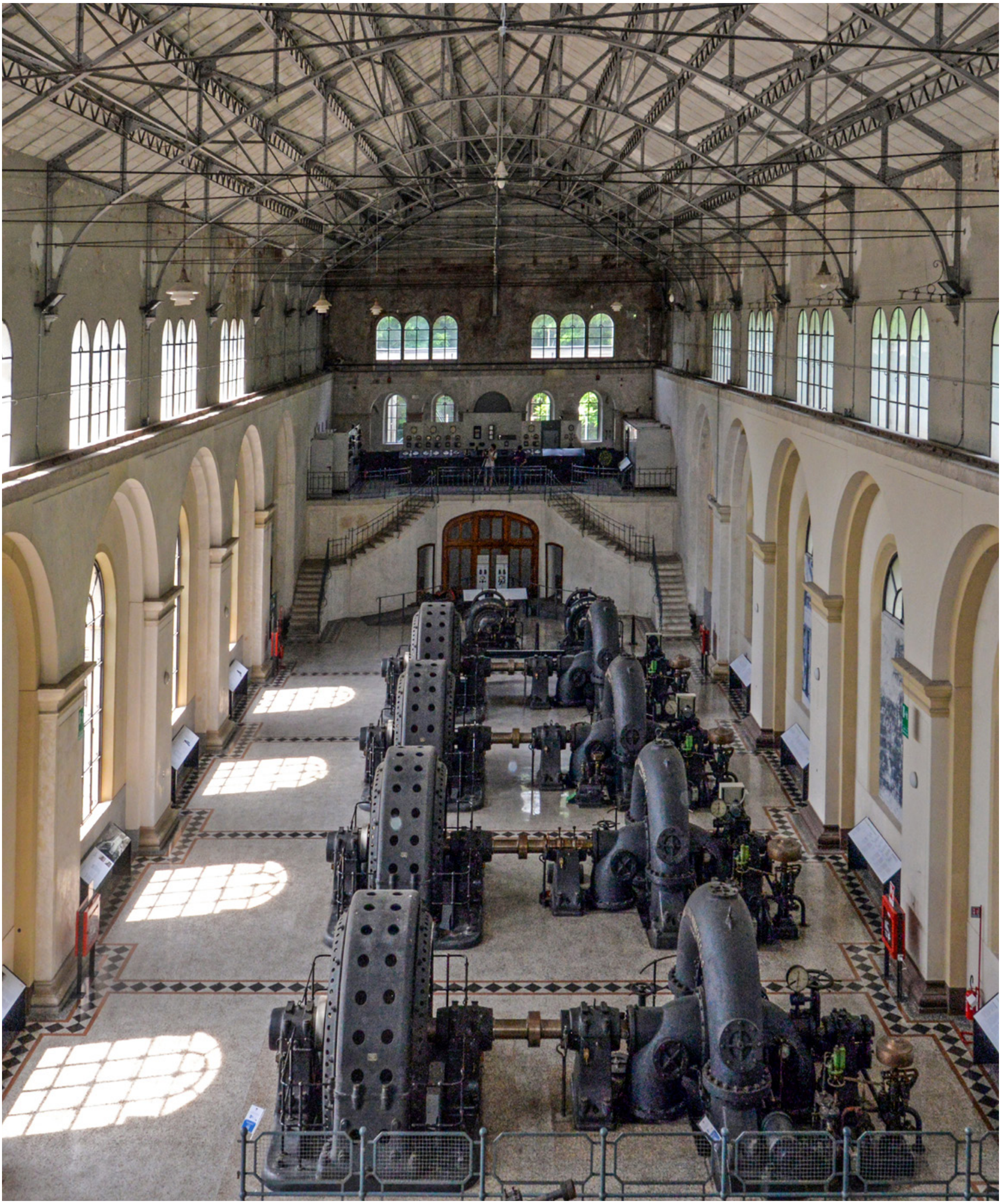

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Cover illustration: Antonio Pitter power plant, interior view (Malnisio). © Francesco Chinellato, Livio Petriccione, 2019

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RELATIONSHIP BETWEEN BUILDING TYPE AND CONSTRUCTION TECHNOLOGIES IN THE FIRST FRIULI VENEZIA GIULIA HYDROELECTRIC PLANTS

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Highlights

The area of Friuli, initially with an infrastructure characterized only by its network of irrigation ditches and mills, in the early twentieth century saw the construction of new types of building complexes linked to industry and energy production. This article firstly outlines, within a general framework, the economic and environmental transformation processes associated with this territorial development. It then examines the creation of the first hydroelectric power plants, in which productive functions and symbolic roles are integrated into the form of new kinds of architecture. The cataloging of these buildings and associated hydraulic works are carried out, analyzing in particular detail those built along the Cellina and Meduna rivers.

Abstract

The paper focuses on the hydroelectric plants in Friuli Venezia Giulia, especially those along the Cellina and Meduna rivers. The technological revolution of water exploitation to produce electricity led to the construction of these buildings between the 19th and 20th centuries; their different structural, technical, architectural, and engineering features became interesting case studies for such industrial heritage. The research analyzed the main features of the power plants built along the Cellina (Malnisio, Giais, Partidor, and San Foca) and Meduna (Meduno, Colle, Istrago, Chievolis, and Valina) rivers, from an architectural, formal, functional, and constructive point of view. The study of these iconic buildings, one infrastructure system related to the "waterways", allows them to be placed within the logic of settlement and production phenomena, and by reinterpreting them in a modern key makes possible refurbishment strategies with actualized needs and functions.

Keywords

Hydroelectric power stations, Friuli Venezia Giulia, Building type.

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1. INTRODUCTION

The new role of energy drove as a factor of territorial development, producing consequently articulated and complex repercussions. The construction of power plants and electrification involve issues beyond the history of techniques and the economic events but also affect social and political history, as well as the evolution of transport, settlements, and the landscape. These epochal changes, however, did not have a precise path in buildings architecture.

Between the end of the 19th and the beginning of the 20th-century, buildings design was subjected by the action of multiple instances and consequent tensions within a rich and dynamic cultural climate. Architects and engineers perceived the inadequacy of the ancient styles used, compared to modernity, without however being able to identify a unique solution. Therefore, despite a new function – energy production – and a lively client nourished by a fast-evolving industrial development, these ferments did not generate substantially new architectures. Even in the hydroelectric plant buildings, the care of form enclosed technical-and-functional related implications. So, except for some distinctions, industrial buildings continued to be masked by eclectic rhetorical skins.

In the industry and infrastructure field, however, new functions and needs continued to emerge, linked to the unusual spaces dimensions, innovative materials and construction processes, and revolutionary production features.

In the 18th century, the first shock, due to the birth of new activities on an urban scale (general markets, infrastructures, proto-industrial buildings), was reabsorbed by Durand's elaborations. He managed to recompose the conflict with an update of the classic tradition. He broke down and recomposed the classical repertoire by *ars* combinatorial and by modular exactness of spaces and constructive elements, within a framework that could still refer to the Vitruvian triad. This Enlightened "response" based on the essentiality, regularity, and the "Newtonian" simplicity of the forms, gave way in the 19th century to new, more articulated, and nagged trends, which embodied into architecture equally jagged poetics (i.e., romanticism, symbolism, and fascination for distant cultures and places).

