



Workers' houses in Torvecasa, Il Faubourg, 2019

Retrofitting Company Towns' residential buildings: from international best practices to local implementations in Friuli Venezia Giulia region (NE Italy)

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ABSTRACT

The paper illustrates the retrofit of company towns' heritage, focusing on energy efficiency strategies for residential buildings with the aim to highlight the best practices, the solutions and methodologies to be implemented for the Friuli Venezia Giulia Region in NE Italy. The starting point is a comprehensive analysis of company town's retrofit strategies featuring a comparison among relevant examples from Europe and Italy. Unesco industrial sites, sites by the Modern Movement, and Italian well-known workers' villages are included in the analysis. The evaluation of the retrofit solutions takes into consideration aspects of protection and valorisation, functional renovation, and environmental sustainability upgrade.

As a result, common strategies for the energy retrofit of company towns' residential heritage are identified and summarised as the first step for their application at local level. In this sense, the study highlights that industrial villages are still inhabited and they require an upgrade according to the guidelines for architectural restoration, which meet the current standards of comfort. Moreover, the strategies drawn from the case-studies reveal an excellent potential of applicability for the local area and its company towns: Panzano shipyard village, Cave del Predil mining site, and Torviscosa factory town.

KEYWORDS

company towns, industrial heritage, workers' housing, conservation practices, energy retrofit

1. RESEARCH AIM

The study focuses on energy retrofit as a peculiar aspect of the redevelopment and regeneration of company towns, identifying the cases in which strategies for environmental sustainability and energy efficiency upgrade have been adopted after preservation and valorisation initiatives. By doing so, it is possible to recognise and compare the best practices for the conservation and refurbishment of the residential heritage according to the restoration of the architectural image, the improvement of the living condition, and the performance upgrade in the different types of houses which compose the historical industrial settlements. The prevalent strategies for the renovation and energy retrofit of company towns' residential heritage have been identified and summarised and they have revealed an excellent potential of applicability for the company towns in the local area of the Friuli Venezia Giulia region (north-east Italy): the Panzano shipyard village, the Cave del Predil mining site, and the Torviscosa factory town.

2. INTRODUCTION

Since the industrial revolution, company towns have been a longstanding feature of the European scene (Garner, 1992; Oliver, 2003; Darley, 2003). Most of them have been closely linked to the mining and textile industries in areas providing natural resources and energy sources. Those settlements have spread especially from the late 19th century in connection with the industrial developments in the textile sector, in line with the mill towns in the northern Europe. Moreover, in the early 20th century, between the 20s and the 40s, a number of company settlements were founded as 'new towns'.

Even in Italy there is a considerable presence of significant examples of company towns (AA.VV., 1981; Covino, 2002; Ciuffetti, 2004), consisting of industrial plants, public buildings, and residential settlements, in the form of workers' houses, which are characterized by repetitive types and construction features.

From the urban and architectural point of view, the company towns feature buildings responding to specific construction criteria, which were set on a simple and regular urban system and followed a linear, orderly and rational structure, which was initially planned according to a low-density settlement model. The residential buildings follow a hierarchical organisation whose recurring building types include houses for labourers and employees, in the form of detached, semi-detached or terraced houses, and villas for managers - also according to the analysis of the case studies -. As a consequence, the creation of the company town has contributed to define the model of a new and independent sub-urban zone, aiming at encouraging the separation from the agricultural sector and the improvement of the workers' living standard, on the one hand, and, at favouring control over behaviour and productivity, on the other.

Initially, the residential buildings, like the factory itself, were managed by the company and rented to the workers and their families. By contrast, today most of them are privately owned, with some of them being managed by local organisations, while some others being now disused and in a state of decay.

Nowadays, company towns, like other monuments of the industrial heritage, are more and more often involved in initiatives for the valorisation of places through the preservation of memories, the restoration of meanings and materials, and the functional and environmental renovation (Berens, 2010; Douet, 2012).

The research study provides thus a survey of the current state of European company towns, focusing on the retrofit works for the workers' houses. The starting point is a comprehensive analysis of company towns retrofit strategies featuring a comparison among relevant examples from Europe and Italy, with the aim to highlight the best practices, the solutions and methodologies to be implemented for the Friuli Venezia Giulia Region in NE Italy. In particular, the investigation analyses the types of intervention which have been planned and applied in company town's heritage, their extent and size, and when they have been or are going to be carried out.

