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POWER PLANT REUTILIZATION STRATEGIES

ENEL POWER PLANTS AND PORT OF GENOA CASE-STUDY

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Summary: This research is part of the present debate on the regeneration of public space through the reutilization of abandoned industrial buildings or buildings falling into disuse, which new condition has led to the creation of fractures in the territory and, in the worst case, to a situation of decay.

In this context, power plants are significant. In order for the power stations to provide energy in a reliable and safe way, they must be technically, environmentally and economically efficient. However, over time, some of these power plants have become obsolete or inadequate.

The objective is to demonstrate how the industrial heritage of these power plants can have an extraordinarily high potential value. Through the methodological research that has been undertaken we are aiming at analyzing the potential of the industrial heritage, which is intrinsic in each "architectural object", and also in the potential for its urban surroundings, landscape and soil renewal, plus its social, territory and symbolic aspects.

Finally, these strategies will eventually be applied to the case-study of the Port of Genoa and its coal-fired power plant that will soon be dismantled in 2020. This power plant is an example of a building conceived in an extra-urban reality that, with the progressive extension of the well-established city nucleus, is now found within a suburban context, or better said, sub-port context, an urban fabric where it has not been planned, neither in a functional level, nor in a social and physical connection level.

Keywords: Regeneration, Re-use, Resilience Industrial Heritage, Industrial Archaeology.

1. Introduction

This research is part of the present debate on the regeneration of public space through the reutilization of abandoned industrial buildings or buildings falling into disuse, which new condition has led to the creation of fractures in the territory and, in the worst case, to a situation of decay.

In this context, power plants are significant. In order for the power stations to provide energy in a reliable and safe way, they must be technically, environmentally and economically efficient. However, over time, some of these power plants have become obsolete or inadequate, mainly as a result of the modifications that have occurred in the surrounding environment.

In Italy, Enel (*Ente Nazionale per l'Energia Elettrica*) has identified 23 plants that have exhausted their life cycle and function. Among them, three typologies can be determined: the first typology corresponds to the power plants that could be converted to the production of renewable energies or to another type of productive activity; the second typology is which, for different reasons, cannot continue production and have no architectural, cultural or social value. The third one is which installations, despite not being able to continue producing, deserve their conservation and valorization.

The thesis deepens this last typology starting from the hypothesis of a reuse that guarantees the physical endurance of the building preserving the historical memory of the place.

It is intended to formulate intervention methodologies looking for similarities and differences between the different examples, analyzing both the typological aspects as well as their relationships with the physical and social environment, to try to create "families" that facilitate the development of these methodologies. We will analyze past experiences, strategies and results achieved in similar interventions, contemplating new uses and methods applicable to different contexts. The objective is to demonstrate how the industrial heritage of power plants can have an extraordinary potential to be valued. In this methodological research we want to analyze the potential of the industrial heritage, intrinsic to each "architectural object", but also of its urbanistic, landscape and land reclassification environments, as well as social, territorial and symbolic aspects. Finally, we will try to apply these methodologies to the case study of the Port of Genoa and its coal-fired power station, which will be decommissioned and returned to the city in 2020. The plant is an example of a building born in an

extra-urban reality, a progressive increase of the consolidated city, is now incorporated in a peri-urban or rather peri-port context, an urbanized fabric for which it had not been thought either at the functional level or at the level of social and physical connections.

2. Reflections on Industrial Archeology

The thesis is located within the framework of Industrial Archeology, as a discipline that deepens the knowledge of industrial history through an interdisciplinary method of studying the material and immaterial processes, direct and indirect.

The discipline of Industrial Archeology was born in the first half of the fifties in England having been one of the first states involved in the Industrial Revolution. Society began to question what to do with industrial buildings that ceased, preventing the demolition of those they considered important for their own past.

For these reasons, Industrial Archeology was more identified with the preservation of the Industrial Heritage, and it was only after the 1960s that a debate arose about the need for its evolution, to become a discipline that had to be inserted in the social history and its remains, as concrete expression of the way of production proper to industrial society (Negri 1978).

Except from Anglo-Saxon case, Industrial Archeology has not been able to provide a methodological and theoretical framework and in all countries the term Industrial Archeology has practically become synonymous with Industrial Heritage.

In Italy, Industrial Archeology began in 1977 with the constitution of the *Società Italiana per l'Archeologia Industriale* which was born with a specifically historical-architectural, rather than archaeological, interest until the 1980s when it entered the Committee for the Conservation of the Industrial Archeology.