The fast discovery of new materials and production processes insistently raised the question of functional beauty and the evidence that beauty was changing its face, opening her to further meanings. At the same time, the industrial society, influenced by a cultural climate substantially far from the logic of technological development, seemed almost ashamed of herself. The process of "aestheticization of technology" – a pervading feature of the 20th century – then began only timidly. The new materials were used according to old schemes, i.e., by manufacturing ionic cast iron columns for warehouses or railway stations, concealing the metal lintels behind false arches, or shaping iron tables as the wicker ones.

This must be added with the shifting – in the structural domain – from the pre-modern approach to the new calculations based on continuum mechanics, together with redistribution of roles and competencies, into the architectural process, following the birth of the engineer as a new professional figure. It is easy to understand how this complex and ramified situation did not immediately lead to the equation "architecture for industry=new architecture" since the basic approach "ended up focusing fatally not on function but representation" remained [1].

Then, gradually but always more decisively, following the architectural trends of the 20th century, a process began in which any rhetorical attitude based on the re-elaboration of a classical or historicist formal repertoire was abandoned, as monumental settings and stately tones or formalistic concerns of defining a representative building "skin". A progressive simplification of lines and volumes started, gradually clarifying the relationship between form and function translated into a new language based on new materials, subject to continuous experimentation (i.e., reinforced concrete, glass-concrete, and aluminum) [2].

As a result, the approach to environmental insertion changed: it was no longer entrusted to imitative or "impressionistic" naturalistic treatments of claddings and materials, and the tension for a characterizing dialogue with the pre-existing structures was overshadowed in order to focus attention on the specificities of the architecture, on its internal measure less and less tributary of the past, stripping the volumes from albeit refined pseudo-vernacular features.

Paradigmatic of this evolution can be considered, within the general framework outlined so far, the hydroelectric plants built along the Cellina and Meduna rivers, the subject of specific research that has continued in recent years at the University of Udine. The first ones built between 1905 and 1918 (Fig. 1) and the second ones between 1948 and 1963 (Fig. 2) represent distinct and significant moments of a process that led to the progressive abandonment of the nineteenth-century setting, reaching – through gradual passages – to concrete achievements of Modern architecture [3].

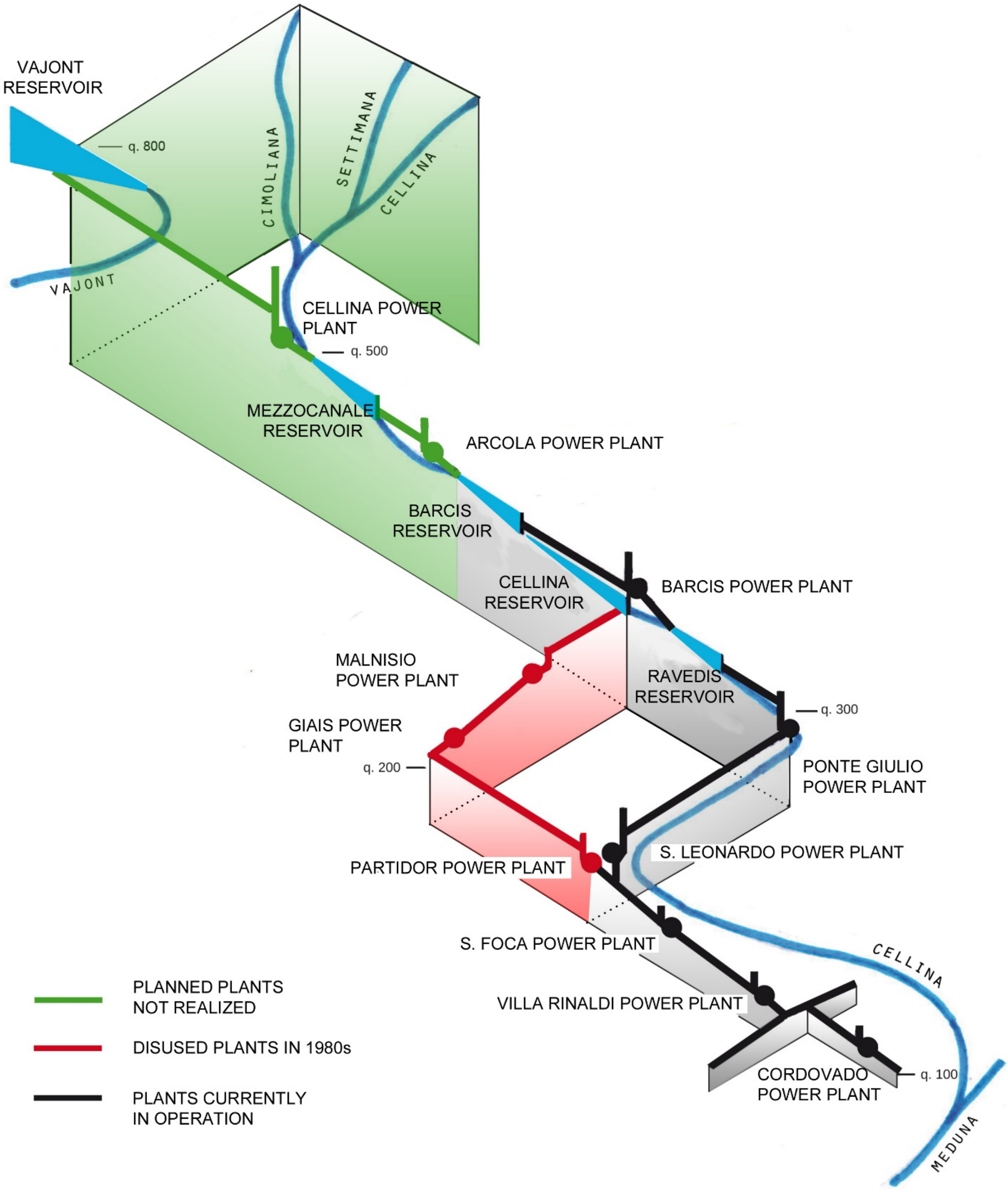

Fig. 1. *General scheme of the hydroelectric exploitation system of Cellina river © F. Chinellato, L. Petriccione.*

