Factsheet

Housing complex - Via Passeggiata dei Castani, Bolzano

PROFILE

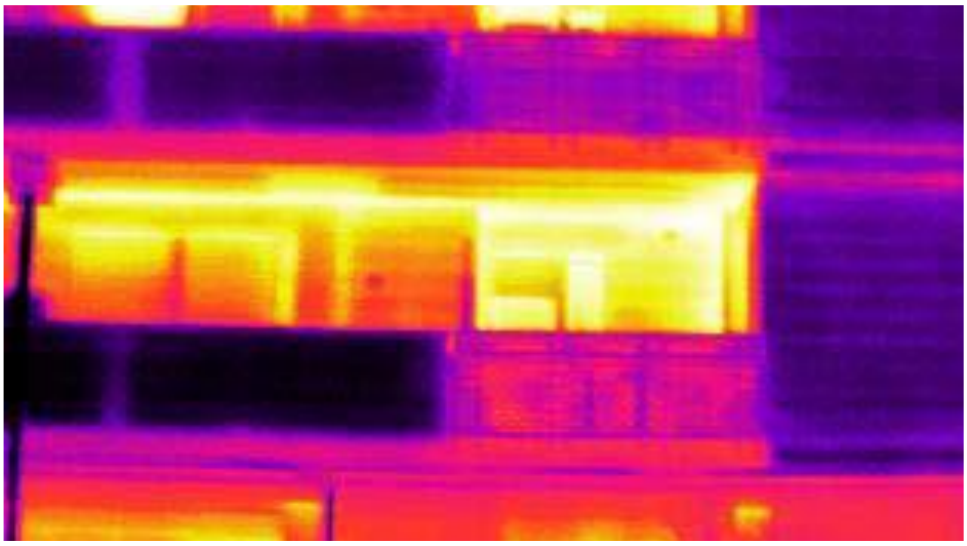
Name and address	Aslago-Oltrisarco Quarter Via Passeggiata dei Castani 33/abcd Building A and 33/efgh Building B
Map	 

	Images ©2017 Google, Cartographic Data ©2017 Google	
Description	Passeggiata dei Castani Area is located in the east side of the city of Bolzano, on a mountainous area and it was built in the nineties. Due to thermal bridges and a non-continuous insulation, the buildings have been exposed to high humidity, water infiltrations and internal surface condensation.	
Ownership	Municipality of Bolzano	
Gross heated volume	24.165 m^3	
Net surface	5.712 m^2	
Number of dwellings	72	
Energy performance		
	Final energy consumption for heating	
	BEFORE	260,1 kWh/m^2year
	AFTER	14,8 kWh/m^2year
	Renewable energy	
	BEFORE	-
	AFTER	74 kWp of photovoltaic plan 437 m² of solar thermal 15 Geothermal wells 150 mt + heat pump

1 - DESCRIPTION BEFORE REFURBISHMENT

Detailed characteristics of building	The project concerns the renovation of the buildings located in Via Passeggiata dei Castani 33/abcd (building A) and 33/efgh (building B) in Bolzano. Each building is composed of 4 staircases for a total of 72 flats, plus a common garage in the basement. The buildings have no cantilevered elements, the balcony spaces are made up of three side enclosed loggias. The shading is affected by the position of the mountainous hill close to the south-east side and this strongly penalizes the energy aspect of the intervention in relation to the solar gains on the façade.
Plot map	 Images ©2017 Google, Cartographic Data ©2017 Google
Building envelope	The perimeter walls are made of hollow wall tiles with an insulation layer of 4 cm. The stairwells walls are reinforced concrete insulated towards the flats with 8 cm perforated bricks. The slab to the basement is devoid of thermal insulation, while the underside of the slab on the first floor has been isolated with different thickness in the two buildings. The reinforced concrete structures are insulated with Eraclit or polystyrene panels, with a variable thickness of 4 to 6 cm, in the outer side. Covering has an insulating layer and a waterproofing sheath covered with nonwoven fabric and protective gravel. Technical features: Exterior walls with reinforced concrete frame and double layer of bricks and cavity insulation (isolamento intercapedine).

	U = 0.67 W/m2K Insulated brick roof U = 0,47 W/m2K Ceiling to cellars with predalles type structure U = 0,63 W/m2K Windows: Double glazing: Ug = 3,1 W/m²K Aluminium frame: Uf = 2,5 W/m²K Aluminium spacer
Technical system	Heating and domestic hot water are produced by autonomous gas fired boilers installed in each flat.

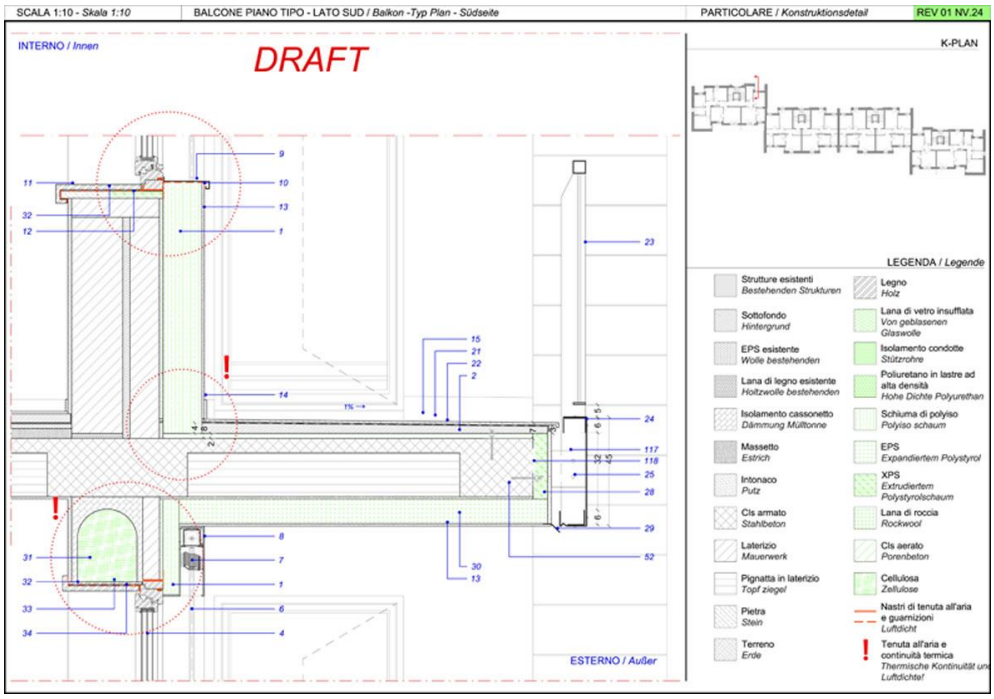
Thermal image before refurbishment	  Images © Eurac Research
Other relevant technical aspects	During the refurbishment works the tenants remained in their own flats. For this reason, one the goals of the design was to ensure a low impact on the residents' habits through in-depth study of building and security aspects. All the interior works in the flats were programmed with the residents, who were informed of their typology and duration. Lastly, the replacement of the plants was scheduled in order to guarantee the least discomfort during the transition period.