Workers' villages retrofitting means to bring a piece

of history yet partially unknown to light. However, the issues of preserving the identity of places and the restrictions involved in the field do not allow deep renovations or reconstruction works. Therefore, the only possible intervention is the conservation of heritage endowed with high 'testimonial value' (Molloy and Urbaniak, 2016).

Furthermore, in some of these settlements, innovative ideas were experimented in the past in the formal conception, in the design of building elements, and in the choice of materials, according to the so-called Modern Movement. As a consequence, these cities and architectures introduce the theme of 'restoring the Modern', which has undermined some of the consolidated conceptions of urban regeneration and architectural restoration (Macdonald and Green, 1996; Stein, 2010; Palazzotto, 2011).

At the same time, it appears necessary to find the right retrofit policies which can assure compliance with current standards, including the aspects of energy and environmental quality without compromising the identity of the places.



Figure 1.

Nord-Pas de Calais mining basin, Shaft 5/5bis at Loos-en-Gohelle around 1906, postcard (Jännick Jérémy).

Figure 2.

Bata suburb in Zlin, early 1930, postcard.



3. MATERIALS AND METHODS

The starting point has been a systematic review of the literature about historic company towns in Europe (Garner, 1992; Molloy and Urbaniak, 2016; Borges and Torres, 2012; De Fusco and Terminio, 2017) and Italy (AA.VV., 1981; Covino, 2002; Ciuffetti, 2004), and then recent research studies into the field, which have revealed a remarkable presence of company towns still less known.

The company towns to be investigated have been subsequently identified also according to the availability of detailed historical-critical and technical studies already completed, as well as according to protection and conservation initiatives currently under way. The presence of this documentation has thus enabled the evaluation of the prevalent measures of protection, restoration and enhancement adopted in the international context for the company towns.

Then, three company towns in the local area have been presented as case studies for the application of possible retrofitting strategies on the residential heritage.

Figure 3.
Crespi d'Adda site, aerial view, 2009
(Lele Monzani).



3.1 COMPANY TOWNS IN EUROPE AND ITALY

The company towns have been selected according to their significance in the international context and according to the availability of detailed research reports or protection and conservation strategies already in force.

Among these, some company towns are recognised among Unesco World Heritage sites (UNESCO, 2018), such as Saltaire (listed in 2001), New Lanark (listed in 2001), the Derwent Valley Mills site (listed in 2001), and the Cornwall and West Devon Mining Landscape (listed in 2006) in Great Britain, the Nord-Pas de Calais Mining Basin (listed in 2012, Fig. 1) in France, the Major Mining Sites of Wallonia (listed in 2013) in Belgium, the Røros mining town (listed in 1980) and the Rjukan-Notodden industrial site (listed in 2015) in Norway, Verla Groundwood and Board Mill (listed in 1996) in Finland, the Crespi D'Adda village (listed in 1995) and the Ivrea industrial city of the 20th century (listed in 2018) in Italy.

Other company towns are internationally acknowledged as examples of model modern urban settlements and architecture, as it is the case of the Bata's industrial villages (from the 30s in Zlín (Fig. 2), Partizánske, Svit and others (Ševeček and Jemelka, 2013)), and of the Sunila pulp mill industrial town (from the 30s, Alvar Aalto, in Finland).

At national level, emerging examples of company towns have been considered according to their importance also in the international context and they include the Crespi D'Adda site (Gasparolo and Ronchi, 2015; Fig. 3), the Carbonia mining town (Peghin and Sanna, 2009), the Leumann Model Village, and the Schio village (Sassi et al., 2013).

3.2 CASE STUDIES AT LOCAL LEVEL

The company towns considered at local level, in the Friuli Venezia Giulia Region (north-east Italy), are the Panzano shipyard village, the mining site of Raibl in Cave del Predil and the factory-town of Torviscosa.

