



BROCHURE TOPIC GROUP CONSTRUCTION

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FOR LIVING



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FOREWORD BY ERIC DANESSE:

When we proposed to launch this Topic Group on construction at the General Assembly in Copenhagen, we mentioned from the start our intention of going to Italy to see this famous Bosco Verticale. This dream has become a reality thanks to EFL and the excellent relationships that our partners forge, particularly with local authorities and architects. But it was also necessary that our members return home with a great deal of valuable information on this subject of construction. And it is increasingly clear that our work for the coming decades will focus on reducing our carbon footprint.

This is where the CasaClima climate and certification institute has been a key player. The Bolzano region where they are located is special in more ways than one: nestled at the foot of the Alps, almost 70% of its population is German speaking. The climate is harsh, and the energy performance of buildings is therefore a priority. Consequently, CasaClima is very advanced in this field, with a concern from the outset for the reduction of carbon emissions. So, thanks to them we were able to satisfy our need to learn and share our knowledge.

During these three days, a total of 25 persons joined the meeting (in person or online), representing the following organisations: TU Delft, Gewobag, Villogia, L&Q Group, Eigen Haard, Chill Services, B&O, Fondazione Housing Sociale, Planet Smart City, Domnis, Berliner Bau Wohnungsgenossenschaft 1892, Hennigsdorfer Wohnungsbaugesellschaft, Places for People, Paris Habitat and EFL itself.

We would like to thank Uwe Staffler of CasaClima who gave us a magnificent welcome - and the visit to the cellars was a great moment - and also Joost Nieuwenhuijzen for his unfailing investment in the organisation.

INTRODUCTION AND OVERVIEW:

Between 6th and 8th of April 2022, around 25 members of Topic Group Construction met for a three-day event in Milano and Bolzano, Italy. The main topic of discussion was the reduction of CO₂ emissions, a topic in which the city of Bolzano and our host for the event, CasaClima, have a recognized expertise. The programme encouraged TG members to reflect on the question of energy production and consumption at the building, neighbourhood and city-level. On the first day, participants had the opportunity to visit the famous Bosco Verticale tower in Milano, in the new commercial district of Porta Nuova. On the second and third day, we dived deeper into the main subject, CO₂ savings, with presentations from experts, practitioners and EFL members. Site visits allowed us to see our reflections put into practice through Bolzano's ambitious Sinfonia project. The programme led to insightful discussions between participants and sparked ideas for applying lessons learned to their own organisations.

ABOUT THE TG CONSTRUCTION:

The Topic Group Construction, led by Eric Danesse, Chief Design Officer in Charge of Innovation and International Relationships at Vilogia, was created to explore all aspects of construction, from cradle to grave, and through the 3 challenges of climate change, affordability, and design. It addresses themes such as materials, architecture, modern methods of construction, BIM, circularity, urban planning, biodiversity, energy, and more. The TG regularly organizes best practice site visits, including workshops, onsite tours, etc as well as meetings with inspiring talks from experts from across Europe. We have looked into cost and resource-efficient ways of building e.g. offsite, modular construction; promoting innovative building and neighbourhood design and construction e.g. Affordable Housing Design Competition, and are actively tackling the challenge of energy retrofitting of buildings in order to reach climate goals.

ABOUT CASA CLIMA:

CasaClima is a public agency linked to the Province of Bolzano - South Tyrol focused on tackling the energy and ecologic transition. One of its main activities is the monitoring of building quality standards for newly built and refurbished buildings. Over the years, CasaClima developed a series of quality assurance certifications for residential buildings, schools, hotels, office buildings, and even wineries, as well as quality seals for buildings components.

Their goal is to help constructors to achieve the best results in terms of energy efficiency and quality of life for residents. To date, CasaClima has certified over 18,000 new and refurbished buildings. In addition, the agency plays an important role in training, knowledge transfer, education on energy efficiency for the building sector, but also communication and awareness-raising among citizens.