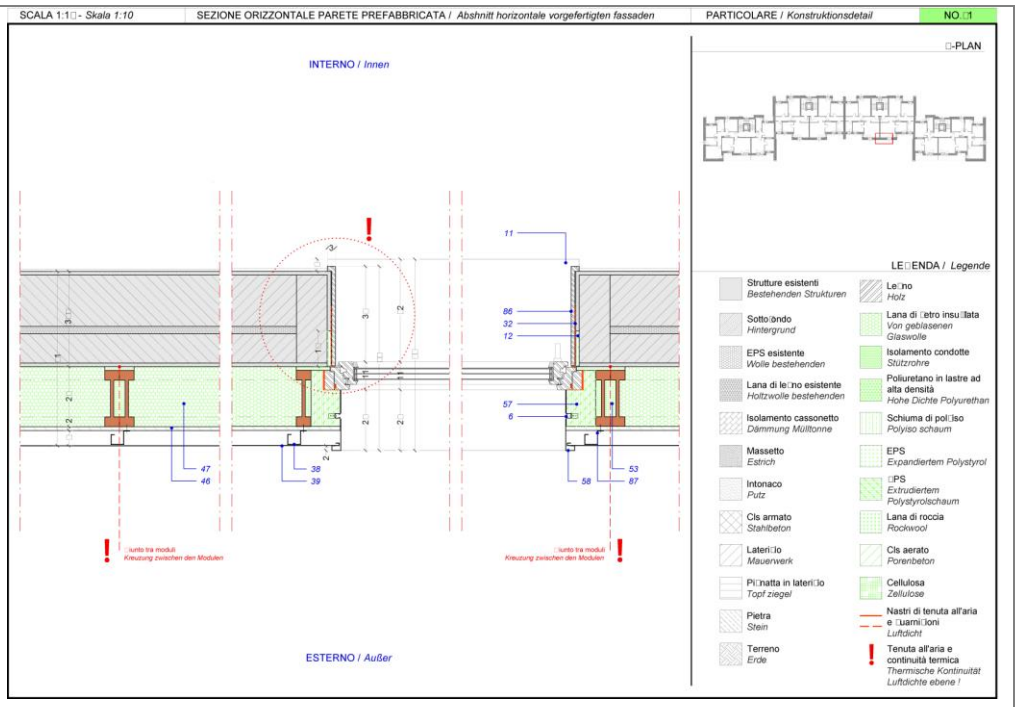
2 – REFURBISHMENT CONCEPT

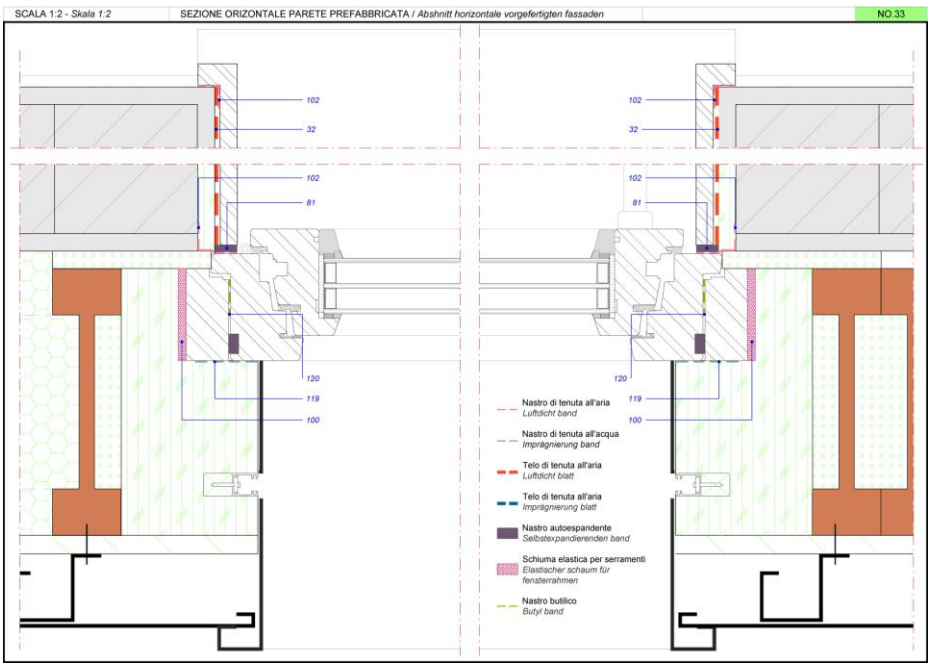
Concept	The project involves the realization of an envelope for the energy improvement of buildings and the rehabilitation of the moisture infiltration in the basement. It includes the installation of a centralized heating system with a geothermal heating pump (characterized by two vertical loops with 15 holes 150mt deep), the implementation of a controlled mechanical ventilation system, plus a photovoltaic field and a solar thermal field on the roof. The need for a "slender" construction site in order to ensure the least impact on the site's inhabitants, together with the goal of high performance energetic envelope have orientated the design team to foresee the use of prefabricated timber frame façade. The façade consists of boxes made of wood beams and wood agglomerated panels. These panels will cover the perimeter walls of the blocks from the first to the fourth floor.  *Figure 1 - Images: © Studio Mellano Associati* The panels have been fixed to the existing walls with reinforced steel supports, connected to the existing reinforced concrete slabs. Attention has been paid to the lateral alignment of the panels in order to ensure the correct alignment of the new façade and to avoid thermal bridges.

