara-Buffalo is an ordinary line, built up on wooden poles – actually not so perfectly straight: These poles are assembled through a horizontal beam system, which (…) expects poles to be kept very next to each other and requires sometimes the presence of crossed wire. This element, in principle, does not contribute to give a nice look to the final result. Certainly, it is not local pride what takes me to say that electric transmission lines in Europe are better made and more efficient than the ones of the New World. (…) To realize those projects which need long reflection, care, and well-pondered thinking, one should follow the principles of the American hurry - or the final result will be terrible". G. Semenza, *Note sulle industrie elettriche negli Stati Uniti*, in "Atti della Associazione Elettrotecnica Italiana", March 1901, pp. 33-34.

[12] "The overhead lines, which represent the most delicate element of transmission lines, are generally designed and installed in a simple way: wooden poles to 30 or 40 metres of distance between them, and randomly stretched wire. Everything is focused on the idea of working in the cheapest way as possible. This is not an Italian method (…) but, if someone is looking for innovative features in the lines, these ones can be found in Italy; (…) The typical Italian items of Electrical Industry are so few that it is worth to insist, in order to preserve and improve them". G. Semenza, *Linee moderne per trasmissioni elettriche d'energia*, in "Atti della Associazione Elettrotecnica Italiana", 1904, pp. 529.

[13] "One of the main differences between the American and the Italian way of working is this one: in Italy we do many things better and more gracefully, but we don't do so much; the Americans maybe don't work as carefully as we do, but they do paradoxically more – much more". G. Semenza, *Note sulle industrie elettriche negli Stati Uniti*, in "Atti della Associazione Elettrotecnica Italiana", March 1901, p. 35.

[14] "the reasons for the speedy progress in our art made in this country". G. Semenza, *Di alcune particolarità dell'industria elettrica negli Stati Uniti d'America*, in "L'Elettrotecnica", November 1921, p. 673.

III. CARTOGRAPHY, GEOGRAPHY AND HISTORY: SYMBOLIZATION AND CODIFICATION OF TRANSMISSION LINES.

In 1922 the geographer Olinto Marinelli published his *Atlante dei tipi geografici desunti dai rilievi dell'Istituto geografico militare*. This thick atlas consists of 78 commented tables, and introduces new conventional signs in Italian maps. Thanks to the analysis of territory features, which were increasingly modified through the human presence, Marinelli classified and exampled into maps so many cartographic types: drainage lands[15], fields, saltpans, canals, roads, towns, cities and factories, but also transmission lines, which he called "Conduzione di forza elettrica ad alto potenziale". In 1909 the Municipality of Milan built up a hydro-electrical power plant at Grosotto – a village in the Lombard Alps. The transmission line for the city of Milan was on the cutting edge: the length was 150 km, for a voltage of 65,000 V.

By the end of the XIXth Century the power stations looked like modern works. However, in some decades' time, (while technology was experiencing a considerable evolution process), these monuments of innovation became obsolete. In recent years some disused plants have become a part of cultural heritage that only industrial archaeology can preserve. Through the XXth Century, (with all of its political and ideological struggles), these buildings represented also a military target to be hidden or camouflaged[16].

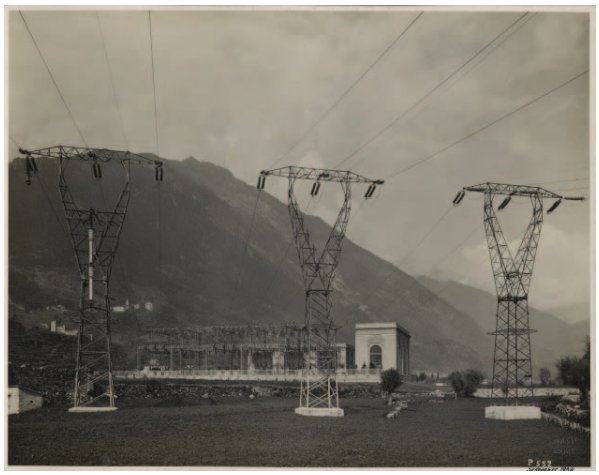

Figure 3. The new trasmission lines at 135 kV in Grosotto (1934). Photo by A. Paoletti from Historical Archive of AEM Foundation.