At a national level, the mining village of Cave del Predil - Predil Quarries -, in the mountains and close to the

Austrian border, is a relevant example of a settlement linked to the territory for its productive vocation, in particular for the exploitation of zinc and lead mines of Raibl (Frangipane, 2017). The settlement is characterised by the presence of industrial, residential and public buildings (Fig. 4).

The Village of Panzano was built in the early 20th century around the shipyard of Monfalcone (Fig. 5) and is one of the most significant examples of urban planning undertaken by the industry in the regional territory. The settlement was inspired by the model of the garden city and included residential buildings as well as a series of public spaces, such as a theatre, shops and sports facilities (Valcovich, 2009). The residential area developed in two distinct parts, one deserved to the labourers and another one deserved to the employees. The two parts are characterised by different building types, dwellings sizes and architectural details, which highlight the novelty of the idea of reproducing the hierarchical composition of the factory organization in the urban planning and building structure.

At international level, the Torviscosa settlement, in the middle of the southern plain, is an example of an industrial-agricultural new town of the early 20th century (Fig. 6). It was built by the SNIA company in

the 30s for the chemical (cellulose) and agricultural production, and to accommodate workers and families providing them with leisure and social activities (Bortolotti, 1988). The town consists of 'serial' buildings, meant to home different working categories (labourers, employees, managers, farmers, etc.) and some public spaces (theatre, refectory, swimming pool area, etc.).

Figure 4.
Cave del Predil mining village in the 30s, postcard.

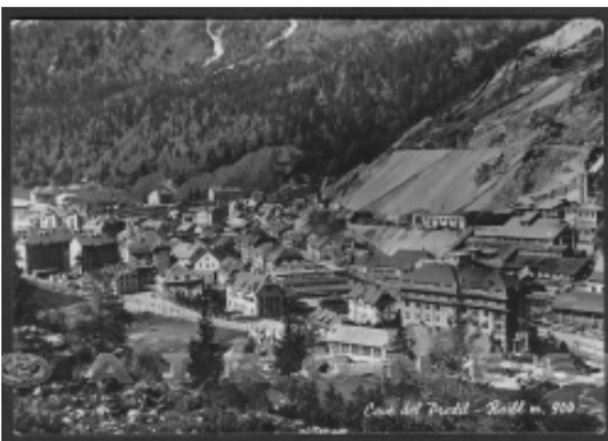


Figure 5.

Panzano shypyards in a postcard from the 60s.



Figure 6.

Torviscosa workers' housing in the 60s, aerial view (source: Archivio storico SNIA Viscosa, FFSC_A25-35).



3.3 EVALUATION CRITERIA

As far as the selected settlements are concerned, this study originated from the need to investigate and evaluate the adoption of energy retrofit programmes for the built heritage of the company towns and in particular of the workers' housing according to the recent policies related to the achievement of energy and climate objectives (Directive EU 2018/844).

The evaluation was carried out considering and verifying the adoption of measures concerning several main aspects for each town (Fig. 7):

- preservation and valorisation of places through protection measures and specific restrictions, guidelines for the conservation and restoration of buildings, activities for education and cultural promotion;
- restoration, functional retrofit and reuse strategies involving the improvement of the quality of life (safety, accessibility, usability, comfort) through the renovation of residential heritage and the addition of new economic and cultural activities in the area;
- improvement of environmental sustainability, at various level, including: policies meant to promote models of sustainable communities, enhancements of environmental sustainability at urban (or neighbourhood) level, and works aimed at improving the energy efficiency of the residential buildings (workers' houses).

4. RESULTS

The comparison among the various preservation and valorisation practices adopted in the company towns considered in the study shows that the majority of the initiatives have focused mainly on the protection and conservation of the public buildings and on the urban settlements as a whole.

Even though various agendas for the typological renovation of workers' housing, including specific criteria and guidelines, are available, a comparative analysis of the environmental issues and especially

of the energy efficiency retrofit strategies has proved more complicated than it was expected due to the lack of a detailed documentation and the scarce attention to this issue, which is still evident today in renovation works on industrial heritage.

However, this study has led to the identification of the general background and of some common trends and principles for the energy retrofit of company towns' residential heritage, which can be effectively implemented also at local level.