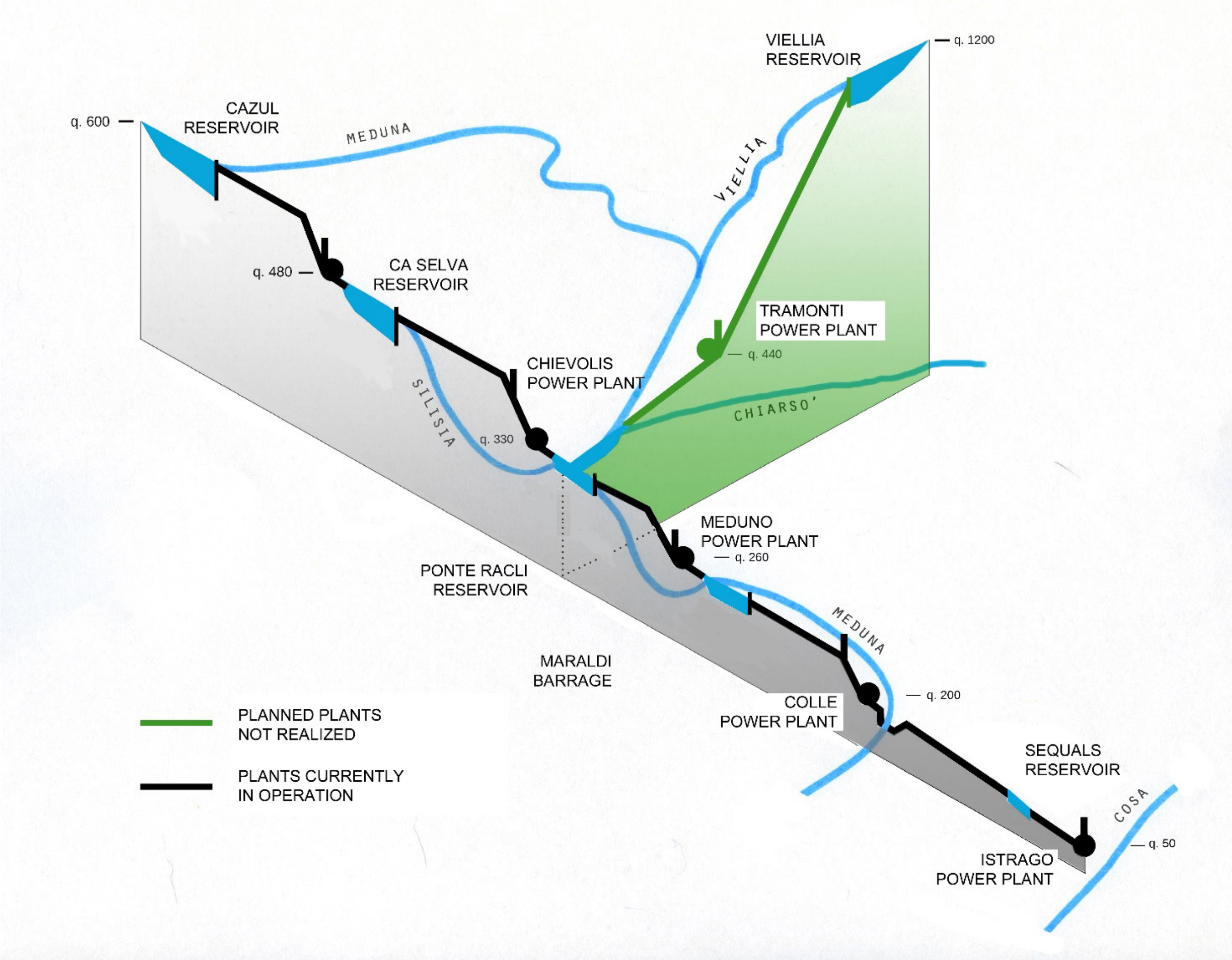

Fig. 2. *General scheme of the hydroelectric exploitation system of Meduna river © F. Chinellato, L. Petriccione.*

2. CELLINA POWER PLANTS

The first power plant along the Cellina, built in 1905 in Malnisio (Fig. 3), was initially designed to produce energy with six hydraulic turbines. However, three were initially installed, then brought to four, of the "Francis" type [4] (these machines were built by the company A. Riva Monneret & C. coupled to the respective 2600 HP Tecnomasio Italiano Brown-Boveri alternators) of 2640 HP with double wheel and double exhaust, with horizontal axis coupled to the relative alternators [5].

The building has a spectacular C-shaped layout, with a central body hosting the engine room, laterally surpassed by the wings hosting the employees' houses and the transformers' spaces. This arrangement where the power plant is crossed by the flow of water, coming from the pipes located behind it and escaping from the front, is frequent in the plants of the time. The layout Malnisio offers indeed an articulated and refined composition suggesting historical references (i.e., the sophisticated insertions of the 18th-century garden fountains or the "barchesse" in Venetian villas).

The façade modular layout, measured by the pilasters that frame the large windows, is linked to the need for a large and bright, unique internal space hosting the engine room.

Each window, a Bramante and Palladian remembrance with its upper profile shaped like a round arch, coincides with a three-light window at the top and a water outlet arch below. In the main body divided into three levels (two underground and occupied by machinery service rooms), there is the engine room, a large unique environment (81x17 m and 18 m high) with an exposed roof, supported by metal trusses of the "Belgian style", with compressed diagonals.

Its great height and brightness are linked to the need to move heavy equipment by an overhead crane operating safely on them. The length of the building depends instead on the number of turbine-alternator units. The module sets the space for each machine, a feature clearly legible: outside, it is equal to the center distance between two large arched windows, while inside, it is identified by the floor design dividing the space into panes for each turbine. The light enters laterally from the large splayed windows, ending in a crowning; here, the thinning of the masonry at the top of the arches hosts the overhead crane tracks. The upper part of the wall is thus slightly set back and illuminated by the upper order of the three-light windows, a feature similar to the women's galleries in medieval churches. At the top, a frieze with hanging arches supported by corbels (a typical motif of the Lombard-Romanesque Middle Ages) finishes the building. This power plant, although built a few years after Malnisio as part of the same production strategy, the Giais power plant (Fig. 4) has a different architecture from a stylistic point of view, and it doesn't show evident relations with the local constructive tradition.

The building includes two parts. The first, an elongated main volume, houses the engine room, presenting a monumental front for the southern access and two unitary fronts (eastern and western ones); the second, slightly higher, hosted transformers and services, presenting more articulated volumes and a rich decorative apparatus.

At first, the power plant had two turbine-alternator groups, with a horizontal axis of 4300 HP each; then, they were replaced by a new type with a vertical axis, with greater efficiency in the presence of variable flow rates with medium-low water jumps.

The Giais power plant goes away from the Malnisio medievalist lexicon and from the Moretti's "assonance with the historical pre-existence"; it seeks the relationship with the place not by historic references, rather by an uncommon "opening" towards the future, represented – by chance but symbolically – by the new railway line.

From a strictly stylistic point of view, Giais's architecture suggests a careful evaluation of the facade treatments, where the classic modules and secessionist linearity are reinterpreted within an essential geometry, set in a modular and purified – nearly – proto-rationalist feature.

The "sail" façade with the stepped pediment also suggests a plurality of references: starting from the Nordic residential and commercial architecture to passing through the contemporary neo-Gothic "square"; these can be extended chronologically looking for roots in the church's salient facades or the stone and thatched roofs of vernacular architecture, where the protruding stepped pediment was a shelter from the winds force on the roof. It embodies the "cathedral" character and an architectural-spatial concept where the main nave does not contain the faithful, but the machines and the control room is a "technological" reinterpretation of the presbytery and the transept in the "croce commissa" plan.