In Italy the debate about the landscape features in rural area had begun in the 50es and 60es of XXth century. In that period, Italy was experiencing a strong economic and industrial growth. The country regions lost population, who emigrated to the big cities of the North, and looked for a job in factories. In 1961, the journalist, historian, and Communist politician Emilio Sereni, wrote his *Storia del paesaggio agrario italiano.* This book was a pioneer work in the history of agriculture. In fact, beside the structural analysis of the territory, it also proposes frequent landscape descriptions, in which the action of human work is described inside its environment.

On the halfway between the historic and geographic context, the most interesting author in Italian Literature is Lucio Gambi, who was professor of Geography at the university of Messina (1953-1960), Milano (1960-1975) and Bologna (1975-95). Gambi wrote many geographic essays. His method was based on humanistic and historic approaches. The landscape descriptions showed in Gambi's works emphasize deeply the evolution of historical context and its effects on the landscape of the territory. The concept of "territory vocation" was introduced in Italy by Carlo Cattaneo, who founded in 1839 the Journal "Il Politecnico. Repertorio mensile di studj applicati alla prosperità e coltura sociale". In particular in his book *Notizie naturali e civili su la Lombardia* (1844), Cattaneo illustrates how the different kinds of society have organized their economical growth inside a specific geographic context, taking advantage of the natural resources and evolving the environment to a more and more articulated configuration. Lombardy has changed through the centuries from an ecological to an anthropic structure, in which people put the economic, scientific and social bases to evolve.

Lucio Gambi also developed the concept of "functional region", with its centres of attraction, urban hierarchies, functional distributions. His innovative geographical theories built up a new approach to leave the human imprint in the landscape during its time of evolution. Introducing the time factor in the geographical research means recognizing the main role of history, with its aspects and different rhythms: "Di fronte a tale complessità di fenomeni e di impulsi storici qual valore ha più – per ciò che riguarda la realtà umana – la ricostruzione di un «paesaggio» (anche quando lo si chiama «umano» visibile e topografico)? Non più quello di elementare schizzo estrinsecativo o di epidermica e facile constatazione (e qualche volta solo di impressione aurorale): che è pochissimo per chi vuol guardare nella realtà delle strutture umane, con mentalità non di ecologo ma di storico" [17]. This method of approach could be transferred to the electrical transmission lines. Pylons and overhead lines, in fact, are an absolute mark

[15] F. L. Cavallo, *Terre, acque, macchine. Geografie della bonifica in Italia tra Ottocento e Novecento,* Reggio Emilia: Diabasis, 2011.

[16] G. Battisti, *Associazione dei geografi italiani, Gruppo di lavoro su l'analisi geografica delle fonti di energia. L'impatto geografico degli impianti energetici. Nuovi scenari per la produzione, i trasporti e i consumi alle soglie del 2000*, Trieste: Punto Idea, 1993.

[17] "In front of such a complexity of phenomena and historical impulses, how much would be important – for human reality – the re-creation of a visible and topographic landscape (even when it is called "human")? Landscape will no longer be an elementary explaining sketch, or a simple and superficial statement (sometimes vague, like an element caught at the light of sunrise). This is just a little thing for the ones who want to look at the reality of human structures not under an ecological, but an historical point of view". L. Gambi, *Paesaggio umano*, in *Una geografia per la storia*, Torino: Einaudi, 1973, p. 174.

of modernity[18]. This landmark has the specific feature to go across different settings. In many cases electrical lines have their origin in alpine areas (where hydro-electrical power plants produce electricity), pass thought the countryside and reach the cities, or the industrial suburbs. These contexts (alpine, rural, urban or industrial) show different landscape features, but also have different effects in fiction. Therefore, transmission lines can be considered like an integrated historical source - in which conductors and pylons are physical and territorial elements.