Energy Solutions	The project goal is a sharp reduction in the energy requirements for heating and domestic hot water production. The existing boilers and the entire gas network for domestic use were dismissed. The project considered extensive use of the renewable sources (solar thermal and geothermal) in the implementation of a hydronic system. The solution reduces fossil energy needs and ensure low operative costs and is based on a hybrid system that includes a gas-fired boiler for DHW production and a geothermal heat pump for heating. This solution covers 69% of the heating needs with renewable sources. The construction envelope has been designed to achieve a high thermal performance, with energy demand for heating of 14.8 kWh/m2year. The solar photovoltaic and solar thermal plants on the roof of the buildings and the design of the thermomechanical plants involved a careful analysis of the solutions that would allow the exploitation of an additional share of renewable energy through the use of a heat pump. In order to avoid the demolition of large partitions inside the housing, the executive project involved the creation of external cavities for the existing enclosure for the passage of the implant posts and the passages of the connection systems to the accommodation at the staircases. This design option also optimizes the transition from the existing system to the new centralized system without having to use transitory solutions
Financing Model	The Sinfonia project covered the part of costs which allowed to bring the energy performance level above the legal requirements. The funds were integrated with the national contribution called Conto Termico.

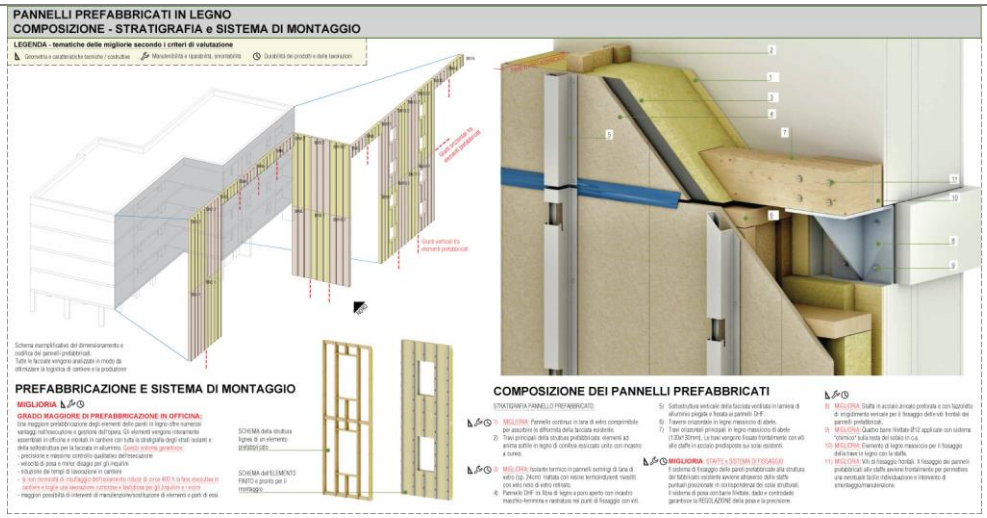
Envelope details

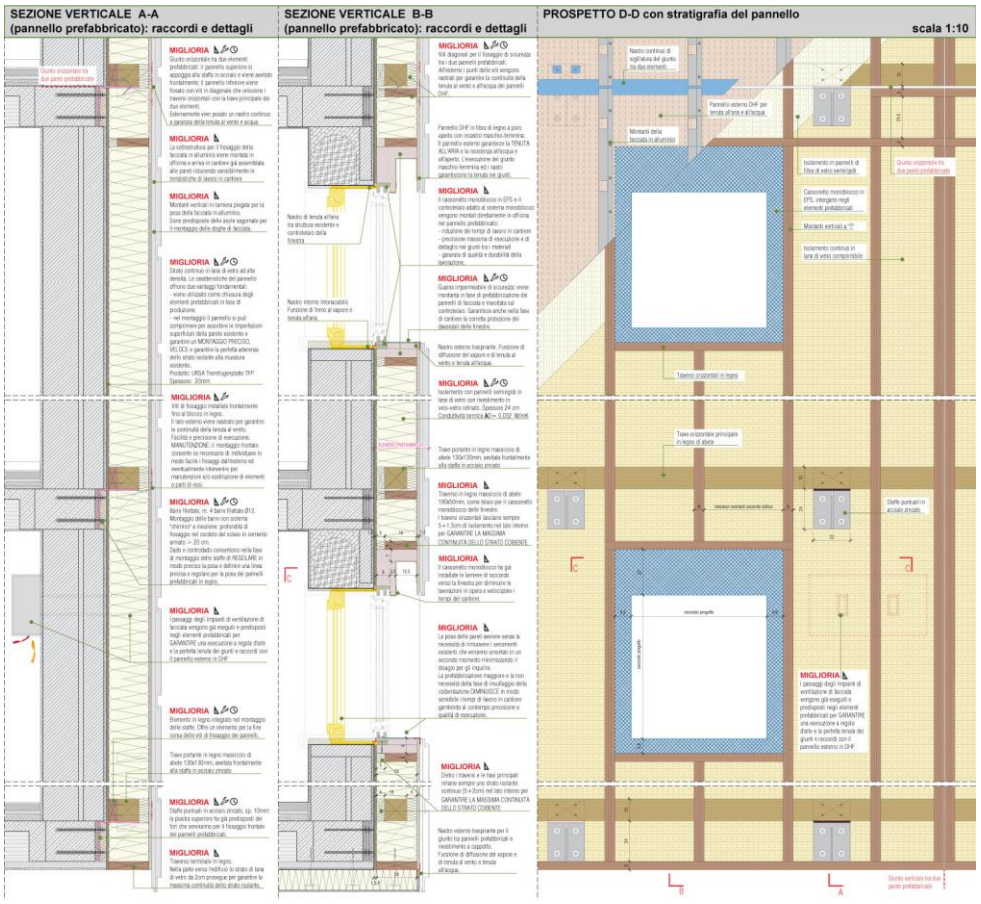
Balcony refurbishment (thermal bridge)	Tender specification drawing done by arch. Alberto Sasso and Studio Mellano Assocciati  Images: © Alberto Sasso and Studio Mellano Associati
Multifunctional Façade and wall section	Tender specification drawing done by arch. Alberto Sasso and Studio Mellano Assocciati