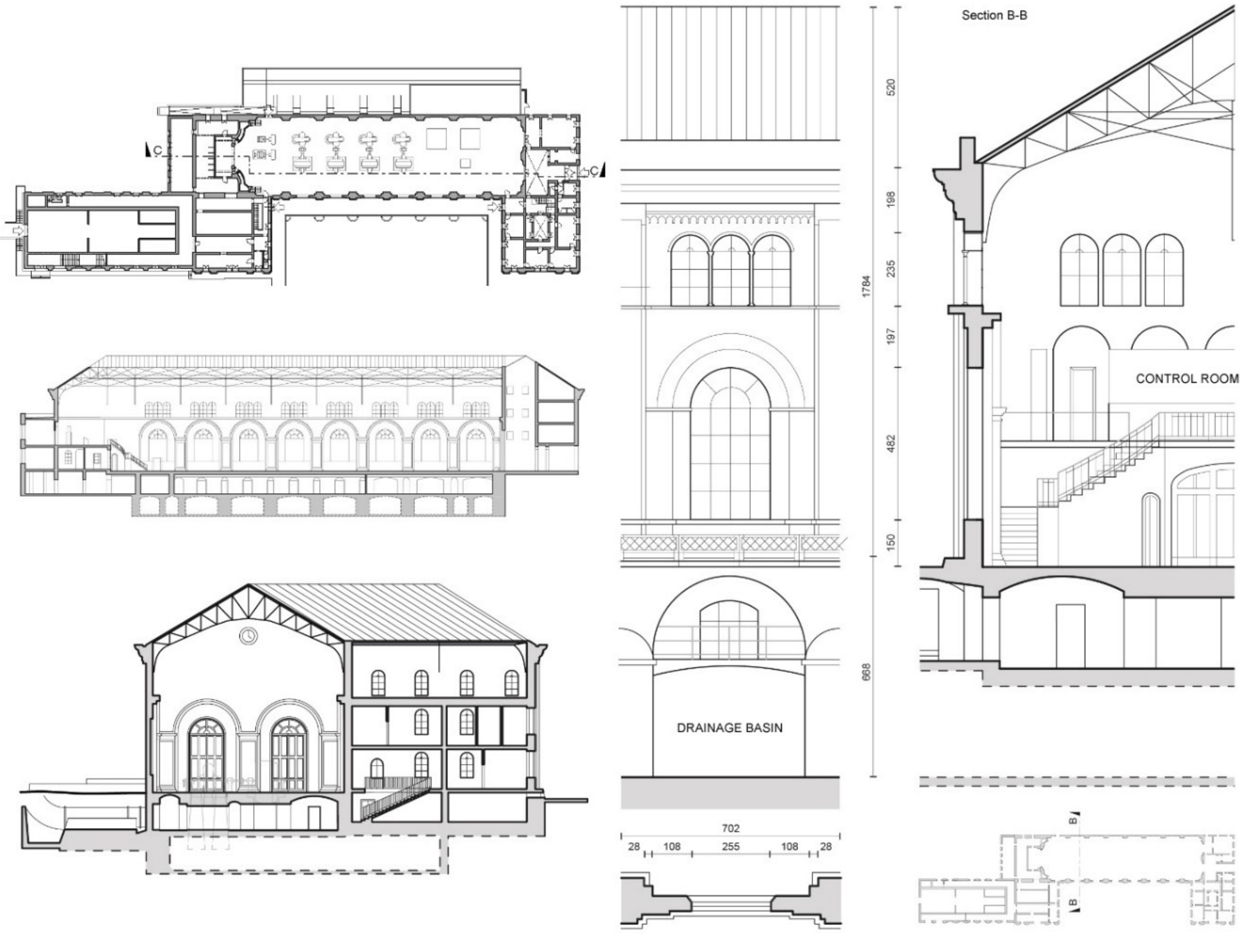

Fig. 3. *Antonio Pitter power plant (Malnisio). Left from de bottom: second level plan, longitudinal section of the main building, cross-section. Right: architectural layout of southern elevation and section B-B © F. Chinellato, L. Petriccione.*

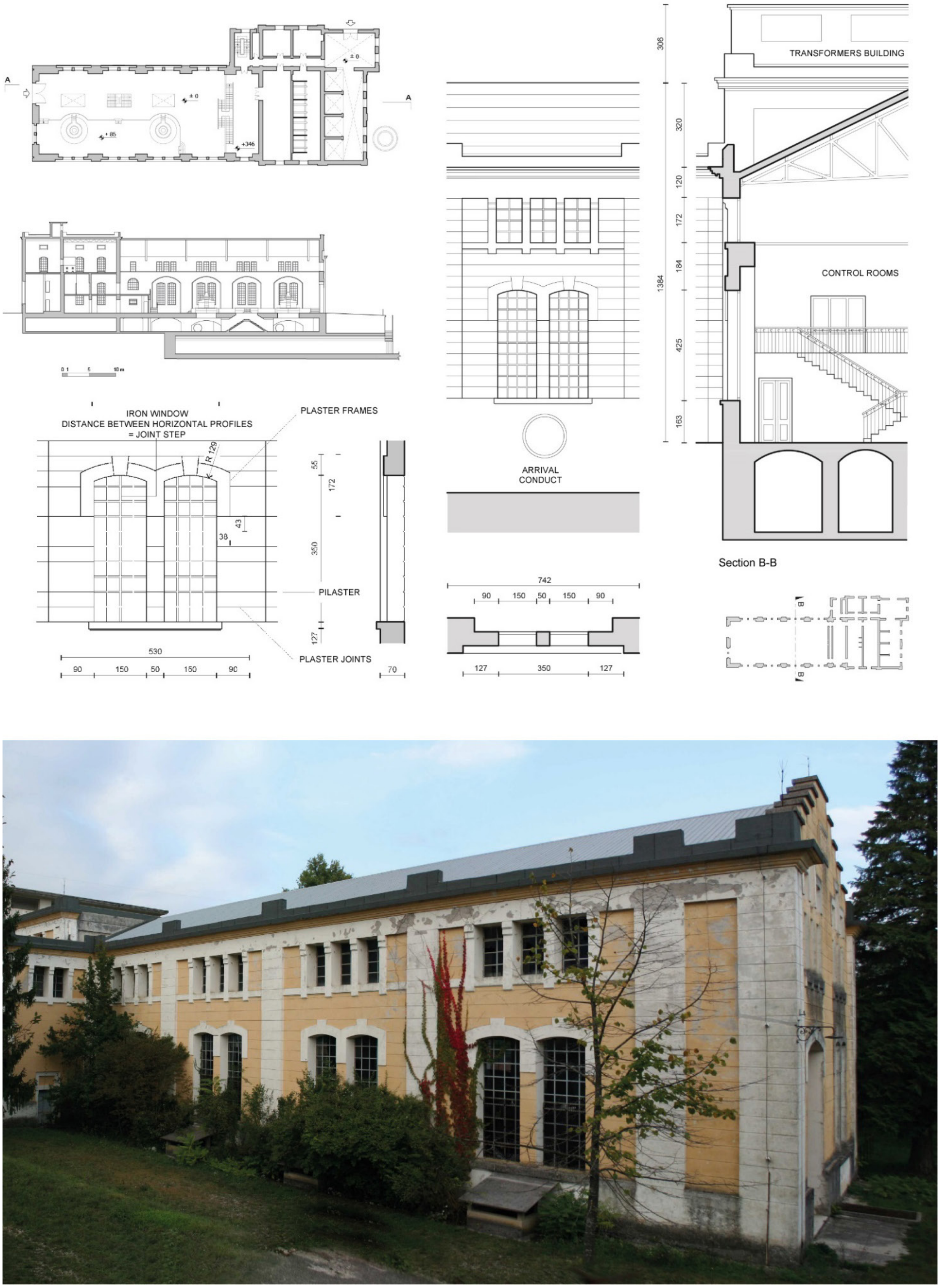

Fig. 4. *Giais power plant. Left from the bottom: power plant plan, longitudinal section, western elevation windows detail. Right: architectural layout of western windows © F. Chinellato, L. Petriccione.*