IV. From Conquest to Protection: The Impact on Environment and Landscape

The first environmentalist movements were born in Europe at the time of the Second Industrial Revolution. Among them should be mentioned the National Trust for Places of Historic Interest or National Beauty (UK, 1894), the Société nationale de la protection des paysages (France, 1901), Bund Heimatschutz (Germany, 1904) and Comitato Nazionale per la Difesa del Paesaggio e dei Monumenti Italici (Italy, 1913). In this pioneer historical period such groups often advanced limited motions and petitions. On the one side, this was due to the small quantity of their members. On the other side, their scarce influence derived from the fact that their campaigns were based just on Romantic concepts – often incoherent[19]. Besides, their organization was not very well structured and co-ordinated. Electrical lines have been a positive symbol of the "conquest of nature" [20] perpetrated through those rising countries in which the economic future perspective looked like very favourable. Those countries, also, could count on plenty of electrical power. Only in recent years the ecological debates put into discussion themes like the risk for human health due to electromagnetic fields, the fatal injuries to birds (both for electrocution and collision) [21], or the landscape pollution caused through bad planning[22].

V. Political Language and Symbols

During the years of the Resistance against Nazi-Fascism, political parties who gave support to partisans were aware of the importance of a suitable electrical system for the economy of Italy in the after-war period. For this reason, a steady defence was organized, from the nazi-fascist attacks[23]. At the same time, in July 1948 the General Secretary of the Communist party Palmiro Togliatti, was shot, after being severely wounded. These events caused an acute political crisis in Italy, with a general strike all through the country. This caused a revolutionary attempt took place at Abbadia San Salvatore (near Siena). Some mine workers in action stations occupied the general electrical and telephonic junction between the North and the South Italy[24].

During the 60es pylons were a symbol of the disliked, authoritative Italian presence in South Tyrol. They were often mined by terrorists as a radical protest and a claim of separatism against Italy[25]. Between the end of 60es and 70es, Italy experienced a terrible political period called "anni di piombo" (lead years). Pylons and electrical lines were considered symbols of bourgeois state. In March 1972 at Segrate, near Milan, the famous publisher Giangiacomo Feltrinelli was found dead at the foot of a high-voltage pylon. Apparently he was killed through his own explosives, but no evident proof of this was ever detected[26].

Figure 4. A Soviet poster showing the strategic importance of transmission lines.

At the end of this brief analysis about the usage of electrical lines as a political symbol, there are also some interesting magazines published by Italian communist groups operating inside factories. Directly inspired by Lenin, who recited: "Communism is Soviet Power along with the electrification of the whole country", some workers of the steel pylons

[18] T. Higuchi, *The visual and Spatial Structure of Landscapes*, Cambridge: Massachussets, 1975.
[19] L. Piccioni, *Il volto amato della Patria. Il primo movimento per la protezione della natura in Italia. 1880-1934*, Camerino: Università degli Studi, 1999.
[20] D. Blackbourn, *The conquest of nature. Water, Landscape, and the Making of Modern Germany*, New York-London: Norton & C, 2006.
[21] V. Penteriani, *L'impatto delle linee elettriche sull'avifauna,* Firenze, WWF Toscana - Regione Toscana Dipartimento sviluppo economico, 1998. See also: *Position Statement on Birds and Power Lines. On the risks to birds from electricity transmission facilities and how to minimise any such adverse effects* adopted by the BirdLife Birds and Habitats Directive Task Force on 10th, May 2007.
[22] *Progetto territorio. Paesaggio elettrico. Problemi ambientali e di pianificazione territoriale nella realizzazione di impianti per il trasporto dell'energia elettrica*, Bologna: Provincia di Bologna, Assessorato alla Programmazione e pianificazione territoriale, 1996.
[23] M. Fini, F. Giannantoni, *La Resistenza più lunga. Lotta partigiana e difesa degli impianti idroelettrici in Valtellina. 1943-1945*, Milano: Sugarco, 1984.
[24] W. Tobagi, *La rivoluzione impossibile. L'attentato a Togliatti. Violenza politica e reazione popolare,* Milano: Il saggiatore, 2009.
[25] G. Bianco, *La guerra dei tralicci,* Rovereto: Manfrini, 1963.
[26] C. Feltrinelli, *Senior Service,* Milano: Feltrinelli, 1999.