We have identified three different approaches, over the years, regarding abandoned industrial buildings and spaces. The first consists in proposing totally new interventions from tabula rasa situations, without taking into account the preexistence; the second is to consider industrial buildings exclusively as Industrial Heritage, putting in value only their architectural values finalized for their conservation. The third approach is to study what exists, trying to put in value and safeguard the aspects that have to do, besides the intrinsic architectural value, also with historical and social value.

This last approach will be the starting point of the research that proposes to adapt and use the processes, typical of Industrial Archeology, to reach the necessary knowledge: the study of the place, the technology of the productive / constructive processes, archeological track generated by them, the means and machinery through which these processes have been carried out, the products of these processes, the related writings, the photographs, the oral knowledge and the landscapes marked by these processes, that is, the industrial landscapes.

We believe that, in general terms and as far as possible, it is important to maintain the industrial pre-existences and propose their reuse in order to preserve, in addition to the building, also the landscape which, in its broadest meaning, originates from a set of factors physical, anthropogenic and biological, which together have decisively influenced that place.

Architectural importance is not the only determinant, on the contrary, it may be marginal in cases where the relationship established by the building with the city is not only physical but also temporary, as an expression of what the building itself, and consequently the city, was at a certain historical moment. As Joseph Rykwert said: History and heritage are linked ineluctably and are part of living in a society (Rykwert 2010).

In reference to the Italian legislation on Industrial Archeology, it should be said that it is not directly part of the cultural heritage, it is not protected like classical archeology, rather as "things of artistic or historical interest". The law that determines this protection is number 1089 of 1939. It states that moving and immobile things, which have an artistic, historical, archaeological and ethnographic interest that have surpassed fifty years of time since its construction, must be put under guardianship. This becomes effective when an urban planning program of the city hall in which a building with these characteristics falls, attributes to it a protection and the typology of valuation attributed to the historic building.

In most cases the value corresponds to the "symbol" in which the building has become, as a recognizable monument of the "memory".

3. The re-use of the landscapes of electricity

3.1 Objectives

We have decided to focus research on power plants by studying them from the typological and spatial point of view, as well as analyzing the reuse experiments carried out or being carried out to identify their criticality and potentiality.

The reason for this choice comes from the opportunity to study specific cases thanks to the start of the Futur-E project of Enel, the Italian multinational producer and distributor of electricity and gas, which provides for the termination of 23 power plants in Italy.

The cessation of these plants is due to particular situations but, in general, has to do with the lower energy consumption by the industrialized countries, due to the economic crisis, which has generated a lower demand by the industrial sector, but also to the growth of energy efficiency, technological innovations of power plants, distribution networks and the increasing attention in not to waste resources and reduce costs by citizens, businesses and public administration.

Each power plant has its own specificities, context and intrinsic values, the initial objective of the thesis is to establish a general criteria to classify them in one of the following typologies:

The plants that could be converted to the production of alternative energy to continue the activity or to another type of productive activity;

- 1- plants that for different reasons, cannot be reconverted for productive activities and have no architectural value, urban, historical or social and therefore can be dismantled;
- 2- the plants that, despite not being able to continue producing, do have some architectural value, urban, historical or social and for which it is expected to return to the city through its re-use;

The thesis focuses on the latter typology. The main objective of the research is to provide methodologies for intervention and analysis in those scenarios where the return of these infrastructures of the industrial sector to the city and territory is advantageous, possible and timely.

The intention is to stimulate a biunivocal resignification between the city in transformation and the industrial heritage, in order to favor, where possible, an urban regeneration that takes as a starting point the dynamism and resilience of these places.

The process has to occur through a series of actions that involve an assimilation of the project and an exchange of proposals so that the uses coincide with the real requirements, making them part of an operating system and not circumscribed actions. The debate on how to trigger virtuous processes on the reuse of obsolete industrial spaces has to go through expanded tools of exchange and debate.

The decisions must take into account all aspects: urban, architectural, social and cultural aspects linked to the way of living the contemporary city.

Through the analysis of existing cases, the processes that led to their development and achievements, a methodological proposal could be generated, a useful starting tool for future work on these topics, a flexible, dynamic and open instrument to receive additions and updates through experiences and specific mappable and supervisable cases.