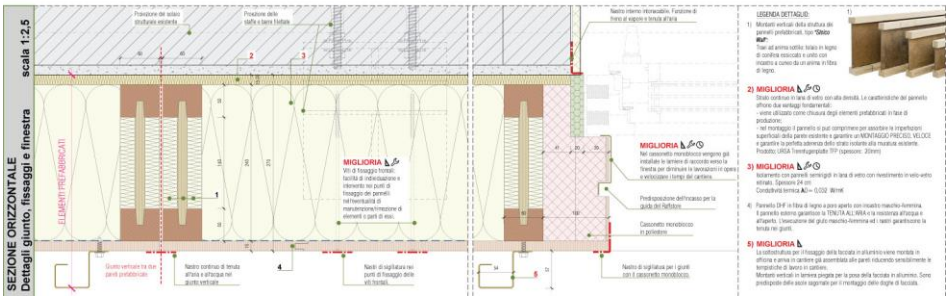


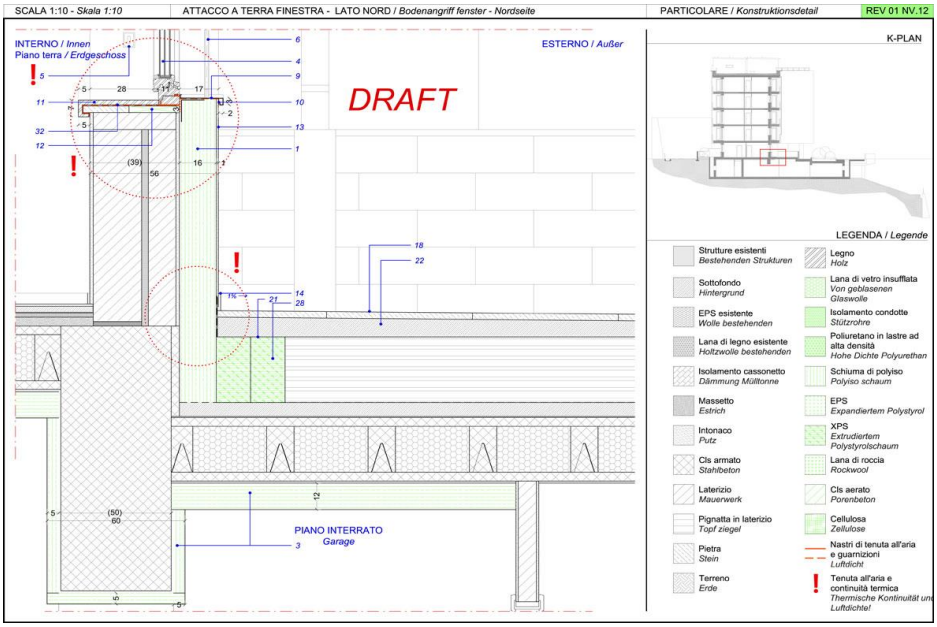
Images: © Alberto Sasso and Studio Mellano Associati