Company SAE (Società Anonima Elettrificazione) of Lecco, published in 1970 a monthly periodical called "Il traliccio"[27]. In 1974 the National Committee of the Italian Communist Party published the monthly periodical "Linea elettrica. Mensile dei lavoratori comunisti dell'Enel e delle Aziende elettriche municipalizzate". In this case, the electrical line is a symbol of co-operation between the employees of different electrical companies – united to claim higher salaries and better working conditions.

VI. THE LITERARY IMAGINATION

In the Italian Literature of the XXth Century, two important authors like Italo Calvino and Primo Levi dealt with technical topics and spoke about electrical lines and pylons in their works[28]. In the 20 funny and fairy tale-like short stories of *Marcovaldo ovvero le stagioni in città* (1963), Italo Calvino describes Marcovaldo's family, who has emigrated from the country to a modern industrial city. There, they try to adapt to the new artificial and surreal urban context. In one of these short stories called *La villeggiatura in panchina* Marcovaldo sits in a bench and looks at a pylon like at the tower of a castle: "all'alto castello di traliccio che arrivava fino ai fili"[29]. In another story called *Un sabato di sole, sabbia e sonno,* Marcovaldo looks at some clouds floating through the sky, and thinks that the electrical wires are moving too: "Come corrono, – pensò delle nuvole. – E dire che non c'è un filo di vento! Poi vide dei fili elettrici: anche quelli correvano come le nuvole"[30]. In the story *II giardino dei gatti ostinati* the hero (Marcovaldo) looks at the nests on the top of the pylons, and sees the same as a symbol of the contrast between the two landscapes – the one of countryside and the one of the city: "E gli uccelli continuavano a fare il nido in tutti i tralicci"[31].

Primo Levi, was not only a writer, but a chemist too. When he came back from Auschwitz, he worked in the laboratory of a Painting Manufacturing Company. All of his books reveal a rational point of view, based on the illuministic concepts, and a positivist technical and scientific mentality, which trusts work and concreteness. Tino Faussone is the main character of the novel *La chiave a stella* (1978). He is a worker from Turin who travels all over the world (Alaska, Africa, Middle East, India, Russia), as assembler of cranes, pylons and bridges. Faussone loves his job, and during a Russian transfer, he has to assemble some pylons which "coricati sembrano scheletri di balene"[32].

VII. THE ARTISTIC IMAGINATION

Transmission lines, on the one side, have always had economic and social importance from the development of electrical traction and from the first applications of alternated current for transmission over long distances. Power lines, on the other side, are above all a symbol of modernity.

Like rail infrastructures, power grids used to be considered like a paradigm of progress, especially in high distance transmissions and in the connection between different regions and countries. For sure, they have contributed to the switching passage of landscape, from natural into technological.

The transmission lines - like power plants and urban lighting - are a key element of "the Electrical Imagination", well showed by the artist Raoul Dufy in his work "La Fée Électricité". Commissioned by the Compagnie parisienne de distribution d'electricité, the huge painting was exhibited in 1937 at the Pavillon de la lumière, in occasion of the Exposition Internationale des Arts et Tecniques Appliqués à la Vie Moderne. In the same year, at the Palais de la Découverte, Fernand Léger exhibited "Le transport des forces" - Purist synthesis of the importance of electrical transmission in modern life.

Figure 5. F. Léger, *Le transport des forces*, 1937, Biot, Musée National Fernand Léger.

The international exhibition in Paris, perfect example of the fundamental importance of electricity, represented an apical evolution which had transformed, since the late XIXth Century, the transmission of electricity from a picturesque element to a symbol of progress in the collective memory.

After the impact shock that the Industrial Revolutions had brought with their various technological applications [33], transmission lines and pylons have become a common element in the literary and artistic representation.