The result of this analysis will be the elaboration of a methodological form applicable to projects of conversion of power plants based on this data:

- Position value (urban, extra-urban or hybrid)
- Extent of the area of interest or relevance
- Forecast for the area
- Planning tools (which have regulated or regulate the transformation of use)
- Technical-economic and managerial models
- Ground property
- Management
- Scalar-dimensional aspects (taking into account the catchment area as infrastructure)
- Analysis of the sensitive elements of the project
- The architectural artifact
- Historical and social value. The memory of the place
- The potential for urban regeneration

It is proposed the study of the conversion of power plants, through proposals for hybridization of productive, cultural, receptive and residential uses. In practice, give the instruments that allow the intervention on the existing industrial heritage safeguarding it as a monument present in the urban fabric and involving all the actors, past and future, of those places.

Giving up these pre-existences, with the aim of creating new spaces from a *tabula rasa*, can bring negative results, especially in densified urban areas. Reusing existing industrial facilities through necessary new and useful uses as well as helping to preserve the historical memory of the place can help create a seam and continuity between the past and the future.

The case of the power plant of Genoa will serve specifically as an example of intervention in a strategic residual space, between port and city, waiting for its mending.

The final objective will be to propose a re-use of the power station that takes into account both the chronology, history, the building system of the building and the urban and social relations it has had with Genoa and its Port.

The research will analyze the urban scale, focusing on the modifications of the port through the movement and fall of the port-city physical barrier that began in the 1990s. In this process, which is reaching this part of the port, the role of the Power Plant may be fundamental, a hinge between the two worlds in a future perspective of new developments.

4.2 Examples

A search has been made and is being done to identify examples of power plants in the world that have gone through a reuse process. The following examples have been identified:

4.2.1 Central Lisbon Tagus | Museu da Electricidade

It began its activity in 1909, becoming the most important coal-fired power station in Portugal, providing electricity to Lisbon for more than half a century and giving work to entire generations of workers. It had different extensions to meet the new needs of power until 1944 when it began its decline due to the energy prioritization of hydroelectric plants.

The Tejo thermoelectric power station continued to operate until 1972 as a reserve center until the definitive closure of 1975.

The historical and social value of the building opened a process, supported by the citizens, to declare it Public Good, recognition that obtained in 1986 and that was the base to allow its conversion into *Museu da Electricidade* in 1990. In 2001 and 2005 the structure had important modernization works.

It is a classic example of Musealization of a building where the container and the contents are maintained and restored. The building itself is used as historical memory of its former function.

4.2.2 Montemartini Thermal Power Plant in Rome | Musei Capitolini

The center began its activity in 1912 and went through various extensions and enhancements: the main ones were the thirties (inaugurated by Benito Mussolini) and the one of the forties, in anticipation of the Universal Exposition of 1942, never took place due to the beginning of the Second World War. In 1997, a museum was inaugurated inside the Musei Capitolini with the exhibition named "The Machines and the Gods".

Also in this case the building and the machines are recovered, but with the objectives of using them as a backdrop fifth that merges, in contrast, with the classic sculptures. It is a kind of musealization, but not self-referential.

4.2.3 Bankside of London | Tate Modern

Its first factory was on the banks of the Thames as early as 1898 and over the years facilities have been developed from coal to oil with upgrading extensions, restructurings and demolitions.

In 1947 the old factory was demolished and the new one was constructed with the current image, in 1974 began its decline due to the energy crisis, the blockade of the oil market and awareness of environmental issues.

The Bankside closed in 1981 and was abandoned until 1994 when it was chosen to transform it into the place to exhibit the paintings given to the city by Henry Tate.

The winning architects of the project were Herzog & De Meuron who proposed a re-use of the iconic and representative spaces of the central. Today the Tate Modern is one of the most visited contemporary art space in the world.

This intervention reuses the main industrial spaces, their large size and height and turns them into exhibition containers of contemporary art.

The memory of the industrial building is obtained through the respect of its main spaces, renouncing the recovery of the machinery.

4.2.4 Nanshi Electric Plant of Shanghai | Power Station of Art

The Central began its activity in 1935 and ceased in 1955. After a long abandon was chosen as the venue for the first museum of contemporary art in China, it was inaugurated in 2012 as the Power Station of Art in Shanghai

The project proposes the maintenance of the imposing original structure as well as its chimney, to witness the Chinese industrial progress of those years. Today it has become a major attraction for the millions of tourists visiting the city of Shanghai.

The intervention strategy is the same as the Tate Modern. A re-use of industrial spaces for cultural purposes aimed at contemporary art.