ABOUT BOLZANO:

The main part of the event took place in Bolzano, the capital city of the province of South Tyrol in northern Italy. The city's greater metropolitan area has about 250,000 inhabitants and it is one of the main urban centers in the Alps mountain range. The city is at the crossroads between Italian and German/Austrian culture, with both languages being widely spoken. South Tyrol has been encouraging the expansion of renewable energy sources for many years. Due to its geography, the Province offers a lot of opportunities for diversifying energy production: hydropower, wood, biogas, photovoltaics, solar, wind and geothermal energy are some of the technologies providing electricity and heat to the region's inhabitants. In the region, energy consumption derived from renewables is much higher than the European and Italian average. In 2021, Bolzano became the first city in Italy to be awarded "Climate Municipality Gold", the highest award for municipal climate protection recognised throughout Europe.



SITE VISIT IN MILAN - PORTA NUOVA AND BOSCO VERTICALE

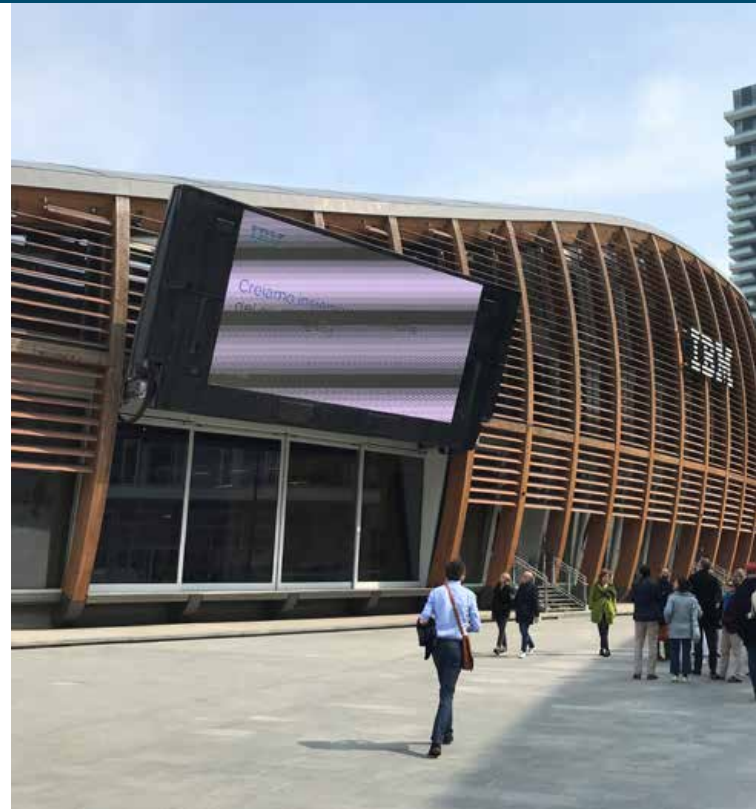
On the first day, participants met in Milan for a guided tour of the neighbourhood Porta Nuova, Milan's new business district. It is located right by the Milano Garibaldi railway station. The Porta Nuova project was first approved in 2004 and took about ten years to complete. The neighbourhood extends over an area of around 290,000 sqm: 170,000 sqm of public space (including a 90,000 sqm park), 140,000 sqm of office space, 40,000 sqm of retail and cultural venues and 403 apartments. One of the goals of the project was to revitalize the area around the railway station, which includes three neighborhoods: Garibaldi, Varesine and Isola. It includes a large number of green spaces.

The visit focused on the area around the Piazza Alvar Aalto. Around the Piazza, we observed skyscrapers and office buildings with retail space at the ground floor. Our guide explained that the whole area was developed by a single company, the Italian branch of a US real estate investor Hines. The project relied strongly on public-private partnerships: for instance, private investors were responsible for realizing and maintaining public spaces for the first 10 years after completion, whilst the city was in charge of the main park.