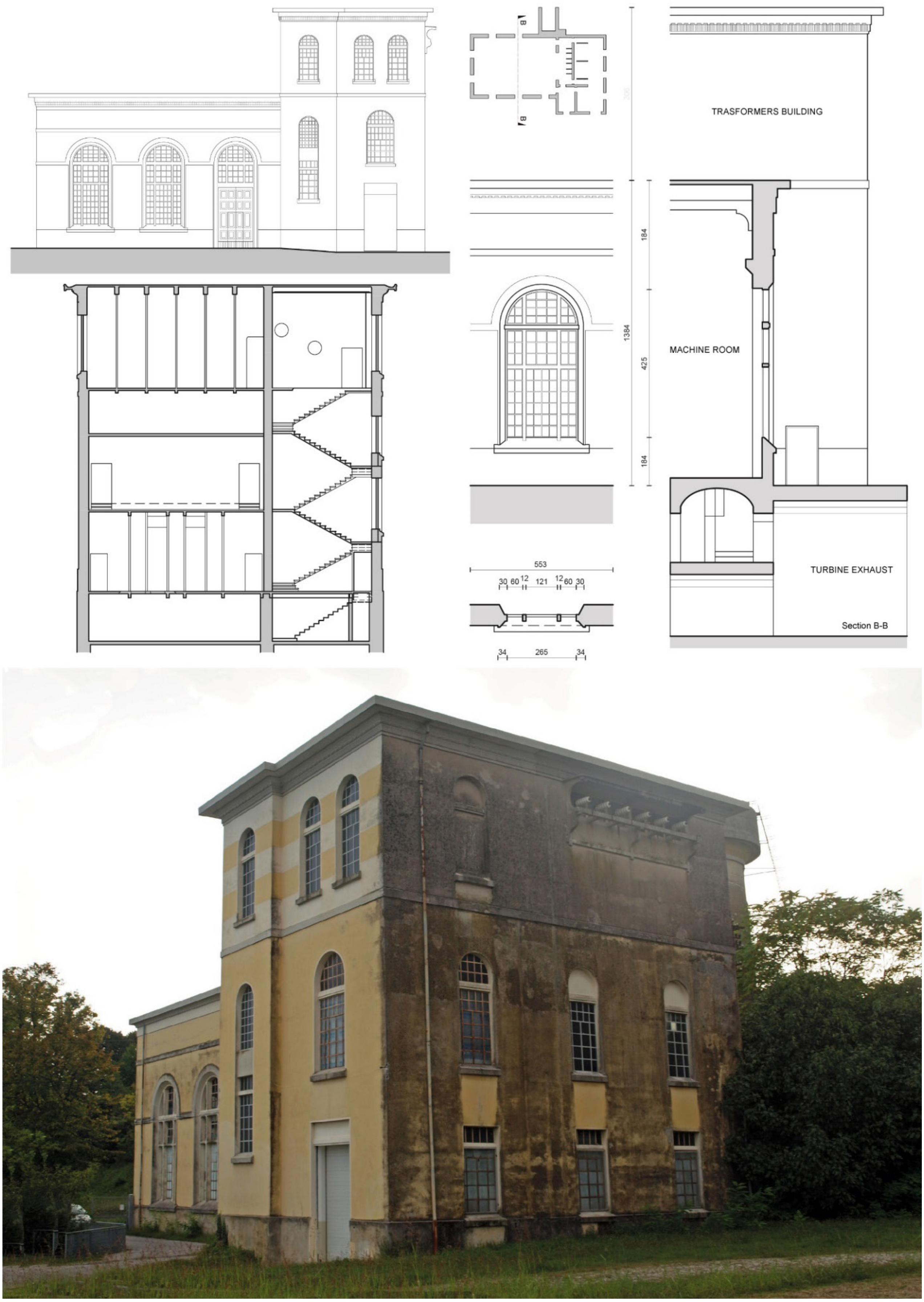

Fig. 5. *Partidor power plant. Left from the bottom, eastern elevation and main gateway, the cross-section of northern building. Right: architectural layout of southern and western elevations © F. Chinellato, L. Petriccione.*

A more in-depth architectural analysis underlines the compositional rules: three elevations (the lateral ones and the one opposite the main entrance) are marked by a refined articulation of alignments, symmetries, and proportional relationships.

The east and west façades of the main volume are rhythmically marked by a single modular architectural grid: two flat pilasters into which a mullioned window is inserted, surmounted by a mullioned window divided by pillars with protruding capital. On the other hand, in the north volume, also in relation to the different heights and the different internal subdivision of the floors, single windows appear both large, with an arched upper profile, smaller and simpler ones. The upper band, on the other hand, is occupied by a sequence of blind niches.

The horizontal features are divided by the modular scanning of the architectural elements, while the vertical ones are divided into homogeneous zones by their alignments which on all fronts, regardless of the planimetric trend, reinforce the unitary perception of the architectural organism, however insistently emphasized by the homogeneous treatment surfaces and joints that give rhythm to the external plastered surfaces.

The third power plant of Partidor (Fig. 5) was built later, at the turn of the First World War. It has two buildings: the first hosts the large unique volume of the engine room (dimensions 18x12.50 m, a height of 11 m). Two groups of Francis-alternator turbines with a total power of 3.5 MVA were located here. The second, slightly higher, houses the access staircase to the upper floors, the transformers, and the departure of the power lines.

The elevations are characterized by large openings reflecting the thermal scheme: a slender reinforced concrete entablature separates the upper part, with a rounded arch profile from the lower one, rectangular and framed into quadrants by reinforced concrete ribs. This entablature visually continues in a line marking all the façades, running parallel to an upper string course and a lower sill marker.

The north and west elevations are simpler and devoid of architectural frames. The Partidor power plant architecture witnessed the great transformations that occurred in the historical period of its construction. Although it seems to renew the configuration of the west wing of the Malnisio, hosting the transformers, the architectural volumes are quite different. They are conceived without the constraint, implicit or explicit, of the reference to the masonry cultural tradition underlined by the architectural orders.

Consequently, the façade composition by the pilasters is deleted, unlike many examples of hydroelectric plants built between the 19th and 20th centuries. The architecture – ruled by equally essential features – exposes pure volumes, simply juxtaposed, flat roofs, minimal projections to emphasize contours and structural lines, as well as geometries adapting to the space's functionalities.

Reinforced concrete is enhanced in its nature as a completely new material: it is not even contaminated by liberty or art nouveau decoration; therefore, it is exhibited as a pure structural means, not only in the exposed beams but also in the ribs of the openings where it designs frames and rich inlays.

Architecture becomes, therefore, a meaningful manifesto about the maturing suggestions, when the new industrial buildings, monumental but serial and still partly "mysterious", contributed to developing new aesthetic values. By following this path, the Partidor pure geometry acquires metaphysical accents "à la De Chirico", by the cadenced arches (also the drainage channel emerges from a dark round opening) cut out clearly in the solid mass of the walls, with the background of the empty and immutable scenery of the "magredi". Along Cellina river stands the last power plant, San Foca [6] (Fig. 6). It is not part of the initial plan for the exploitation of the Cellina river. However, it is still connected to the other ones, both because it was commissioned by Aristide Zenari, who was the main project holder and built in the same period (1912), exploiting the waters of the same watercourse.

The plant, taking advantage of a drop of 18 m, is very small (it was able to deliver a power of 205 HP or 150 kW) and produced electricity in the local area only. From the analysis of one of the very rare historical photos concerning the building, it is clear that the supply pipeline was made of concrete. Since having a small production, the plant probably had a 'mini-Francis' turbine; its plant layout was similar to the Giais and Partidor functional scheme, even on a small scale (dimensions 9x15 m). The building is a masterpiece of Art Nouveau architecture. The west elevation, therefore, repeats, by different proportions, but with even greater definition in the decorative apparatus, the unmistakable upper profile of the Giais plant.