4.2.5 Duisburg Meiderich Ironworks | Landschaftspark

The industrial center of Duisburg began its activity in 1903 producing steel, had 200 hectares worked with coal and had its own power plant. It was in activity until 1985 when it closed by the European Steel crisis.

Also in this case a citizen action prevents its demolition. The state of North Rhine-Westphalia acquired its property inserting it in a process of landscaping renovation, economic and social that impelled an architecture competition.

The winning project of the arch. Peter Latz foresaw the reduction of pollutants through phyto-remediation and finally the re-use of the complex as a recreational-cultural amusement park of more than 180 hectares, thanks also to the support of private capital.

The power plant, 170 meters long and 35 meters wide, is now a flexible container that hosts events of different scales throughout the year.

The Landschaftspark opened in 1994 has created a cultural environment in the region based on a process of economic reconversion, favoring the redevelopment of the area and offering new perspectives of development for the community. A place of aggregation that has appreciated its old industrial history.

In this case we have opted for a mixed strategy: on the one hand we have recovered and maintained buildings and some machines, reusing them for playful purposes, and in others, as is the case of the power station, it has been decided to value spatiality and scope of the architectural space, renouncing the recovery of the old industrial machines.

The turbine room becomes a flexible and versatile space, a backdrop for different activities throughout the year.

4.2.6 Kraftwerk Mitte de Berlin | Kraftwerk Berlin

Built in the same years the Berlin Wall was in operation from 1964 to 1997. In 2006, Kraftwerk became a hybrid space for events, exhibitions and techno music.

As in the previous project, the re-use of architectural spaces for recreational and cultural uses is proposed. The difference is that, by using all the available spaces and not only the turbine room, very different scale activities can be proposed.

4.2.7 Duisburg Battersea Power Station of London

Battersea Power Station has been one of the UK's first coal-fired power stations, built in the 1930s and has been in business until 1986.

The building was then placed under protection as a Monument of National Interest, until in 2012 it was sold to a private that foresaw the realization of an hybrid space with shops, residences, public spaces and for leisure.

The realization of the projects, whose masterplan was realized by the architect Rafael Viñoly, has begun in 2013 and its completion is estimated in 2025.

In this case, the private component of the project is strong. Buildings are proposed around the central building to make the intervention sustainable. Regarding the original building, the proposal is to recover the original architectural space, forgetting the machinery, mainly to propose commercial and tertiary uses.

The state of the art studied to date demonstrates how the strategies of intervention in the re-use of power plants go in the direction of private interventions that can take an economic profitability from the re-use interventions that normally require a strong economic effort.

We understand that, in general, the saturation of cultural containers and the difficulty of being economically profitable leads to the introduction of the concept of functional hybridization to make these operations sustainable, and to attract private capital that can take charge of reuse and recovery of these buildings.

The thesis will analyze not only the architectural aspects of the examples, but also will deepen in the rehabilitation and urban regeneration aspects, where they exist.

In the absence of specific examples of power plants, the range will be opened to other types of industrial buildings or infrastructures, in order to concentrate precisely on urban aspects, understanding that the aspects of urban regeneration do not depend directly on the typology of the building, rather than intervention strategies.

4.3 The Enel Futur-E project

From this cluster of comparative experiences the research wants to analyze the buildings that are part of the Futur-E project of Enel, the first electric operator in Italy.

This project focuses on a real and very current situation, the reconversion of 23 power stations throughout Italy (Fig. 1) which are about to be shut down for different reasons ranging from obsolescence to environmental problems or economic opportunity.

In this context Enel wants, with the FUTUR-E project, to take responsibility for this transition, with the widest consensus of the community and stakeholders, starting with its former workers.

A territorial analysis is being carried out in order to define the potential of the plants, through the conversion proposals in different production facilities or with totally different uses.

Since the middle of 2015 Enel has started to work on concrete proposals regarding some of these plants and the research is monitoring these projects finalized to an analysis and evaluation of the results achieved within 2 years.

We will try to extrapolate the results and understand which of them and why they have failed and / or succeeded, trying to apply the methodological chart previously elaborated, through the case studies, to test and eventually modify or improve it.

5. The Port of Genoa Thermoelectric Power Plant

The case study of this research will be the Genoa power plant, projected in 1927 using the best techniques of industrial architecture with the anticipation of future expansions and enhancements that were produced in the years 1951 and 1957 (Fig 2-7). In recent years production has been significantly reduced, mainly due to the limitations imposed by environmental reasons and the beginning of a process of cessation of the production activity expected for 2017. The plant, linked by the *Soprintendenza dei Beni Architettonici and Ambientali* as a building of architectural and historical interest, will be returned decontaminated to the Port Authority in 2020.