4.1 SOCIAL AND ECONOMIC SUSTAINABILITY

Most of the European company towns are still inhabited today. In particular, the number of inhabitants has generally remained almost constant in the last decades; in some cases the population has even enjoyed an exponential growth following the evolution of the town in an industrial city (e.g. Wolfsburg, Zlin and Svit), while in others a depopulation phenomenon has come after the cessation of industrial activities and conversion or museumification of the site (e.g. New Lanark from 2500 to 200 residents).

Likewise, in Italian company towns, according to the recent census, the population has remained quite the same in Carbonia (30.000 hab.), Leumann (2000 hab.), Panzano (2500 hab.), and Torviscosa (2800 hab.), while it has remarkably decreased in Cave del Predil (400 hab.) and Crespi D'Adda (397 hab.) due to the closure of the factories.

The case studies have also revealed that many of those industrial villages are still inhabited by the descendants of the employees of the former factories, which proves the peculiar attachment to the places (Birkeland, 2008). Furthermore, the socio-economic context of the company towns features a desire for an upgrade both by the residents' and the administration's side, despite their poor economic potential.

Figure 7.
Comparison within
protection, restoration
and retrofit practices in EU
company towns
(authors, 2018).

Company Town	Country	Dates	Protection	Conservation	Retrofit
Derwent Valley Mills site	UK	1700 - 1800	■	■	
Nord-Pas de Calais Mining Basin	FR	1700 - 1900	■	■	
Røros	NO	1700 - 1900	■	■	
New Lanark	UK	1795	■	■	■
Schio workers' village	IT	1817		■	
Cité Ouvrière di Noisiel	FR	1825 - 1870	■	■	
Saltaire	UK	1850	■	■	■
Leumann model village	IT	1875		■	
Crespi d'Adda	IT	1878	■	■	
Verla Groundwood and Board Mill	FI	1890	■	■	
Cornwall and West Devon Mining Landscape	UK	1800 - 1900	■	■	
Major Mining Sites of Wallonia	BE	1800 - 1900	■	■	
Zyrardow	PL	1800-1900	■		
Port Sunlight	UK	1889 - 1933	■	■	
Rjukan-Notodden Industrial Heritage Site	NO	1900	■	■	■
Kiruna	SW	1900 - 1910			■
Panzano	IT	1910		■	■
Cave del Predil	IT	1910	■	■	
Torviscosa	IT	1930		■	■
Ivrea	IT	1930 - 1960	■	■	■
Zlín	CZ	1930		■	
Svit	SK	1934		■	
Sunila Pulpmill and housing	FI	1936 - 1938		■	
Carbonia	IT	1937		■	■
Wolfsburg	DE	1938			■

4.2 CULTURAL SUSTAINABILITY: CONSERVATION OF THE BUILT HERITAGE

Protection and conservation practices of the built heritage in company towns have varied mainly according to the 'grade' of cultural value attributed to the site.

Namely, one of the best practices for the preservation and management of cultural heritage is the one adopted for the World Heritage sites (UNESCO, 2018), which includes the identification of the protected area and its buffer zone, the listing and protection of individual assets of interest, the definition of strategies and priorities for intervention in the Management Plan (Toniolo et al., 2015; Borgarino et al., 2016). Accordingly, the Unesco sites of Saltaire, New Lanark, Derwent Valley Mills, Cornwall and West Devon, Nord-Pas de Calais, Wallonia, Røros, Rjukan-Notodden, Verla Groundwood, Crespi D'Adda, and Ivrea include also residential neighbourhoods or groups of buildings for labourers, which are listed as cultural heritage of the company town as well as other

monuments (Fig. 8-10).

Furthermore, the Management plans for World Heritage sites (UNESCO, 2013; UNESCO 2014a; UNESCO 2014b; UNESCO 2016) generally suggest the provision of recommendations about the restoration, such as the eventual replacement of elements, and the possibility to obtain grants and guidance in order to manage maintenance and restoration in a positive way.

The company towns' assets protected at national level are correspondingly subject to specific safeguard measures, including requirements and restrictions about the possible conservation and renovation works, and are supervised by the administrations in charge (e.g. Historic England in UK, the Ministry of Cultural Heritage and Activities in Italy).