The southern façade is characterized by an interesting window. The central opening follows the “thermal” type divided by robust wall ribs, while the lateral ones can be seen as its residual “splinters”. These “cut-on” windows, with pointed or pointed upper profiles of Gothic ancestry, have been variously reinterpreted in the context of nineteenth-twentieth-century eclecticism. In the emerging tower, however, the large articulated window stands out, together with its decorative apparatus, occupying almost the entire façade. In the ‘mushroom’ shape of the large central opening, the reference to architectural experiments, like Raimondo D’Aronco’s ones, is clearly evident.

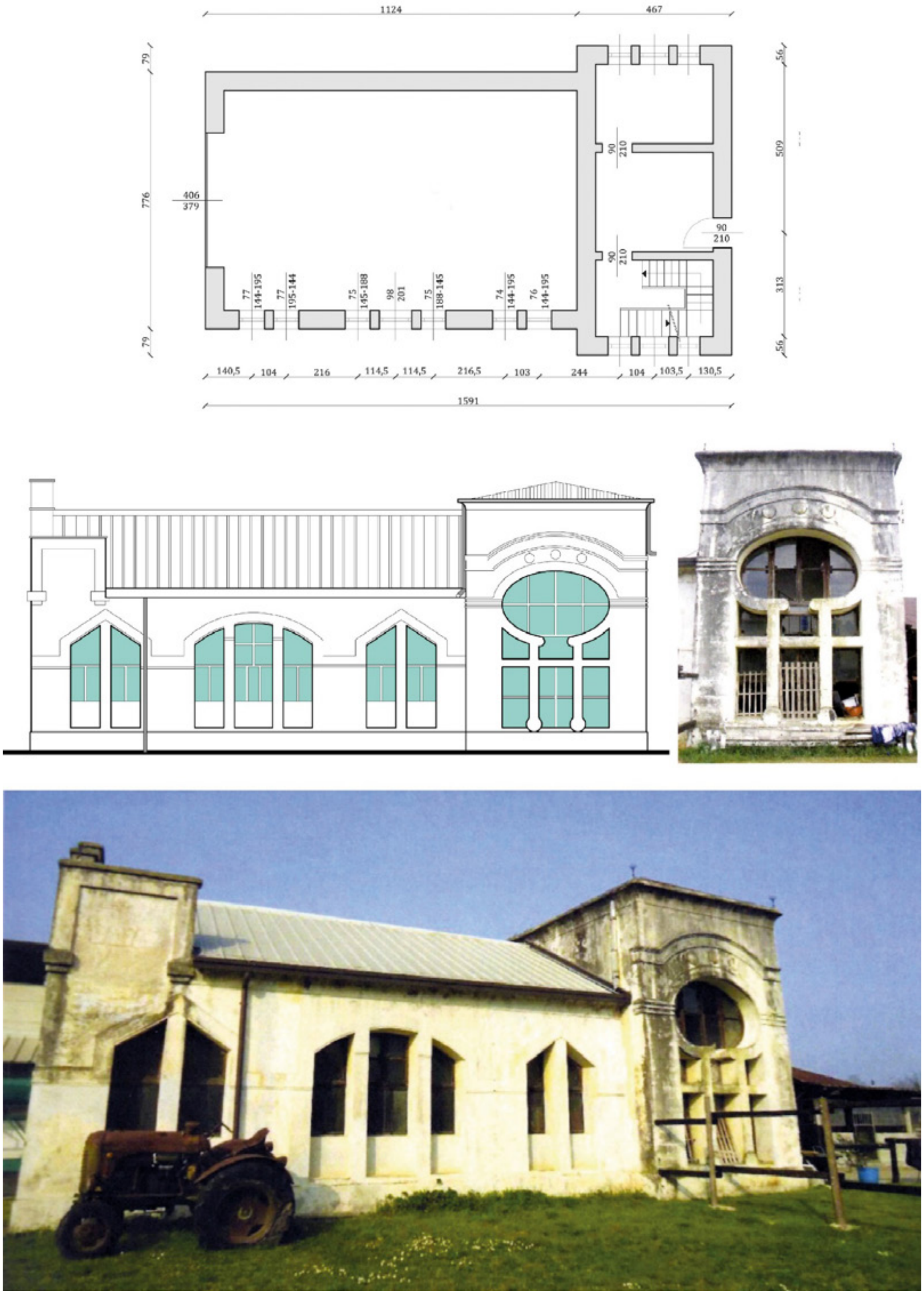

Fig. 6. *San Foca power plant. Bottom: first level plan. Centre: southern elevation and “mushroom” window detail © F. Chinellato, L. Petriccione.*

3. MEDUNA POWER PLANTS

As the Cellina power plants were paradigmatic of their time, those built along the Meduna river are exemplary of the spatial evolution and the architectural concept developed in the following forty years. A certain differentiation is also found between the first three and the last two, built in the early 1960s.

The Colle, Meduno e Istrago power plants are valuable, clear examples of proto-rationalist architecture, where, in the large luminous and monumental spaces and the architectural features, the building organism coherently synthesizes in itself the structural, functional, material aspects, expressive and decorative traits. The latter often are represented by frescoes which, like those of the Colle and Meduno power plants (designed by architect De Min), are signed by Giuseppe Ravanelli (Cornate d'Adda 1887 Milan 1956, an artist who probably arrived in Friuli following the architect De Min) are linked to the theme of water and energy production.

In all buildings, however, the results of a complex and jagged path unraveling between the two world wars: from the first "visionaries" and unsettling intuitions of Sant'Elia, through the ferments of Portaluppi's "sui generis" eclecticism complex and the rigorous research by Giovanni Muzio reached up to the almost exasperated Giò Ponti and Gaetano Minnucci functionalism.

The new aesthetics received as assumed the Gaetano Minnucci words: "aesthetic harmony must coincide with the perfect material static laws by which architecture strictly depends" with the broader aim of "harmonizing the relationships both between form and techniques means and form and practical needs" [7].

The requests of "representativeness" were so resized to some extent, or rather they were changed from the unconditional celebration to a more subtle intention of embodying the "immaterial essence" of the new energy in the buildings, conjugating to a new, less glorified, and more rationally set idea of progress. The first three plants present instead a calibrated willingness to transfer architecture.

If anything, we find, in the first three plants, a calibrated intent to transfer formal parties and figurative rhythms into a functional architecture, even if they were originally dedicated to the most qualified residential