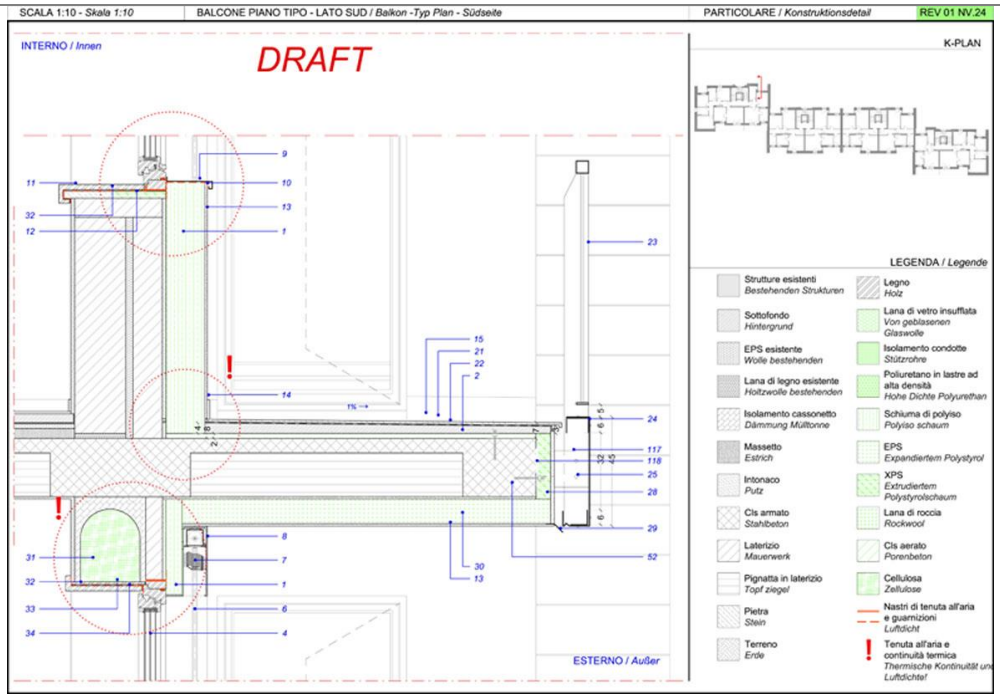


Images: © Alberto Sasso and Studio Mellano Associati

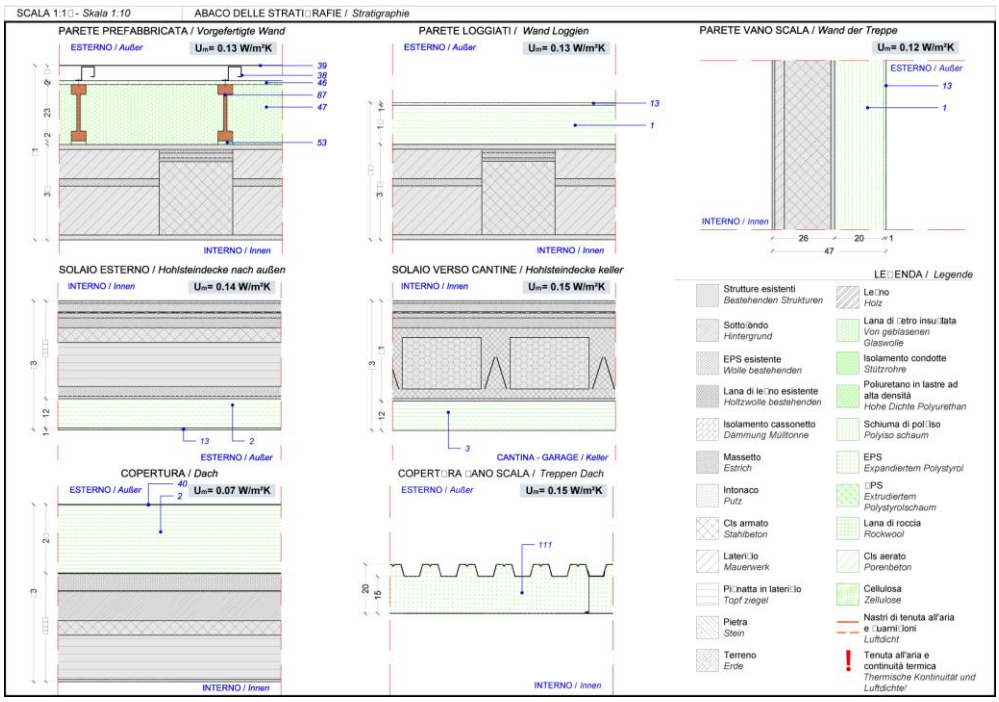




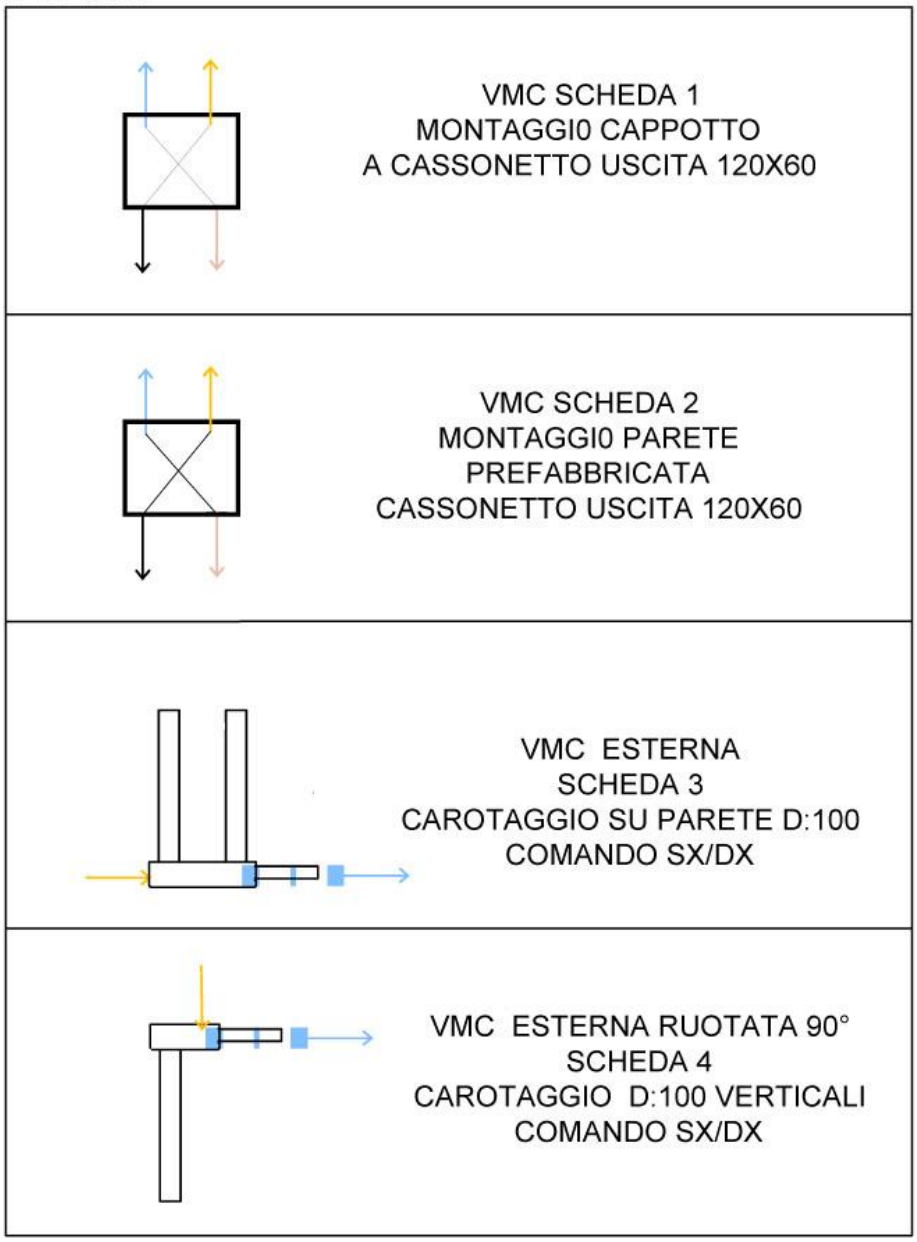
Images: © Alberto Sasso and Studio Mellano Associati