The neighborhood was primarily designed as a business, commercial and leisure district rather than as a residential area. A bit further down the road, near the Bosco Verticale, we did observe a few social housing buildings, which were preserved from the 'old neighborhood'. On the other hand,

while the project included the creation of new apartments, this new housing supply seemed focused exclusively on high-end housing. In Porta Nuova, the contrast between the old and the new is quite striking: a few steps from the high towers of the new business district, we observed old houses with traditional Milano architecture, with entrance from the balcony.

Towards the end of the visit, we stopped at the famous Bosco Verticale ('Vertical Forest') residential complex, designed by architect Stefano Boeri. It was built as part of the urban renewal project of Porta Nuova and inaugurated in 2014. It is made up of two towers of 80 and 112 meters, covered with the equivalent of 30,000 m² of vegetation: 480 large and medium trees, 300 small trees, 15,000 perennial



and covering plants and 5,000 shrubs. In line with the development of green façades, the project aimed to be a landmark for architecture biodiversity and sustainability. According to the architect, one of the goals was to counter urban sprawl by providing a more natural environment while preserving the advantages of urban life. The tree species were carefully selected by biologists and placed according to height and orientation of facades. One of the great challenges is to ensure that the plants that adorn the facades to the north are resistant to low sunlight, and also that the plants that grow on the highest floors are not bothered by the stronger wind at altitude. They prompted the creation of an urban ecosystem as they became inhabited by birds and insects. The vegetation also helps to produce oxygen and absorb CO₂, purifies air by absorbing harmful particles and counters the urban heat island effect by protecting the apartments from the sun and creating a cooler microclimate.

At the start of the marketing of apartments, buyers were reluctant because of the high maintenance costs associated with gardening. The initial sale prices were therefore relatively low (around €3,000 per m²). Now everyone wants to live there and prices have soared (around €15,000 per m²)!



KEYNOTE SPEAKERS AND LECTURES:

In Bolzano, participants attended several lectures at CasaClima headquarters, located at NOI Techpark, the science and technology park of South Tyrol. This site, which has been described as “South Tyrol’s innovation district” hosts 4 research institutes, 4 Faculties of the Free University of Bozen-Bolzano, 40 scientific laboratories, 40 companies and 30 start-ups.



Ulrich Santa, Managing director of the CasaClima – Presentation of CasaClima



Ulrich Santa, Managing Director of CasaClima, introduced participants to the activities carried out by the CasaClima agency in the field of energy and ecologic transition. He explained how CasaClima’s quality assurance process makes sure that sustainability standards measure the real performance of buildings by supervising the whole construction process, from approval to delivery. To do so, CasaClima carries out quality audits on construction sites (at least 2 for each building) to allow constructors to prevent and solve errors. The certification process looks at both passive and active components, putting energy efficiency first: thermal

insulation, quality of doors and windows, air tightness, shading systems, absence of thermal bridges. As part of the process, CasaClima also puts instruments and tools at the disposal of the planner, including software (energy and sustainability calculation, cost-efficiency analysis) and a catalogue of construction notes with best practices from the sector. Living comfort and quality of life after building delivery is also key to CasaClima’s evaluation. Since the first certificate was delivered 20 years ago, CasaClima has moved from an exclusive focus on energy efficiency and has been incorporating a wider set of sustainability and living comfort criteria, such as life-cycle assessment of materials, water cycle, sound insulation, indoor air quality and natural daylight. In addition, to address the challenge of retrofitting the existing housing stock, CasaClima developed a certification for improving the efficiency of existing buildings. The agency is also currently extending its vision from the building to the district and city-level by supporting municipalities on their way to sustainability.

It is important to note that CasaClima also has international ambitions. Its certification method has a certain interest in other European countries.