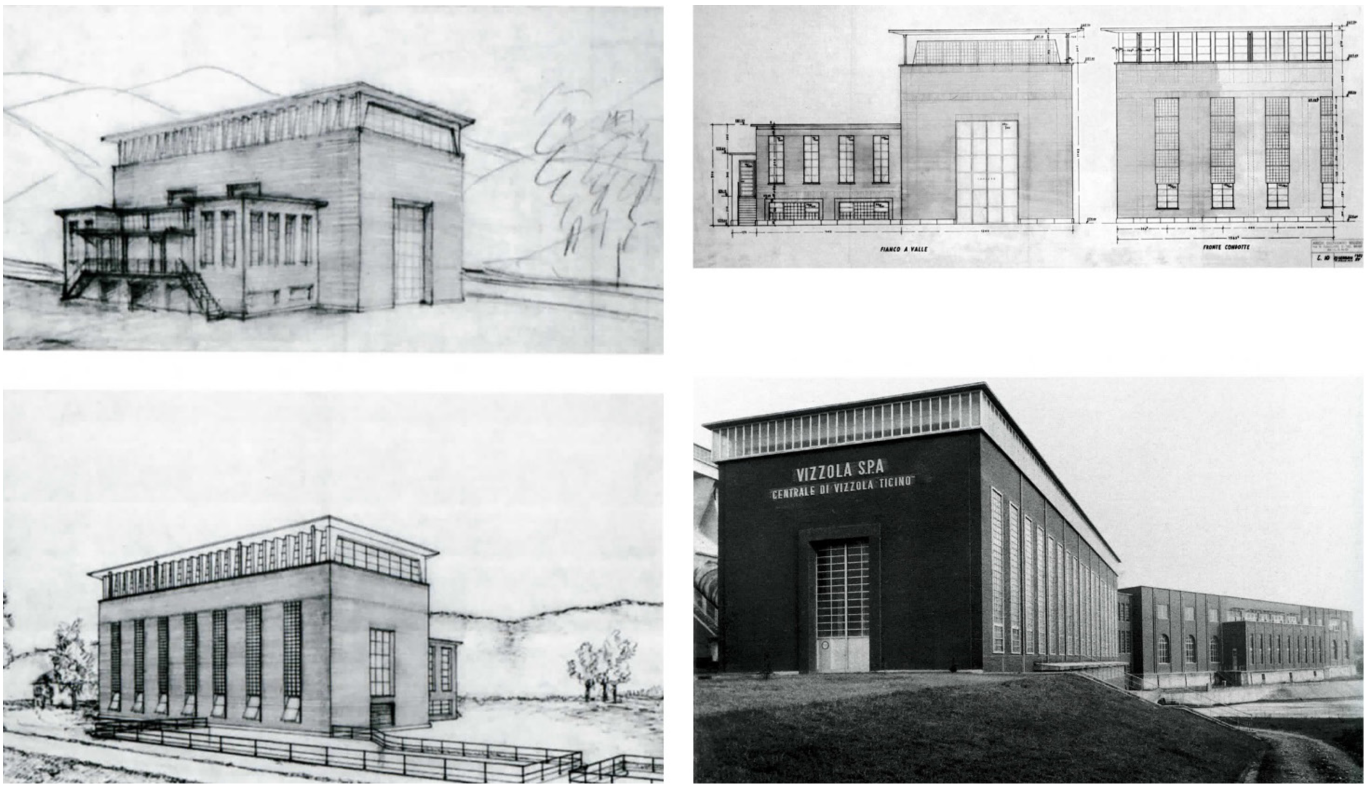

Fig. 7. *Hydroelectric plants designed by Giovanni Muzio. Top left and right: drawings of San Mango sul Calore power plant (Avellino, 1938) and perspective views of the building and valley side elevation. Right below: Vizzola Ticino power plant (Varese, 1937). Historical archive of ENEL Giuseppe Colombo, Sesto San Giovanni.*

types or to more really representative buildings. This by reinterpreting them in the dialectic with the plants' technical features, as well by a calibrated use of materials defining the true building image only through smooth surface effects and material differences.

Such features clearly mark the architecture of the Meduna power plants, where the search for a plastic form is clearly underlined by a firm and coherent layout of floors and volumes, as in Giovanni Muzio's San Mango sul Calore (AV) and Vizzola Ticino (VA) power plants (Fig. 7).

Since the Colle power plant (Fig. 8), albeit built with limited resources in the immediate post-war contingencies (1949), the valuable architecture marks a moment of transition where, while abandoning the stylistic features of the past, plasticity and massiveness of the masonry construction are not denied.

Compared to the early 20th-century power plants, lines become clear and profiles squared; the building volume – an essential parallelepiped – is divided into two parts, whose demarcation line corresponds to the internal path of the bridge crane. The lower one is punctuated by three large openings, hosted in just recessed niches and by the main access door. A refined stylistic syncretism is implemented by the juxtaposition of a hieratically abstract layout in the lower part based on the scanning of squares and rectangles and the refined alignment of the windows and in the upper section a modern reinterpretation of the classical order.

The roof indeed is raised above a glazed attic supported by pilasters with a mixtilinear section. The upper openings, narrow and elongated, with a longitudinal dimension equal to the underlying niches one and aligned with them as metopes, are separated from each other by the triglyphs aligned by the small columns. Above them, a marked entablature supports the roof.

The Meduno power plant (1952), the largest of those then planned by SAICI (Fig. 9), is characterized by a large pronao with square pillars and externally marked by the alternating use of plaster and exposed brick "celebrating the cult of electricity in the form of a temple with a porch front" [8]. As in the Colle power station, but with much larger dimensions, two volumes mold the building: they are not juxtaposed but overlapped with the main body connected onto a large square basement.

This building resumes the idea – already set by Muzio, Minnucci, et al. – of the building as a simple case perforated by regular rows of full-height openings and concluded at the top by a continuous window that arose from the need to obtain "the perfect functional adherence of the external vertical side born from the frequency of the ribs calculated to the considerable thrust of the wind and of the horizontal strip of total ventilation" [9].

These two paths, however, are made separately on two fronts and not overlapping as usually. The justification can be found in the arrangement of the machines that are housed not into the interior space rather at the bottom of a cavity, a gigantic artificial gorge, in the heart of the plant.

The perimeter walls, even if articulated, are then reflected inside in a single full-height room, not condi-

Fig. 8. *Two historical images of Colle hydroelectric power plant.*

Fig. 9. *Historical photo of Meduno power plant.*

tioned by the arrangement of the machinery, a monumental, large and evocative hall, in which the warm diffused brightness, the center opens, protected by a railing, the huge 45 m deep well (14 m in diameter) on the bottom lie two powerful 5.7 KVA turbo-alternators.

The openings play on the various fronts is complex: it does not, however, affect the building legibility and its unity. The claddings combinatorial play is cleverly calculated by the alternation of the exposed brick present in the ribs marking the upper openings, by the columns supporting the portico and on the entire front side facing and the plaster that characterizes the windows on the ground floor, the whole upper volume and the back wall of the portico. The flat roof protruding from the building volume and the portico's horizontal roof draw two strong lines for the building, unequivocally defining its "modern" feature.

Later, the Istrago power plant was built following the project architect De Min (Fig. 10), commissioned in 1953. The building recovers the full brick use, according to a theme widely used by De Min in Torviscosa company buildings, and is composed, similarly to those of Colle and Meduno: two volumes, one with a single floor and one with a double-height, visually unified by the identical surface treatment.

The roof is slightly convex following the rectangular plan of the building that expands to the west, in the curved and autonomous appendix of the apse, hosting the control room. In the higher main volume on the eastern side, there is a very large central opening acting both as a door (in the lower part) and as a fixed window (in the upper part). On its sides, two large rectangular blind niches find a geometric correspondence in the large windows on the front of the lateral building and, more generally, in the rhythmic scanning of square openings that uniformly characterize the other fronts.

The relationships between full and empty spaces and between the different rhythms of the windows are the real key to understanding the building architecture. The register of the upper openings, steady in height, adjusts in

Fig. 10. *Two historical images of the Istrago power plant.*

width on the various fronts following the below one. The result is a prime rhythm that finds a counterpoint in the second one generated by the play of shadows, spaced and deep in the lower hole, which is denser, lighter, and more secluded in the upper one. Inside, the chromatic play between the smooth black marble floor streaked with white and the color of the production and control systems of the power line – like in Torviscosa – is refined and engaging.

The exploitation of the Meduna was completed at the beginning of the 1960s to cope with further energy inputs for production due to the expansion of the electrochemical Torviscosa plants. Accordingly, the Silisia basin – a Meduna right tributary – also began, and the last two power plants were built, Chievolis and Valina (Fig. 11).