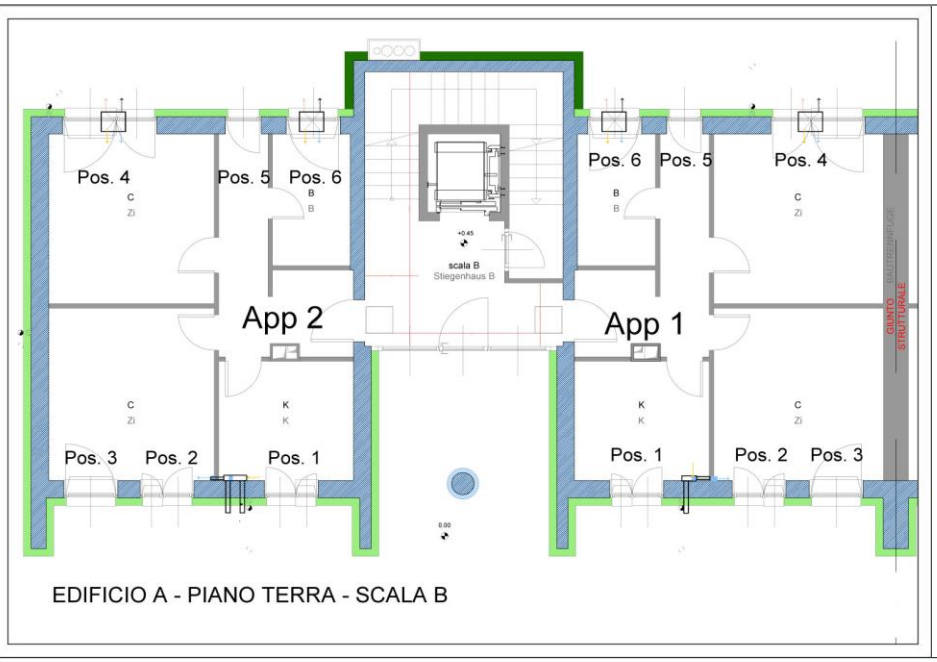


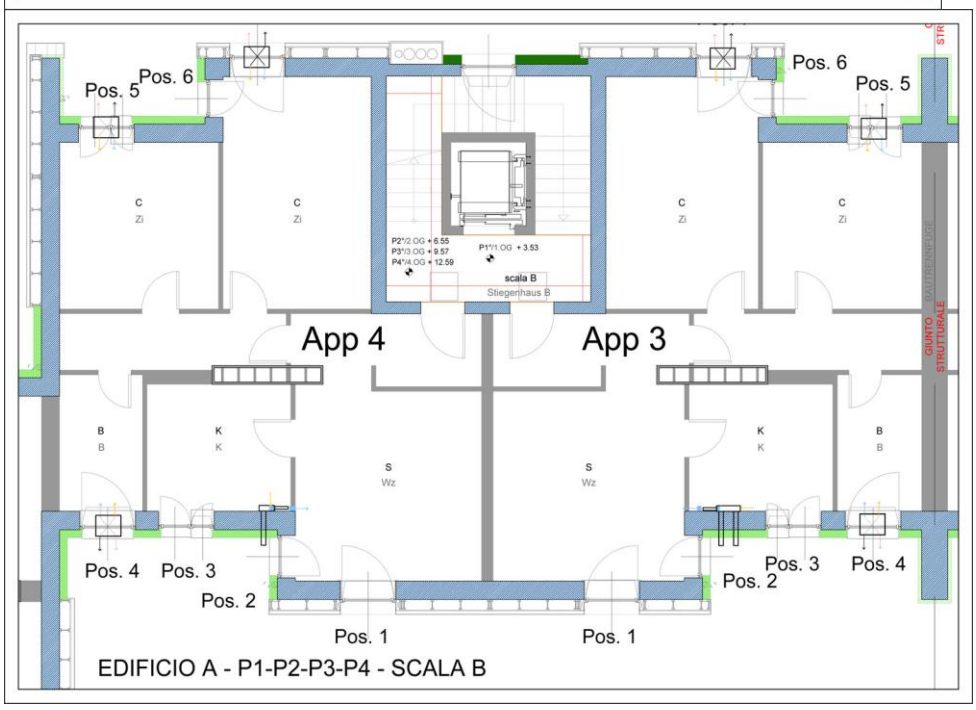
Images: © Alberto Sasso and Studio Mellano Associati

Envelope section	Tender specification drawing done by arch. Alberto Sasso and Studio Mellano Associati  Images: © Alberto Sasso and Studio Mellano Associati

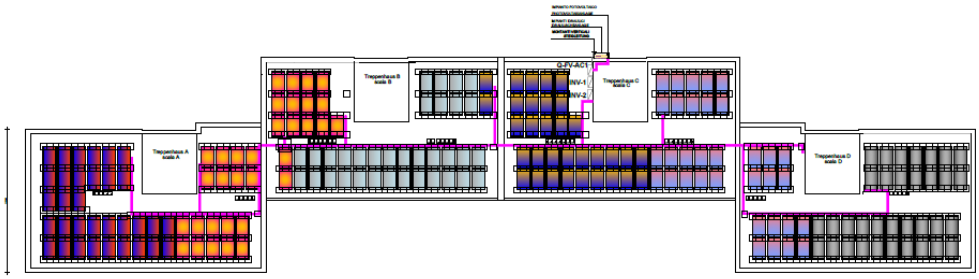
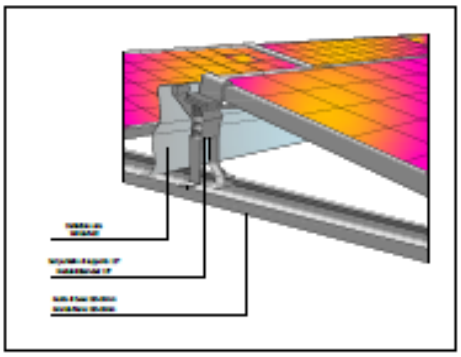
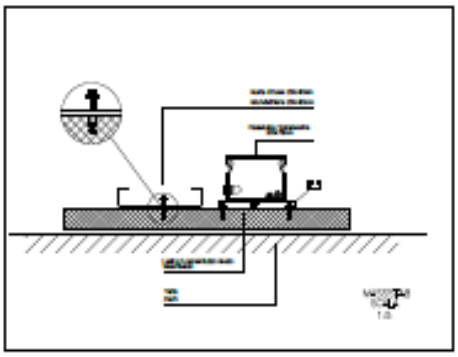
Technical system

Mechanical ventilation	Decentralized mechanical ventilation LEGENDA  Images from The HOC certificate





Images from the HOC certificate

Electric renewable integration	   Images: © Energytech Ingenieure Srl

3 - IMPLEMENTATION

Stakeholders involved	
Building owner	Municipality of Bolzano
Architectural project	Ing. Giorgio Sandrone e Ing. Paolo Sobrino - Studio Mellano Associati (TO) Arch. Alberto Sasso - Officina di Architettura (TO) Arch. Manuel Benedikter - Manuel Benedikter architecture (BZ)
Plant engineering project	Ing. Andrea Cagni - EQ Ingegneria (TO) Ing. Massimo Vettori - Studio Tecnico Vettori (BZ)

	Arch. Dipl. Ing. Gerhard Kopeinig - Arch + More (Austria)
Responsible for the Procedure **(RUP)**	Ing. Rosario Celi
Project Co-ordinator:	Dott. Emanuele Sascor
Construction company	Associazione temporanea d'Impresa made up by the firms CARRON BAU S.R.L., ASTER HOLZBAU S.R.L. WOLF FENSTER S.P.A.
Energy consultant, scientific support	Agenzia Casa Clima, Eurac