No concrete strategy for future re-use is envisaged for this center, and in the coming years a citizen debate will be opened on what to do and how to do it. (Fig.8-9)

The research wants to be an instrument that supports and helps in this process and, to do so, it will be fundamental to analyze the development and changes that have affected the port of Genoa in the last 30 years. Since the 1990s, the Genoa administration had the intuition to invest in the port, to open up to the contemporary world through new projects, subtracting it from the industrial port and assigning it to the city (Fig. 10).

This process of urban reconquest of the port areas has been possible using, in this particular area of the city, much of the public investments that have concurred in Genoa and major events listed as follows:

- The 1992 great exhibition which, as in Seville, commemorated the fifth century of the Discovery of America;
- Its election as G-8 headquarters in 2001;
- Its designation as European Capital of Culture in 2004;

This virtuous process that has turned the port into heart of the city has been developed from the east of the port to the west and has stopped right at the *Lanterna*, the symbol of Genoa (harbor lighthouse) with a quite fortunate pedestrian promenade due to its sinuosity and mixtures with the port and road infrastructures, which closed the interventions of the historical port. In 2014 a museum has been opened at the base of the Lantern and activities of different nature are organized in its surroundings. But only the museum fails to activate virtuous processes of recovery of

these spaces that are strongly characterized by the industrial presence and the port infrastructures. The power plant in Genoa is tangent to the *Lanterna* and the opportunity for its cessation and the hypotheses about its reuse can be the key to round up the recovery of the *Porto Antico* and to re-stitch this space to the city (Fig. 11).

Through a co-tutelage program, a work is being carried out, together with the *Dipartimento di Scienze per l'Architettura della Scuola Politecnica* in Genoa, on the dynamics between spaces between city and port. We try to identify the most appropriate intervention strategies, with the intention of testing the methodological premises, considering the specific case of the Genoa Power Plant in its urban area of reference, the port, with its specific dynamics and actors.

The research on this power station is located in the context of the evolution of the coastal system and specifically on the port-urban boundary of the city. It is located in the port area at the foot of the *Lanterna*, lighthouse and symbol of Genoa, and a few hundred meters of residential neighborhoods and the cruise terminal and containers. It is configured as a horizon of great potential that can help to promote the integration of these spaces in that process, begun in the nineties, which has returned to the city the contact with the port and its maritime spaces.

This research is currently carrying out a deep typological study of the power plant of Genoa through the collection of data, designs and photographs thanks to the various archives that reconstruct its architectural and cultural history: central archives in Genoa, archives Port Authority of Genoa and central archives of ENEL in Naples. A lot of unpublished material has been found and is being organized and classified.

6. Conclusions

In the contemporary world it is indispensable to work on methodologies and typologies of reuse interventions in order to introduce a sustainability criteria. The research project is based on this need, trying to respond to the disuse of industrial spaces in urbanized fabrics and in particular that of power plants.

The research aims to identify intervention techniques for this buildings typology that take into account their spatiality and constructive systems and also the international experiences.

The study of the case-study will lead to the verification of the intervention methodologies identified through a proposal of project strategies that will take into account the typology, its historical importance and the potentialities towards their reuse.

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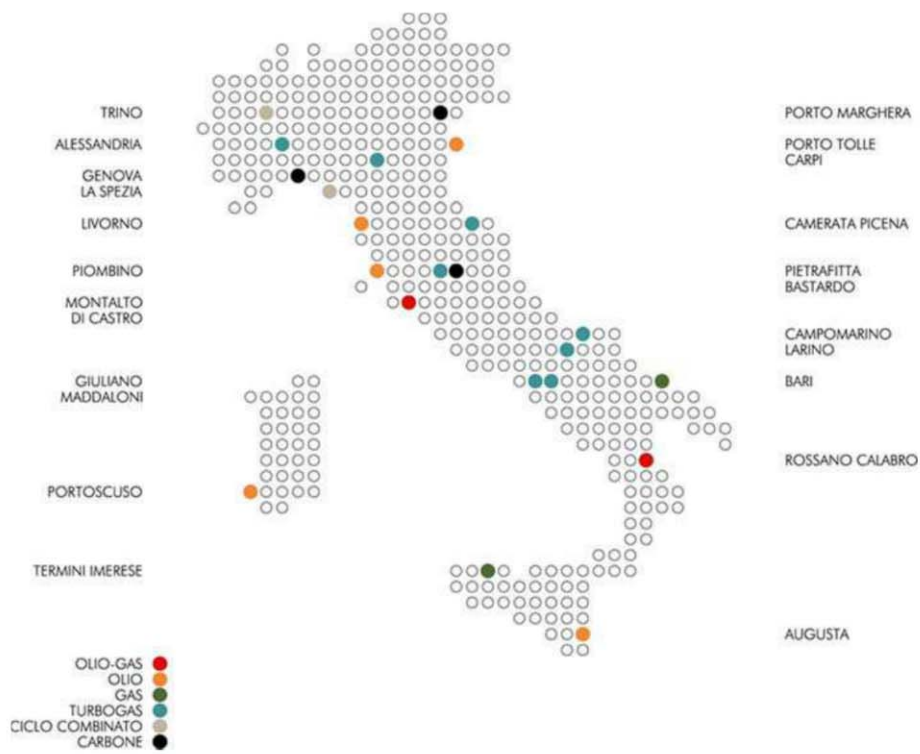