However, on various levels, those protection measures express the increasing and undeniable need for guidelines, which have to be specific for the residential heritage, in relation to the restoration of the architectural image as well as to the compliance with the current standards of usability, accessibility,

Figure 8.
Houses in Saltaire, UK (Tim Green, 2017).



Figure 9.
Workers' housing in Bruay-La-Buissière,
Nord-Pas de Calais mining basin, FR
(Hubert Bouvet, 2011).





Figure 10.
Worker's house in Crespi d'Adda, IT
(Ian Spackman, 2007).

comfort, and environmental sustainability. In this sense, the national and local public bodies involved in the field of cultural heritage have sometimes introduced generic guidelines for the conservation and renovation of the historical housing stock, in some cases also suggesting the appropriate solution for specific building components (e.g. guidance to repair and upgrade traditional windows by Historic England (Wood et al., 2017) or the homeowners' guide for the model village of Saltaire (Bradford District Council, 2007)). In Italy, several credible initiatives at local (regional or municipal) level have also promoted agendas for the typological renovation of workers' houses with criteria and guidelines specifically drafted for each settlement, as it is exemplified by the detailed plan for the city of Carbonia (Comune di Carbonia, 2016), and by the 'restoration manual' for the Crespi D'Adda company town (Gasparolo and Ronchi, 2015). However, those guidelines, recommendations and specifications appear mainly focused on the restoration practices and paid poor attention to the aspects of energy retrofit of the built heritage, which do play a key role in current regeneration strategies.

4.3 ENVIRONMENTAL SUSTAINABILITY OF THE INDUSTRIAL SETTLEMENTS

A comparative analysis of the environmental issues - and especially of the energy efficiency retrofit strategies - has proved more complicated than it was expected because of the lack of a detailed documentation on these topics in the planning and projects proposed for the renovation of the housing stock in company towns.

On the contrary, the energy performance appears a central topic in consideration of the fact that the residential heritage of company towns dates back mainly to the 19th or early 20th century, when the energy question was at an embryonic stage - even though several studies showed that there were already some reference to concepts concerning the thermo-hygrometric properties of materials. Dealing with these buildings means to come to terms with their significant environmental impact and to envisage actions for an energy performance upgrade according to their use, also taking into account the evolving domestic comfort (temperatures, ventilation, daylight, ...) and economic needs (Hartman et al., 2013; Troi and Bastian, 2014).

Moreover, in addition to meeting the requirements of usability (to eliminate architectural barriers which prevent the proper use and liveability of spaces) and safety requirements (to establish actions ensuring an adequate level of static and seismic performance), buildings have to meet requirements about energy efficiency, environmental sustainability, energy saving, and reduction of CO2 emission (Battisti, 2016), according to the current legislation (Directive EU 2018/844).

Nevertheless, in the company towns presented, several interventions aimed at the improvement of environmental sustainability can be found at various level. Initiatives for the enhancements of environmental quality at urban-neighbourhood level (Auclair and Fairclough, 2015) have been carried out in different World Heritage sites. For example, in the New Lanark mills and village, which was founded in 1786, the New Lanark Trust has restored and converted the historic buildings focusing on the concepts of regeneration

(touristic and commercial uses) and sustainability, and new water-source hydro-electric turbine and heat-pump have been installed in the existing mill in order to provide electricity and heating for some buildings and leisure activities in the site (Rodwell and EFFESUS, 2013). Moreover, in Rjukan Hydro Town in Norway (Fig.11), large mirrors were placed on the mountainside above the settlement, in 2013, to reflect the sun and illuminate the town square, which would otherwise lie in the shadow for 7 months per year.

Works aimed at improving the energy efficiency of the residential buildings (workers' houses) are briefly described in the restoration handbooks for the cities of Carbonia and Crespi D'Adda (Gasparolo and Ronchi, 2015; Comune di Carbonia, 2016) and in practical recommendations for several model villages in the UK. As best practice and opportunity for improving the energy efficiency of residential buildings, they generally suggest retrofitting the building envelope by internal insulation - walls, roof, floors - by upgrading the windows, replacing heating generators with more efficient ones, possibly

integrating them with renewable energy systems such as solar and photovoltaic panels.