[27] A. Cerri, *Gli sviluppi della trasmissione dell'energia elettrica*, in [11], pp. 239-274.
[28] Many writers talk about electricity in their work. See: [7, 10-11].
[29] "The high pylon castle almost reaching the wires". I. Calvino, *Marcovaldo ovvero le stagioni in città,* Torino: Einaudi, 1963, pp. 12.
[30] "(Marcovaldo) thought of the clouds, and said to himself: How speedy they are running – though the least breath of wind is not whispering around. Then he looked at the electric pylon, which were running like the clouds". I. Calvino, *Marcovaldo ovvero le stagioni in città,* Torino: Einaudi, 1963, pp. 33.
[31] "The birds went on building up their nests on the top of the pylons". I. Calvino, *Marcovaldo ovvero le stagioni in città,* Torino: Einaudi, 1963, pp. 124.
[32] "lay down like many whale skeletons". P. Levi, *La chiave a stella*, Torino: Einaudi, 1978, p. 65.
[33] F. D. Klingender, *Arte e rivoluzione industriale*, Torino: Einaudi, 1972.

Hidden, shown or emphasized, power lines have been part of the urban and rural landscape, and then switched into an ideological element.

In fact, transmission lines are seen in three ways. First of all, illustrators and writers like Jules Verne and Albert Robida celebrated this new element of modernity with imaginative and prophetic visions of the electrical future (for example: *La vie électrique*[34]). By the way, many artists left out these topics in their works, and gave importance to the concept of nature highlighted by Rousseau, against human acts.

Another way of describing this aspect of landscape is showed by some contemporary illustrators like Achille Beltrame in Italy. In fact, in several illustrated periodicals ("L'Illustrazione italiana", "Harper's Weekly", etc.) distribution lines are seen and documented in an objective and realistic way.

Figure 6. An illustration by Albert Robida from his work *La vie électrique* (1890).

At the beginning of the XXth Century, urban landscape with its transformations becomes the main subject of modernity. Trams and traction lines were soon represented in various works. Some paintings by Carlo Carrà like "Piazza del Duomo" (1909), "Notturno in piazza Beccaria" (1910), "I funerali dell'anarchico Galli" (1911), illustrate the industrial growth of Milan. In the same years, Filippo Tommaso Marinetti, founder of the Futurist movement, wrote: "Milano […] è il regno dell'elettricità […]. A Milano non esiste orizzonte […] hanno messo le sbarre al posto del soffitto: per i tram elettrici, si dice"[35].

Figure 7. C. Carrà, *Piazza del Duomo*, 1909, Milano, Private Collection.

A few years later, in the different social and artistic context of the United States, Edward Hopper talked the tramway lines of Yonkers in one of his works named after these (1916).

Figure 8. E. Hopper, *Yonkers*, 1916, New York, Whitney Museum of American Art

The role of electricity in modern life was especially exalted by Futurism - in particular by Umberto Boccioni, the most important artist of the movement.

[34] A. Robida, *Le Ventième Siècle. La vie électrique*, Paris: A la librarie illustrée, 1890.

[35] "Milan (…) is the kingdom of Electricity (…). Horizon does not exist in Milan (…) they put bars to replace the ceiling – for electric tramways, they say", C. Salaris, *Marinetti. Arte e vita futurista*, Roma, Editori Riuniti, 1997, p. 24.

To celebrate the new urban and industrial landscape, Boccioni has always found inspiration from the electrical elements. This is already visible in its earliest symbolist works such as "Beata solitudo, sola beatitudo" (1908). In his drawing, Boccioni portrays factories, chimneys and transmission lines.

Figure 9. U. Boccioni, *Beata solitudo, sola beatitudo*, 1908, Milano, Private Collection.

If "Officine a Porta Romana" (1910), (with the representation of municipal power plant in piazza Trento), and "La città che sale" (1910-11) are the most important works by Boccioni related to the transformation of the urban landscape, "Elasticità" (1912) represents the perfect synthesis of light, speed and motion. In this painting are clearly depicted the pylons of transmission lines, which (like the chimneys) characterize the landscape of the Milan suburbs - dominated through the figure of the knight[36].

Power lines were also an important element in unfinished works by the futurist architect Antonio Sant'Elia. In his power plant projects, lines were not only technical, but also real structure and architecture elements.