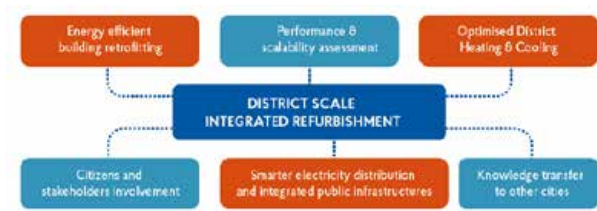
Smart City Development in Bolzano - presentation by Daniele Vettorato from Eurac Research

Participants learned about Smart City Development in Bolzano from Daniele Vettorato, Coordinator of the Urban and Regional Energy Systems research group at Eurac research, a private research center based in Bolzano with over 500 staff members. He highlighted the change in the smart city concept, moving from a strictly technological perspective to a more integrated vision, equally focused on community-building. Energy communities is now one of the driving concepts within smart city development, while living labs and co-creation have also developed as part of this process.

The rest of the presentation focused mainly on Sinfonia, an EU-funded smart city project to deploy large-scale, integrated and scalable energy solutions in mid-sized European cities, which was piloted in Bolzano between 2014 and 2020. Total budget is 43 million €, co-financed by the EU for 27 million €. Overall investment in the region is over 30 million € as building efficiency measures are running in parallel with a massive extension of district heating in Bolzano.

The project was divided into three main pillars:

- Enhancement of district heating system
- Infrastructure for mobility and services
- Large-scale refurbishment of social housing



The main goal of the project was to refurbish 100,000 m2 of living surface in two pilot cities, Bolzano and Innsbruck, with a reduction of 40 to 50% in energy consumption and an application of renewables by 20%. In Bolzano, 5 social housing building complexes representing over 30,000 m2 of floor space were refurbished. In addition, the city's district heating system was expanded, and on-site renewable energy (geothermal, solar thermal, photovoltaic) was installed in the refurbished buildings.

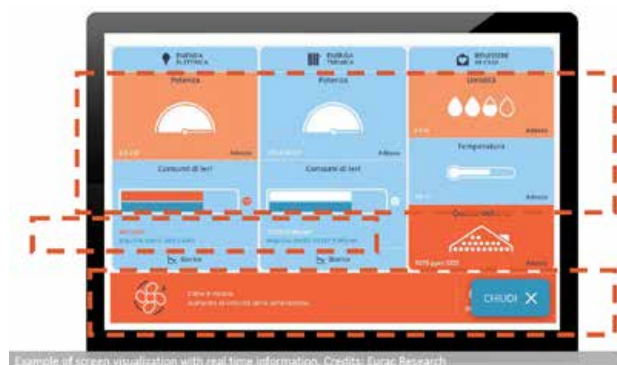


A few aspects of the project's implementation are interesting to consider. First of all, cooperation between many stakeholders was essential to the success of the project. It relied on a strong partnership between research, industry and citizens: project partners, architects, engineers, many construction companies and the inhabitants themselves all played an important role.

Another point to consider is the gap between the expected level of energy savings and the real energy consumption of the building: while an 83% reduction was anticipated during the design phase, this figure was not fully achieved. This is due to the fact that the reduction was calculated considering a scenario of optimal use by tenants. The take-home message is that technical solutions for energy efficiency should always go hand-in-hand with encouraging changes in the habits and behaviour of residents.

Sinfonia attempted to address this issue by setting up temporary exhibitions in every building, in order to inform the tenants about the changes in their home and the new implemented technologies. A system of monitoring of real energy consumption through screen displays with real-time

information was also implemented in over 100 dwellings. Tenants will be encouraged to adjust their energy consumption according to the real-time data they are provided about thermal and electric energy consumption in their dwelling, as well as other indicators such as room temperature and humidity.



Example of screen visualization with real time information. Credits: Eurac Research



Presentation on Energy, Emissions and Buildings – Wolfram Sparber

Head of EURAC's Institute for Renewable Energy Wolfram Sparber delivered a presentation of energy, emissions and buildings. He first introduced the activities of the Institute for Renewable Energy. Started in 2005, this Institute now has 129 collaborators, 9 labs, and an overall budget of 28 million euros. Among its research fields, five are directly linked to buildings, and the laboratories carry out accredited testing

activities in the fields of PV, building and façade components testing, heat pumps, hydrothermal testing, simulation testing of district heating and cooling networks, facade testing and long-term data collection of PV technology. The work carried out by the Institute is done in close collaboration with industrial partners, which can be linked to the development of a particular product or be part of a long-term cooperation or a European project.