Fig. 1 Las 23 Centrales del Proyecto Futur-E

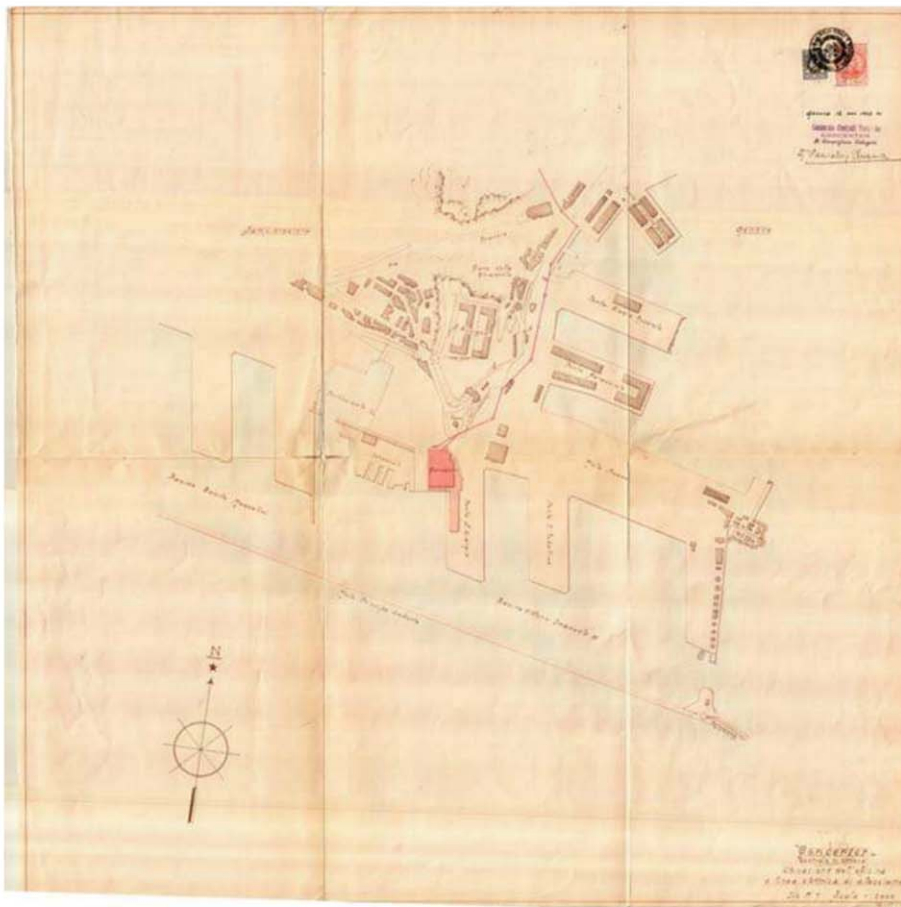


Fig. 2 Planimetría del proyecto original

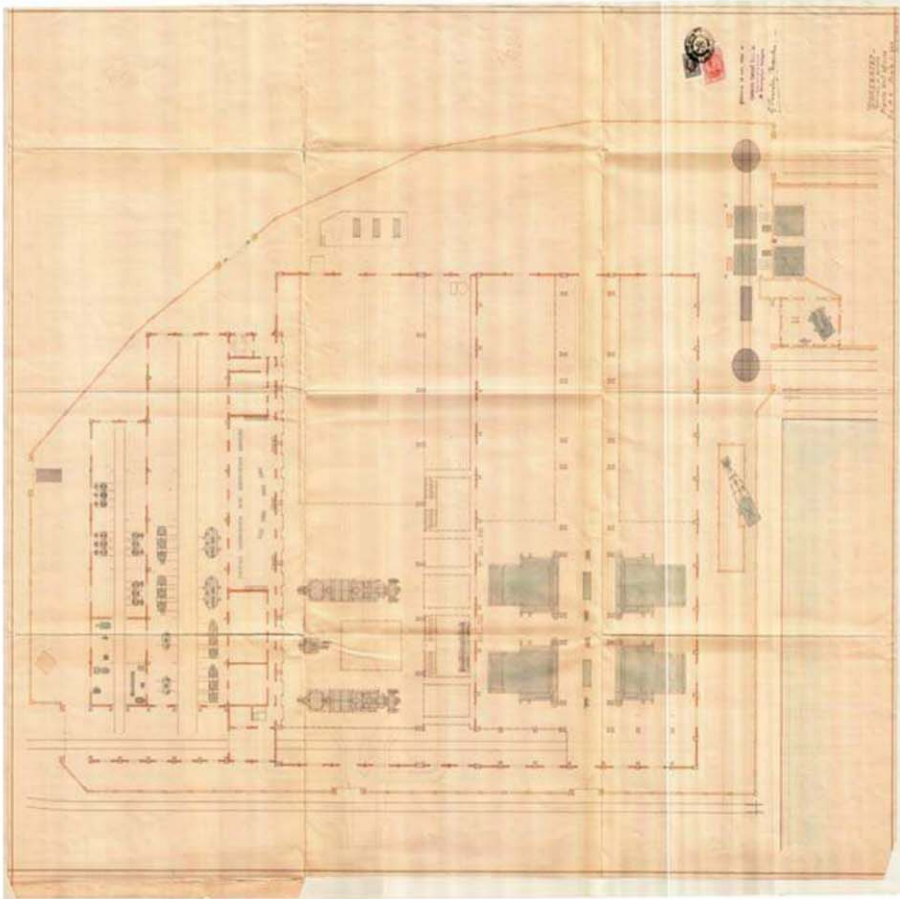


Fig. 3 Planta baja del proyecto original

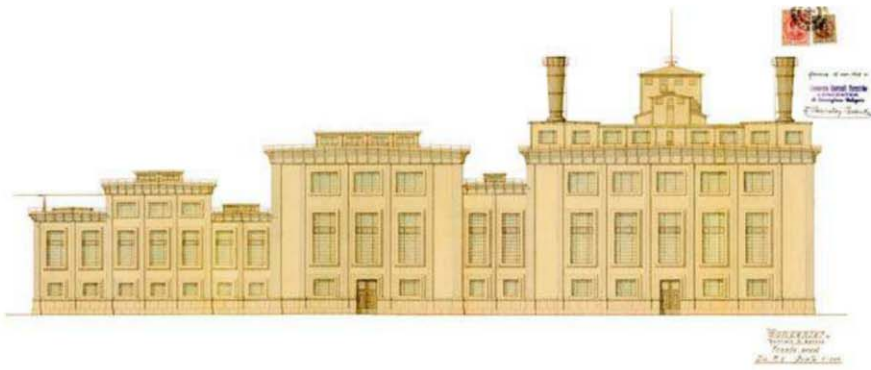