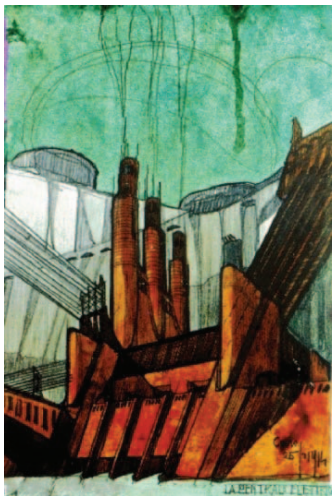

Figure 10. A. Sant'Elia, *Studio per centrale elettrica*, 1914, Private Collection.

Marinetti, in his numerous writings often admired transmission lines. For this reason Enrico Prampolini in the portrait "F.T. Marinetti. Sintesi plastica di Marinetti" (1924), painted a pylon on the left of the composition.

Figure 11. E. Prampolini, *F.T. Marinetti. Sintesi plastica di Marinetti,* 1924, Torino, Galleria Civica d'Arte Moderna e Contemporanea.

At the end of World War I, with the fall of Avant-gardes, Futurist movement evolved following different paths. However, the theme of power lines survived - often represented in rural context either by the Aereopittura movement ("Paesaggio Aereo", by Tato, 1932), or by a famous and versatile artist like Fortunato Depero ("Notturno alpestre", 1944).

Out of Italian area, in Germany transmission lines went on being an important feature of the industrial city in the realistic works by Hans Balusheck ("Feierabend", 1925) and in

[36] M. Fratelli, *Umberto Boccioni: Elasticità*, in A. Negri, *Esercizi di lettura*, Milano: Skira, 2002.

incisive and ironic representations of Otto Dix ("Arbeiter John", 1920) as well as in the Neue Sachlichkeit movement[37].

Figure 12. H. Balusheck, *Feierabend*, 1925, Berlin, Märkischen Museum.

In France, power lines became an important element of geometry. Le Corbusier and Amédée Ozenfant in *La peinture moderne* (1925), manifesto of Purist movement, celebrated the "power of geometry"[38] in contemporary cities. In this context of "return to order", Fernand Léger represented numerous pylons to symbolize the "New Age of Machines" ("La ville", 1919).

As pure geometric element and image of modernity, transmission lines became a symbol of control in the "century of ideologies". These elements celebrated both political authority and bourgeoisie.

Their usage in ideological terms is clear in the wall decorations of the Fascist Era, and particularly in the new and monumental Post Office Buildings of Trento, La Spezia and Palermo. Artists like Depero, Prampolini, and Benedetta Cappa (Marinetti's wife) contributed to their construction.

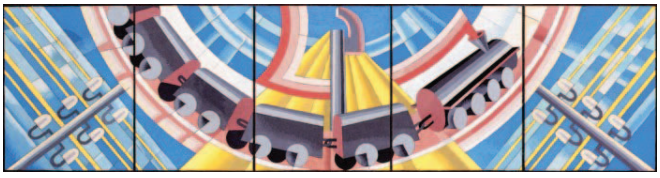

Figure 13. F. Depero, *Ferrovia* (sketch for the glasses of Post Office of Trento), 1934, Trento, MART.

But not only fascism used this symbol. Transmission lines are showed, under different points of view, also in several Soviet posters and in some works of the Mexican Muralism.

In 1939, the Sindicato Mexicano de Electricistas of Mexico City entrusted to David Alvaro Siqueiros the realization of a work which would become one of his masterpieces: "Portrait of the Bourgeoisie". This mural is a denounce of the alliance between entrepreneurs and fascism against the working class. The authority of capitalism is represented through pylons and transmission lines.

Again in the North-American context, (though with different meanings), transmission lines are often represented by the Precisionism movement - in particular in Charles Sheeler's "Conversation - Sky and Earth" (1940), or in Ralston Crawford's "Electrification" (1936), or in "Bright Light at Russell's Corners", by George Ault (1946). These works celebrated the great industry of the United States.

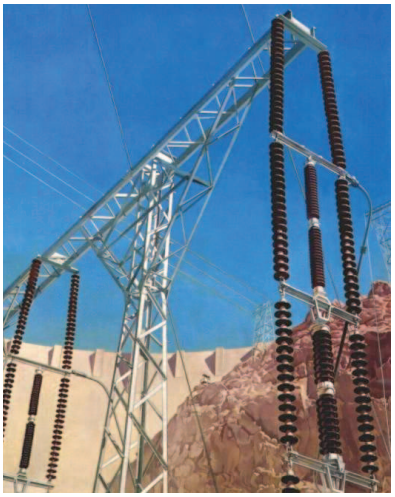

Figure 14. C. Sheeler, *Conversation - Sky and Earth*, 1940, Fort Worth, Amon Carter Museum.