Our 6 Research fields

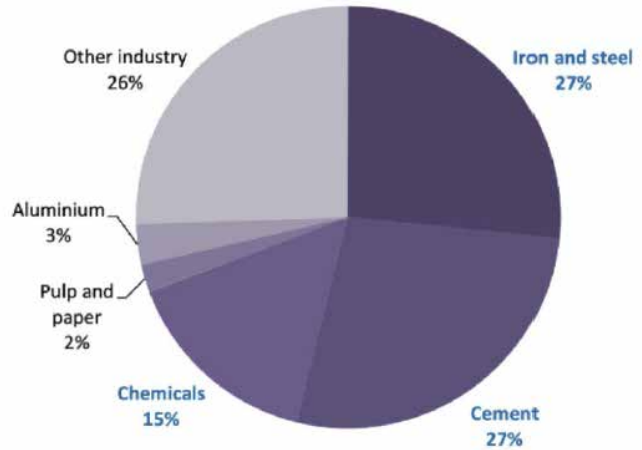


Mr. Sparber shared some insights about what housing companies can do to accelerate the energy transition in order to meet the European and IPCC targets. First, he made a point that housing companies can play a role in reducing transport-sector emissions by encouraging the uptake of electric vehicles. Though historically, transportation was separated from buildings on the energy scene, this is changing with e-mobility, as owners of electric vehicles who have the possibility to do so charge mainly at home. In his view, electric charging stations in each single garage or parking place are key for a transition to a low-carbon cities.

The second key message has to do with the replacement of heating systems: according to our speaker, this is as necessary as energy-efficiency measures in order to reduce emissions. For this reason, he recommends connecting buildings to district heating whenever possible. Even if many district heating systems are fossil at the moment, they are much more likely to become sustainable in the future, as they are a base infrastructure for cities which can be connected to many energies. Another alternative would be biomass heat pumps. Mr. Sparber also argues in favour of hybrid solutions: heating systems relying mostly on heat pumps with a fossil fuel as a back-up for peaks of heat demand during winter. Above all, he stressed that the replacement of gas and oil boilers is inevitable, and as such, it has to be prepared in order to avoid the replacement of fossil fuel boilers merely with newer fossil fuel boilers.

The last point is linked to the choice of construction materials. Based on the observation that iron, steel and cement are responsible for more than 50% of global emissions by industry, it is absolutely necessary to replace these materials with low-carbon alternatives or with bio-based materials. Bio-based materials have the added benefit of capturing CO₂, acting as temporary CO₂ storage. One option to encourage the use of low-carbon materials whenever possible is to make it part of a company's purchasing standards: in this way, no additional thought by management is needed and over time the building stock becomes more and more sustainable. The same principle may be applied to other sustainable construction practices such as green roofs and renewable energy application on site. Finally, when implementing low-carbon materials, it is important to have tools to evaluate accurately their environmental impact, as deforestation and importation of woods from developing countries can offset the benefits from avoiding the use of carbon-intensive materials.

Share of Global Direct CO₂ Emissions by Industry Subsector



Source: Brinwald Molisch, Adam Baylin Stern, and Sawonika McCaughy, Transforming Industry Through CCUS (Paris: International Energy Agency, 2018), <https://www.iea.org/reports/transforming-industry-through-ccus>.

Climate Solutions Series: Decarbonizing Heavy Industry | Center for Strategic and International Studies (csis.org)

Refurbishment case studies around Europe



PRESENTATIONS BY ELF MEMBERS

EFL members gave an overview of the policy landscape for CO₂ savings in different European countries.