Fig. 4 Alzado del proyecto original

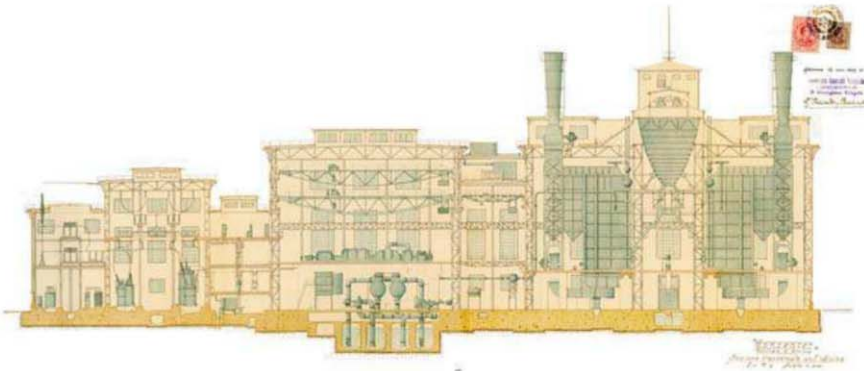


Fig. 5 Sección del proyecto original

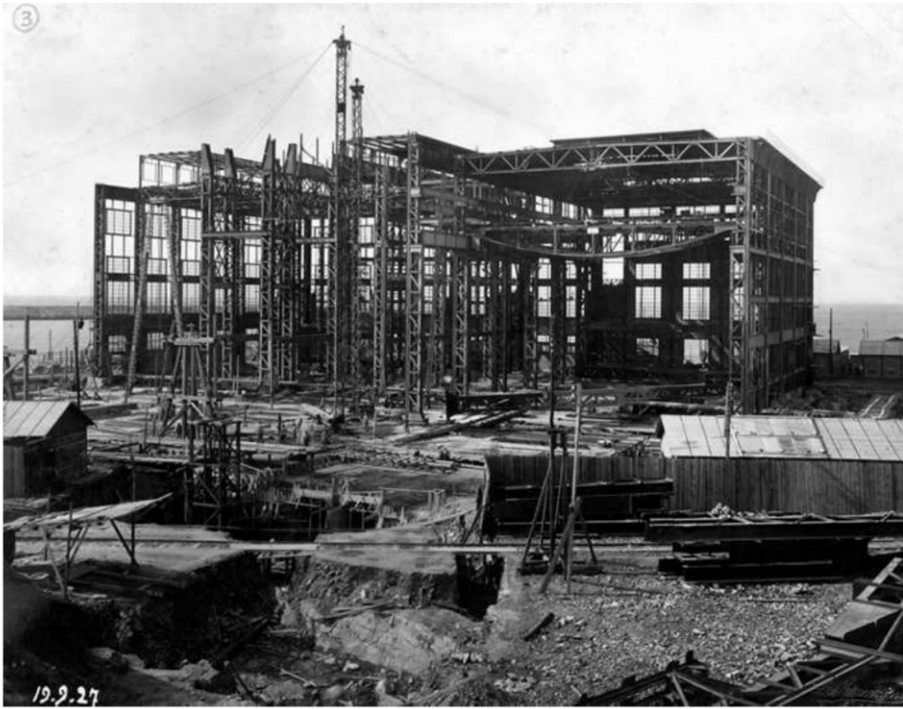


Fig. 6 Fase de construcción 1927



Fig. 7 Interior Sala turbinas 1927