According to the best practices, in order to preserve the built heritage and to intervene in the appropriate way, it would be advisable to assess the actual state of the buildings by carrying out a survey activity on architectural (plans, sections, elevations) and construction elements (materials, building techniques, degradation), in the first phase. A careful evaluation of the energy balance, of the heat losses of the envelope, and of the climate condition of the surrounding environment will enable the identification of all the parameters which contribute to the definition of the possible compatible retrofit works. The orientation and solar irradiation of the building also fosters bioclimatic approaches, which take advantage of the free thermal gains for heating during the winter seasons, and protect from overheating - i.e. through vegetation and shading devices - during the summer, without any deep-renovation of the building. The observation of the orography and of the rainfall can be helpful to propose strategies for the sustainable

Figure 11.
New Town (house type O), Market square and Tyskerbyen housing area, Rjukan Hydro Town, NO (Per Berntsen, 2013).



Figure 12.
Cave del Predil mining village, IT
(Anna Frangipane, 2016).

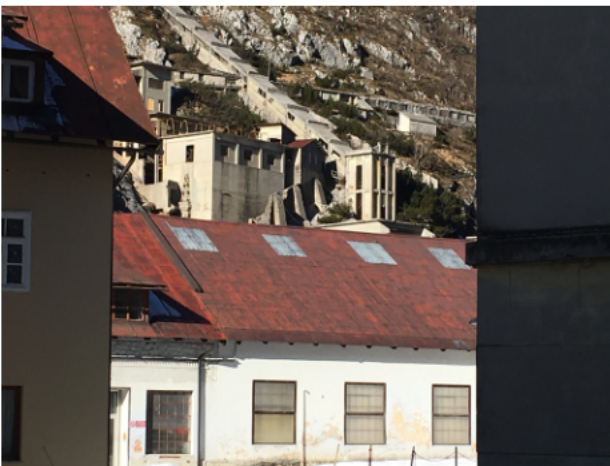


Figure 13.
Houses in Cave del Predil mining village, IT
(Anna Frangipane, 2016).



use of water such as the rainwater harvesting and reuse. Additionally, the energy audit (Dall'Ò, 2013), providing a monitoring of the building typologies through instrumental investigations and direct survey, can provide information about the exact existing stratigraphy and the presence of critical points, which need to be considered in order to propose effective and compatible retrofit works (Baiani and Pascucci, 2018). The analysis of the site and the bioclimatic study of the building appear as preparatory tools leading to the subsequent design choices also by means of the correct use of modern insulation technologies, of high-performance fixtures - if the existing ones cannot be recovered - and of efficient services.

In the final phase, the retrofit guidelines - i.e. the recommendations of actions considered optimal, according to the best practices - should be proposed, also as useful tools in case studies for future intervention.

4.4 IMPLEMENTATION ON COMPANY TOWNS IN THE LOCAL AREA

The strategies for conservation and restoration of the built heritage, which have been implemented in well-known company towns throughout Europe, reveal an excellent potential of applicability to the company towns in the Friuli Venezia Region, which are characterised by the early 20th century architecture and recurring building types.

However, it is worth pointing out that, although those company towns are very similar in scale and architectural features to international examples, they need adequate protection measures, consistent urban planning, and effective cultural promotion policies. The company towns in the Friuli Venezia Region are also expecting the completion of the conservation and valorisation process started in the 2000s for each settlement, and the guidelines for the restoration and energy retrofit of buildings must follow.

In particular, the Cave del Predil mining village (Fig. 12, Fig.13) has been recently listed as a "Pole of high symbolic value" by the Regional Landscape Plan (Regione FVG, 2018), while two of its public buildings

Figure 14.
Panzano workers' houses
(authors, 2019)



Figure 15.
Panzano workers' houses after
renovation works (authors, 2019).



are nationally listed as Cultural Heritage (since 2009). However, the closure of the mine, in 1991, has led to the abandonment of part of the historical residential buildings and to the progressive depopulation of the settlement, whose few economic resources today are the activity of the local museum "Polo Museale Cave" (www.minieradiraibl.it).