FRANCE:

In France, national policy targets the most energy-consuming buildings: by 2023, new rentals of class G buildings will be prohibited. By 2025, the rule will be extended to class F buildings, and by 2035, to class E buildings. For now, French government sets more ambitious goals for new construction than for rehabilitation. At Vilogia, the goal is to reduce emissions by 30% by 2030 and by 80% by 2050. The EnegieSprong method, which started in the Netherlands and is expanding into other European countries, will be industrialized and applied to 400 Vilogia homes.



ITALY:

In Italy, regulation on CO₂ emissions is implemented not only at the national, but also at the regional level. Italy follows European Commission guidelines regarding the reduction of CO₂ emissions. However, even though rented property has to be evaluated for energy performance, this rule is often not enforced. One policy used to incentivize the energy transition is the so-called "Superbonus": a fiscal deduction on income tax over 5 to 10 years for retrofitting existing buildings. First limited to individuals, this incentive was later on also made available to banks and companies. This policy was followed with interest by other governments in Europe and later inspired similar incentive programs.



GERMANY:

In Germany, the national goal is to be carbon neutral by 2045. The country's energy production still relies primarily on gas, coal and oil. 38,2% of electricity generation, however, comes from wind power. A recent law in Germany establishes that landlords renting properties with G efficiency must pay for 10% of heating costs. Gewobag has a lot of older housing stock, which increased significantly when the government mandated the sale of private homes to social housing companies, which in their majority were very energy inefficient. Currently, Gewobag spends 120 million euros every year for old homes refurbishment.



UNITED KINGDOM:

The UK's Net Zero Strategy aims at achieving net zero emissions by 2050, as well as a 78% reduction of emissions by 2035 as compared to 1990. In addition, the government published a "ten point plan for a green industrial revolution", with a lot of investment in wind energy and support for net zero aviation and green finance. In 2022, there was a change in building regulations, with a mandated 30% reduction of carbon emissions in new construction. The objective is that by 2025, new build housing should be energy efficient and no longer need retrofitting by 2050. To support these goals, L&Q is investing in research and development. A lot of the budget previously allocated to new construction (goal of building 100,000 homes over a ten-year period) was redirected to the renovation of existing homes. They will spend £1.9bn improving their stock over the next 7 years!



THE NETHERLANDS:

The Netherlands also aims at carbon neutrality by 2050, while 16% of energy should be renewable already by 2023. There are different standards for new buildings and for renovation, with more restrictions on new buildings in an attempt to make them "future-proof". However, old buildings are also getting transformed, for example by adding winter gardens in front of brick buildings, which improves thermal insulation and reduces energy consumption for heating. Eigen Haard established a roadmap with short, mid and long-term goals for achieving carbon neutrality, which involves using as little material as possible, using sustainable raw materials that do not affect ecosystems and using materials as long as possible.



SITE VISITS IN BOLZANO:

Alperia Tower

Our first stop was the Alperia Tower, which is part of Bolzano's district heating network. With over 250,000 customers, Alperia is the largest energy producer in the region and the 1st green energy producer in Italy.

This thermal energy storage tower was put into operation in 2015 as part of the expansion project of district heating to cover 3/4th of the city of Bolzano. It stores hot water which is heated by two incinerators, one using 130.000 tons per year of waste and one using an innovative gas blend. The storage capacity of 5,800 m³ of water with a temperature of approximately 95°C corresponds to a storage capacity of 220 MWh, will compensate for the peak loads of heat collection of the district heating network, allowing even more customers to connect to the district heating network. In order to contribute positively to the urban landscape, an architectural tender was held for the external design of the tower.