Costs and financing	
Refurbishment costs	• Overall costs for renovation € 5,394,130.23 • Monitoring € 167,463.16€ • Monitoring system € 6,897.95 • DL (Works' supervision): € 153,211.51
Financial resources	• Renovation works covered by Sinfonia: (50%) € 1,486,480.00 • Renovation works covered by conto termico (65%) € 3,301,650.00 • Sinfonia's contribution to monitoring € 247,000.00 (50%) • DL (Works' supervision): € 72,800 (50%) • Monitoring system = € 7,795.00

Implementation planning	
1 - Signature consortium agreement	**2014**
Approval of the European Community; the City Council of Bolzano approved the participation at the project, start of the Sinfonia project.	
2 – Planning of the energy pilot district	**2014**
3 - Tender procedure for the energy refurbishment project	**December 2015**
An open procedure was chosen.	
4 - Approval of the preliminary, the final and the detail project	**May-December 2016**
5 - Tender procedure for the energy refurbishment works	**April 2017**
6 – Start of the energy refurbishment	**July 2017**
7 – End of the energy refurbishment	**May 2019**
8 – 60 days for the refinement works	**May 2019-July 2019**
9 – Administrative and technical validation	**July 2019-** **November 2019**

Work progress	
Installation of the VMC in the inner of the flats (photo by Rosita Izzo)	 
Multifunctional precast façade in Aster laboratory (photo by Rosita Izzo)	

Geothermal probe (photo by Rosita Izzo)	
Mounting of the aluminium cladding (photos by Arch. Alberto Olivotto/Arch. Manuel Benedikter)	
New thermal central (photos by Arch. Rosita Izzo)	 

Insulation of the heating distribution and insulation of the cellar (photos by Arch. Rosita Izzo and Arch. Alberto Olivotto/Arch. Manuel Benedikter)	 

4 - DESCRIPTION AFTER REFURBISHMENT

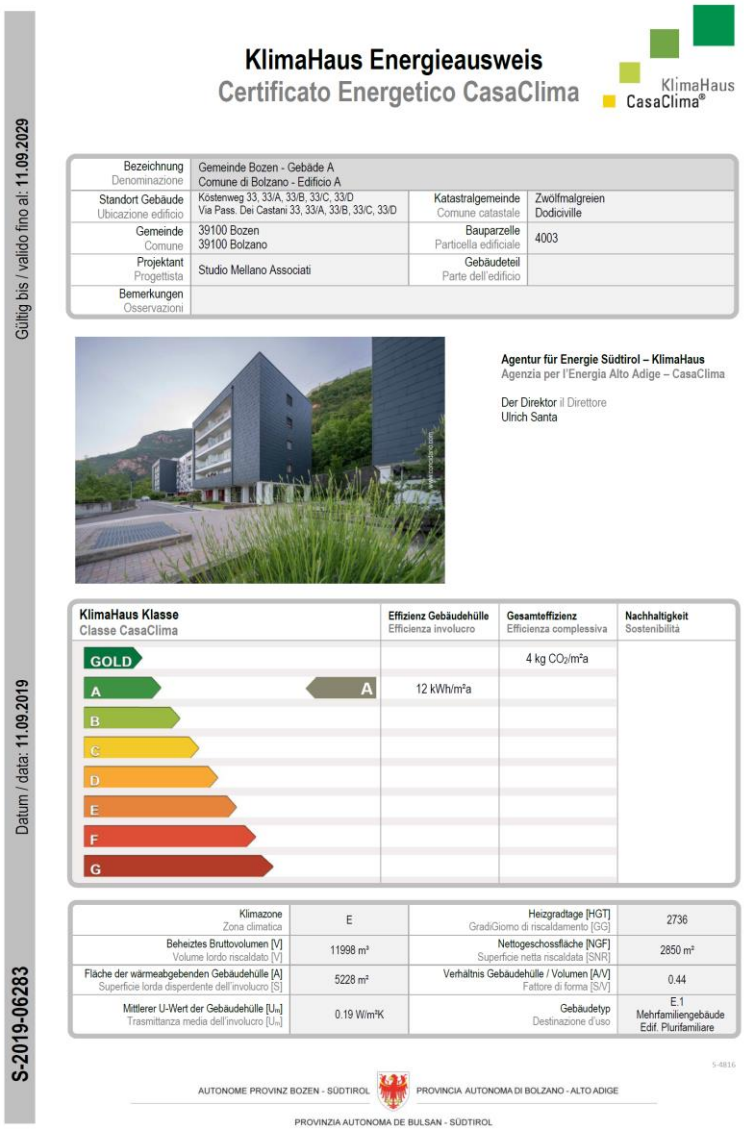
Photo to show architectonic concept

PHOTO: Dario Conci

Envelope characteristics (from the HOC certificate)

Façade/wall	W/m²K	**0,14**
Roof	W/m²K	**0,08**
Ground floor	W/m²K	**0,22**
Windows	W/m²K	**0,7**
Average U-value	W/m²K	**0,19**

Energy efficiency certificate



KlimaHaus Energieausweis
Certificato Energetico CasaClima

KlimaHaus CasaClima®

Gültig bis / valido fino al: 11.09.2029
Datum / data: 11.09.2019
S-2019-06283

Bezeichnung Denominazione	Gemeinde Bozen - Gebäde A Comune di Bolzano - Edificio A		
Standort Gebäude Ubicazione edificio	Kostenweg 33, 33/A, 33/B, 33/C, 33/D Via Pass. Dei Castani 33, 33/A, 33/B, 33/C, 33/D	Katastralgemeinde Comune catastale	Zwölfmalgreien Dodiciville
Gemeinde Comune	39100 Bozen 39100 Bolzano	Bauparzelle Particella edificiale	4003
Projektant Progettista	Studio Mellano Associati	Gebäudeteil Parte dell'edificio	
Bemerkungen Osservazioni			

Agentur für Energie Südtirol – KlimaHaus
Agenzia per l'Energia Alto Adige – CasaClima