In the shipyard village of Panzano, the neighbourhoods of workers' housing and two large hospitality structures (Albergo operai for labourers and Albergo impiegati for employees) have been restored during the last decade (Garofolo, 2003; Comune di Monfalcone, 2010), which has given a system of places of high cultural value and of tourism potential

back to the community (Fig. 14, Fig.15), as well as an accommodation for the Shipbuilding Museum of Monfalcone (www.mucamonfalcone.it).

In the industrial-agricultural new town of Torviscosa, the SNIA technical office directly looked after the maintenance works until the 70s, but now the majority of houses are privately owned with some of them being disused and in need for renovation (Fig. 16, Fig.17, Fig.18, Fig.19). Since the 60s, the "CID Centro Informazione Documentazione" (www.cid-torviscosa.it) has kept the important documentary heritage related to the history of Torviscosa, making it easily accessible to all and promoting its knowledge and study through exhibitions and publishing activity.

However, the company towns of Cave del Predil, Panzano and Torviscosa, still require a comprehensive and detailed investigation about the energy and environmental issues of their residential heritage.

First of all, the quarry of Cave del Predil and the plant of Torviscosa surrounding areas are still tackling relevant environmental issues resulting from the heavy impact and pollution of the former industrial activities (mining and chemical production), so that brownfields reclamation needs are constantly discussed as a priority.

Figure 16.
Workers' houses type 4-BIS in 1948, Torviscosa, IT
(source:Archivio storico SNIA, FFSCN_TV-0643).



Figure 17.
Workers' houses type 4-BIS,
Torviscosa, IT (authors, 2019).



Figure 18.
Workers' houses type 01M in 1945,
Torviscosa, IT (source: Archivio storico
SNIA, FFSCN_TV-0611)



At the same time, recent studies and research programmes have provided a detailed documentation of the residential heritage of the three company towns, their recurring building types, materials and constructions techniques. These data set the basis for the definition of the guidelines for the restoration and the energy efficiency upgrade, according to architectural types and components, without overlooking the concepts of reversibility and compatible maintenance.

5. DISCUSSION

The analysis of the different case studies has proved that the selected European company towns have been renovated and restored by respecting their high historical value, but they still need attention and improvement from an environmental protection point of view.

Indeed, much of the retrofit works represent unique episodes or involve only minimal parts of the settlements. Therefore, it would be advisable to search for concordant approaches, in order to define a common set of criteria, which should be adopted in the different contexts and which should include concerns about the historical as well as the cultural-social and physical-environmental points of views. Nevertheless, dealing with different types of building and construction techniques implies a certain difficulty in identifying the proper materials and technologies to choose when planning an intervention on a built heritage. Therefore, inconsistent works and materials on a single building can cause a gradual process of transformation which compromises the integrity of the whole complex.

An on-going research will provide a detailed analysis of one local company town - Torviscosa - in order to propose dedicated retrofit solutions and guidelines. The results of the research could be useful for future projects addressed to similar built heritage which are willing to adopt the best practice of working to preserve, restore and renew parts of territories, such as the workers' villages, which narrate the history of our countries.



Figure 19.
*Workers' houses type 01M
in Torviscosa, IT
(authors, 2018).*

6. CONCLUSIONS

Retrofitting the company towns' residential heritage is a cultural and environmental objective of utmost interest in the Italian and European context.

The identification of the best practices adopted in the international field as well as the definition of locally applicable strategies for the case studies towns - in the Friuli Venezia Giulia Region - provide an important contribution to the research sector. In fact, the company towns represent a sizable heritage and an important legacy of the industrial past to be preserved and enhanced: besides witnessing the history of labour in the last centuries, the workers' villages of the company towns are places which still have great potential, as they are still inhabited and usually beloved by the local population.

In the awareness that the main value of the company towns resides in the relationships within the elements which compose the entire urban settlement (housing, factory, landscape), the renovation of the residential heritage - in its different aspects including architectural, urban and energy quality - could be the starting point to regenerate the entire areas, which once were the heart of the industrial production.

The study highlights the importance of preservation and conservation of the historical built heritage from the cultural and social point of view and it also underlines the necessity of taking into consideration environmental aspects during the renovation process by defining guidelines, which summarise the best practice in the field.

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