Here, after ten years, the first three, a further evolution of the design culture can be read. The buildings, in comparison with the previous ones, are naked and architecturally simplified – till anonymous – even if fairly integrated into the landscape thanks to the concrete gray neutrality and the use of a system of large degrading terraces. They consist of a single low volume built close to the waterway and characterized exclusively by the rhythmic windows on the façade. Here there are no formalisms or internal wall decorations. Nevertheless, an indulgent historical-critical reading can glimpse in them the definitive abandonment of representative intentions and linguistic codes borrowed from other building types. It may also be noted the acknowledgment of the architectural ferments occurring elsewhere, with a very different quality of conception and language from Giò Ponti by Gaetano Minnucci. The different relationship between full and empty – with the prevalence of the latter – in the large windowed surfaces can be interpreted as a tension towards transparency, thus translating into the brightness and lightness of the envelope. The exposed concrete marks the desire to express the new materials' nature, in an almost brutalist sense, and the simplicity of the forms pursues the functional frankness or a "plastic form expression of its function and fully adherent to it" [6].

In Chievolis, the rectangular plan is extruded vertically to form four essential elevations. The elevation facing the waterway is characterized by the presence of nine large narrow windows separated by thin and insistent ribs and by the second order of blind niches, an attestation of the openings below rhythm. The structure embodies the rationalist "free façade" and clearly denounces the structure since the external thread is defined by the frames interposed between the openings.

The Valina plant follows the Chievolis architectural model in an even more elementary way. Only the façade facing the watercourse has windows; the others – without openings and decorations – are sparse rough concrete surfaces. Here one can see two superimposed registers of 5 windows each. All the windows, wide and narrow, are separated from the next one by an inclined reinforced concrete curb recalling the slides that carry the swirled water to the stream, becoming a futuristic maneuvering cabin open to the landscape below.

All these buildings mark the advent of a "technical civilization" which expresses itself directly in a purely

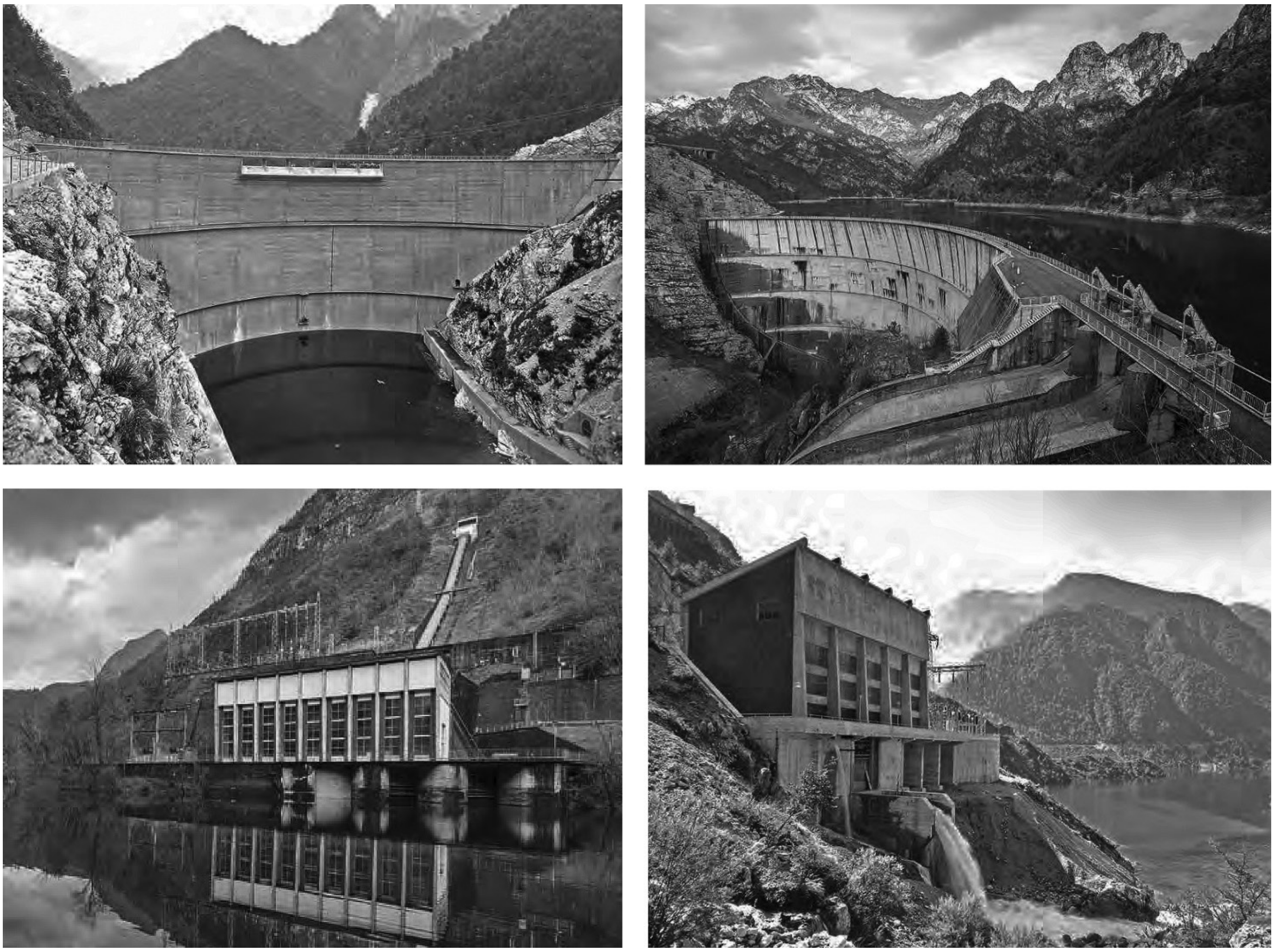

Fig. 11. *Plants built in the 1960s along Meduna river. Above: the Cà Zul (left) and Cà Selva (right) dams. Below: the Chievolis (left) and Valina (right) power plants.*

functional "industrial architecture", responding to the various technological needs by the aseptic application of objective technical principles, now become ordinary, apparently without the designer's cultural mediation or particular aesthetic concern, given that the intent, to "place in the most honored visibility those authentic wonders that are modern systems" as Minnucci stated.

4. CONCLUSIONS

The research outlined the essential features of the first hydroelectric plants, built in Friuli Venezia Giulia from the typological and technological point of view. It identified their specificities and characterizing elements, indispensable for elaborating the interpretative keys necessary both for the single building refurbishment project and for the redevelopment of the settlement heritage as a whole, including in a broader sense the material traces as the witness of local cultures [7].

These buildings had, since their construction and after, an important role (territorial, infrastructural and symbolic), marking an epochal transition. While the Meduna power plants are still operational, the Cellina ones – following the settlement, economic, technological, and productive changes – lost their original function. The Giais, Partidor, and San Foca are abandoned while Malnisio, after a restoration, became a museum and a polyfunctional center. Such buildings – strictly linked with the water power exploitation – are heavily integrated into the habitat; they also set new – even different from the previous, but non necessarily negatives – natural and environmental values.

Following this relationship with the environmental context, the study of these buildings and infrastructures along the "waterways" takes great importance within a systemic logic. This is an indispensable condition: it can place them in a historical perspective giving them as a "document" and understanding the phenomena in progress and reinterpreting them within the new settlement and functional realities relationships; it also can contribute in perspective to the resolution of current or future needs/emergencies on a territorial scale.

5. REFERENCES

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