Fig. 8 Alrededores de la Central Eléctrica



Fig. 9 Externo actual de la Central Eléctrica

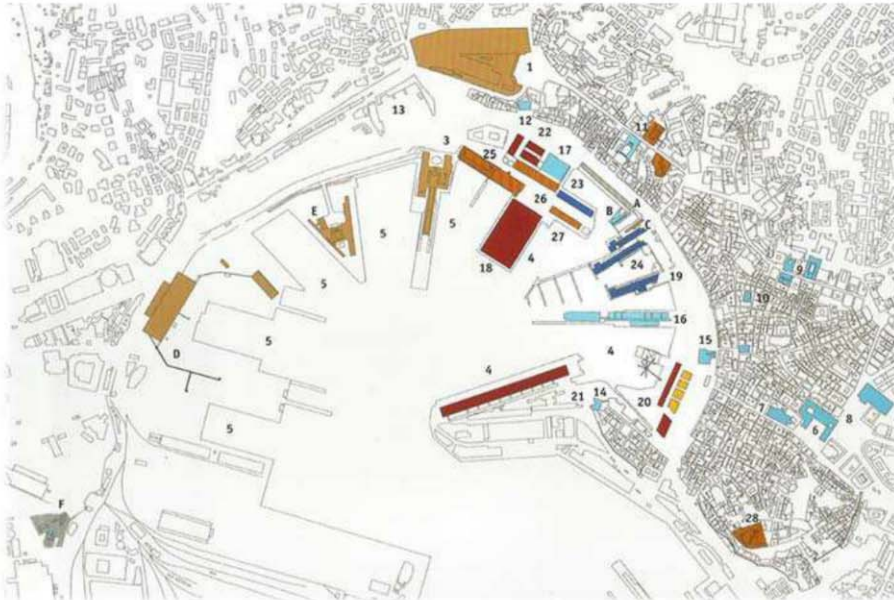


Fig. 10 Planimetría de las transformaciones del Puerto de Génova



Fig. 11 Nuevo Museo de la Lantera y en el fondo la Central Eletrica