In Europe, the presence of power lines as a symbol of reactionary bourgeoisie is visible in several socialist cartoons. Giuseppe Scalarini, inventor of the satirical cartoon in Italy and illustrator of the socialist newspaper "Avanti!", often painted in his sketches pylons and chimneys as a symbol of oppression (see "La mano del gigante", 1920)[39].

Beyond any kind of ideology, power companies promoted transmission lines as a symbol of beauty. Many hydro-electrical power stations (in Italy, for example, Carona, Grosio, etc.) showed their supply systems into big murals. However, their consecration can be remarked in some particular historical archives of power enterprises. Antonio Paoletti worked for various electricity companies, including Società Edison and Azienda Elettrica Municipale (AEM) of Milan. He left a huge photographic documentation that shows not only scientific and industrial progress, but also aesthetic research[40].

[37] A. Negri, *Carne e ferro. La pittura tedesca intorno al 1925 e l'invenzione della Neue Sachlichkeit*, Segrate: Nike, 1999.
[38] Le Corbusier, A. Ozenfant, *Sulla pittura moderna*, Milano: Christian Marinotti Edizioni, 2004, pp. 103-116.
[39] M. De Micheli, *Scalarini. Vita e disegni del grande caricaturista politico*, Milano: Feltrinelli, 1978.
[40] L. Leonelli, *Anni Luce. Immagini storiche dell'Archivio AEM*, Milano: AEM, 1997.

Figure 15. A photo of transmission lines' pylons from the Historical Archive of Dalmine Foundation.

Furthermore, photographic documents are used in various technical magazines (like "Electrical World", "L'Energia Elettrica", "L'Elettrotecnica", etc.) and in some House Organs like "il chilowattora" of AEM.

The archives of other manufacturing and supplying Companies show this kind of artistic objects. In particular of railway electrification, especially, a meaningful photographic documentation is stored at the Dalmine Foundation. Mannesmann's poles are visible on these picture. At the Pirelli Foundation, instead, are kept several photos of electrical cables. Another important issue is the presence of transmission lines in corporative communication, like the symbols of Companies in letter heads and share certificates.

Not surprising, either, is the fact that transmission lines are used by Companies and artists for advertising (see "Pali SCAC", by Fortunato Depero, 1937) and for self-representation (see the painting by Guglielmo Baldassini, "La ricevitrice elettrica sud dell'AEM di Milano in costruzione", 1934). Even film directors like Ermanno Olmi and Nelo Risi represented the electrical industrialization of the country in some scenes of their enterprise's movies[41].

In an academic context, at the Politecnico di Milano many frame of degree celebration show pictures of students near transmission lines, steaming locomotives, building sites and chimneys[42].

[41] B. Tobagi, *Ermanno Olmi. Gli anni Edison. Documentari e cortometraggi 1954-1958*, Milano: Edison-Feltrinelli, 2008; G. Canova, G. Bursi, *Cinema elettrico. I film dell'Archivio AEM (1928-1962)*, Milano: AEM-Rizzoli, 2011.

[42] O. Selvafolta, *Arte, storia e cultura politecnica nei quadri di laurea dal 1883 al 1939*, in A. Galbani, A. Silvestri, *Foto di gruppo*, Politecnico di Milano, 2005, pp. 25-48.

Figure 16. Transmission lines showed in a frame of degre celebration – 1922, Politecnico di Milano.

Today, power lines must face new challenges moved by the public opinion – such as environmental and health issues. In the post-modern era, some transmission lines are laid underground or conceptually transformed into design objects[43].

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[43] P. Berardi, A. Posati, M. Rebolini, R. Rendina, *Innovazione nelle linee elettriche aeree*, in "L'Energia Elettrica", n. 4, July-August 2011, pp. 19-29.