Alperia started using a blend of natural gas and hydrogen in the gas incinerator, with the goal of reducing exhaust gas emissions. The hydrogen is transported from the nearby Hydrogen Centre in Bolzano-South, located at only 3,5km by road transportation. With this new blend, Alperia was able to reduce CO₂ emissions by 25% and significantly cut the emissions of other polluting gases, such as methane (-15%) and nitrogen oxides (-40%). Regarding the waste incinerator, an issue which was discussed is the strict regulations imposed by the Italian authorities, which establish that only local waste can be burned, and in limited quantities. This led to a discussion on the necessity of considering both the advantages and the negative externalities of different methods of energy production. As participants pointed out, no energy is 100% clean.





Another interesting aspect of Alperia's activity is the data collection model they have developed. This model considers data from supply to consumption, including all important information at the distribution level. As part of the modernization of its processes, Alperia digitalized and integrated its data collection into a unified model. Previously, there had been two separate networks, one for

supply, and one for demand, which did not allow for cross-analysis. The new software, on the other hand, provides a complete overview of network behaviour based on the collected data and allows Alperia to detect irregularities in real time. This dual network also makes it possible to adapt supply to demand in real time, by predicting user behaviour.



Casanova District and Refurbished IPES building

After our first site visit, we headed to the Casanova District, a social housing neighbourhood built between 2004 and 2010 by IPES Bolzano, the public housing company of the Province Südtirol/Alto Adige. This housing was built considering sustainability standards: in particular, all the buildings have green roofs, and the whole area is connected to district heating. In Bolzano, social housing is owned mostly by the Province through IPES and attributed based on income. There is around 13,000 social housing units and 30,000 social housing tenants, for a population of around 106,000 people. The price of rent in social housing varies from 0 to 7 euros per square meter.

We also visited one of the social housing buildings which was renovated as part of Sinfonia. As part of the project, IPES worked with CasaClima on retrofitting. Indeed, IPES has been operating since the 1930s, and a lot of buildings

from the 1950s to the 1980s face big problems with thermal insulation. The building we visited was built in the late 1970s and was made up of 106 dwellings before refurbishment. After the renovation, 10 additional dwellings were added through building elevation, thanks to a law that establishes that refurbished buildings can increase their building volume by up to 10%. The main transformation implemented was the addition of external insulation to the building, as well as the inclusion of a ventilation system. In addition, the existing windows were replaced by triple-glazed windows. The refurbishment involved social as well as technical challenges. Indeed, tenants were not displaced during the works: movable walls were used to isolate areas of the housing units with ongoing works while allowing tenants to go on with their everyday life. All workers were clearly identifiable in order to create a sensation of safety and facilitate communication.

CONCLUSIONS AND LESSONS LEARNED

CONCLUDING REMARKS BY ERIC DANESSE:

What I will remember from these 3 days is that all the countries represented are aiming for the same target: carbon neutrality as quickly as possible, with a goal no later than 2050. The means to achieve this are essentially the same: efficient thermal renovations, use of low-carbon materials, financial incentives, increasingly frequent use of renewable energies. Bolzano is a very advanced city in this area and, thanks to CasaClima and its certification method, its advance is even structured. European funds are particularly well used there.

The experts present, and in particular Wolfram Sparber who is an international authority on the subject, gave us some keys to go even faster: on mobility, on the replacement of fuel and gas boilers, on materials, etc...

Because climate change is there, and it's not a joke, our visit to the cellars illustrated it in a very concrete way, because winegrowers are already confronted with it. In their plans, they soon consider replacing their vines with other varieties more resistant to heat waves.

We must prepare our cities for this inevitable change. In parallel with the work on the carbon footprint, we will also have to strengthen our stock and give it more resilience. With the scarcity of fossil resources, energy change is also on the way. The participants have understood this well and the theme of renewable energies, energy communities and self-consumption, electric mobility should be one of our next topics of reflection.

Again, we want to thank everybody for joining and participating. We hope to see you next time in good health and spirit!





EUROPEAN FEDERATION
FOR LIVING

CONTACT INFO

European Federation for Living

Official Postal address / P.O. Box 67065 / NL-1060 JB Amsterdam

E: info@ef-l.eu / W: www.ef-l.eu