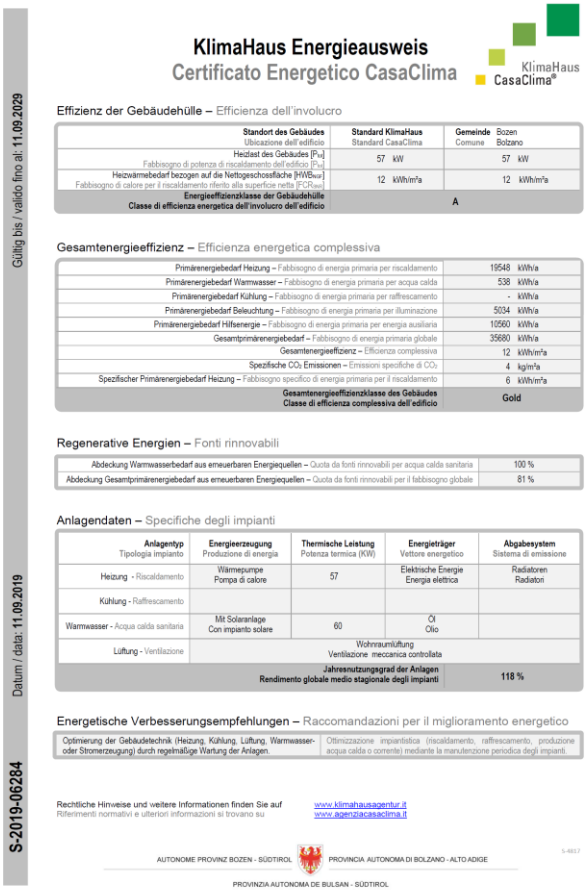
Der Direktor il Direttore
Ulrich Santa

KlimaHaus Klasse Classe CasaClima	Effizienz Gebäudehülle Efficienza involucro	Gesamteffizienz Efficienza complessiva	Nachhaltigkeit Sostenibilità
GOLD		4 kg CO_2/m^2a	
A ← A	12 kWh/m^2a		
B			
C			
D			
E			
F			
G			

Klimazone Zona climatica	E	Heizgradtage [HGT] Gradi/Giorno di riscaldamento [GG]	2736
Beheiztes Bruttovolumen [V] Volume lordo riscaldato [V]	11998 m³	Nettogeschossfläche [NGF] Superficie netta riscaldata [SNR]	2850 m²
Fläche der wärmeabgebenden Gebäudehülle [A] Superficie lorda disperdente dell'involucro [S]	5228 m²	Verhältnis Gebäudehülle / Volumen [A/V] Fattore di forma [S/V]	0.44
Mittlerer U-Wert der Gebäudehülle [U_m] Trasmittanza media dell'involucro [U_m]	0.19 W/m²K	Gebäudetyp Destinazione d'uso	E.1 Mehrfamiliengebäude Edif. Plurifamiliare

5-4816

AUTONOME PROVINZ BOZEN - SÜDTIROL PROVINCIA AUTONOMA DI BOLZANO - ALTO ADIGE
PROVINZIA AUTONOMA DE BULSAN - SÜDTIROL



Gültig bis / valido fino al: 11.09.2029

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S-2019-06284

KlimaHaus Energieausweis
Certificato Energetico CasaClima

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Effizienz der Gebäudehülle – Efficienza dell'involucro

Standort des Gebäudes Ubicazione dell'edificio	Standard KlimaHaus Standard CasaClima	Gemeinde Comune	Bozen Bolzano
Heizlast des Gebäudes [P_{tot}] Fabbisogno di potenza di riscaldamento dell'edificio [P_{tot}]	57 kW	57	kW
Heizwärmebedarf bezogen auf die Nettogeschossfläche [HWB_{NGF}] Fabbisogno di calore per il riscaldamento riferito alla superficie netta [FCP_{SNE}]	12 kWh/m²a	12	kWh/m²a
Energieeffizienzklasse der Gebäudehülle **Classe di efficienza energetica dell'involucro dell'edificio**	**A**		

Gesamtenergieeffizienz – Efficienza energetica complessiva

Primärenergiebedarf Heizung – Fabbisogno di energia primaria per riscaldamento	19548 kWh/a
Primärenergiebedarf Warmwasser – Fabbisogno di energia primaria per acqua calda	538 kWh/a
Primärenergiebedarf Kühlung – Fabbisogno di energia primaria per raffrescamento	kWh/a
Primärenergiebedarf Beleuchtung – Fabbisogno di energia primaria per illuminazione	5034 kWh/a
Primärenergiebedarf Hilfsenergie – Fabbisogno di energia primaria per energia ausiliaria	10560 kWh/a
Gesamtprimärenergiebedarf – Fabbisogno di energia primaria globale	35680 kWh/a
Gesamtenergieeffizienz – Efficienza complessiva	12 kWh/m²a
Spezifische CO_2 Emissionen – Emissioni specifiche di CO_2	4 kg/m²a
Spezifischer Primärenergiebedarf Heizung – Fabbisogno specifico di energia primaria per il riscaldamento	6 kWh/m²a
Gesamtenergieeffizienzklasse des Gebäudes **Classe di efficienza complessiva dell'edificio**	**Gold**

Regenerative Energien – Fonti rinnovabili

Abdeckung Warmwasserbedarf aus erneuerbaren Energiequellen – Quota da fonti rinnovabili per acqua calda sanitaria	100 %
Abdeckung Gesamtprimärenergiebedarf aus erneuerbaren Energiequellen – Quota da fonti rinnovabili per il fabbisogno globale	81 %

Anlagendaten – Specifiche degli impianti

Anlagentyp Tipologia impianto	Energieerzeugung Produzione di energia	Thermische Leistung Potenza termica (KW)	Energieträger Vettore energetico	Abgabesystem Sistema di emissione
Heizung - Riscaldamento	Wärmepumpe Pompa di calore	57	Elektrische Energie Energia elettrica	Radiatoren Radiatori
Kühlung - Raffrescamento				
Warmwasser - Acqua calda sanitaria	Mit Solaranlage Con impianto solare	60	Öl Olio	
Lüftung - Ventilazione	Wohnraumlüftung Ventilazione meccanica controllata			
			Jahresnutzungsgrad der Anlagen **Rendimento globale medio stagionale degli impianti**	**118 %**

Energetische Verbesserungsempfehlungen – Raccomandazioni per il miglioramento energetico

Optimierung der Gebäudetechnik (Heizung, Kühlung, Lüftung, Warmwasser- oder Stromerzeugung) durch regelmäßige Wartung der Anlagen.	Ottimizzazione impiantistica (riscaldamento, raffrescamento, produzione acqua calda o corrente) mediante la manutenzione periodica degli impianti.

Rechtliche Hinweise und weitere Informationen finden Sie auf
Riferimenti normativi e ulteriori informazioni si trovano su

www.klimahausagentur.it
www.agenziacasaclima.it

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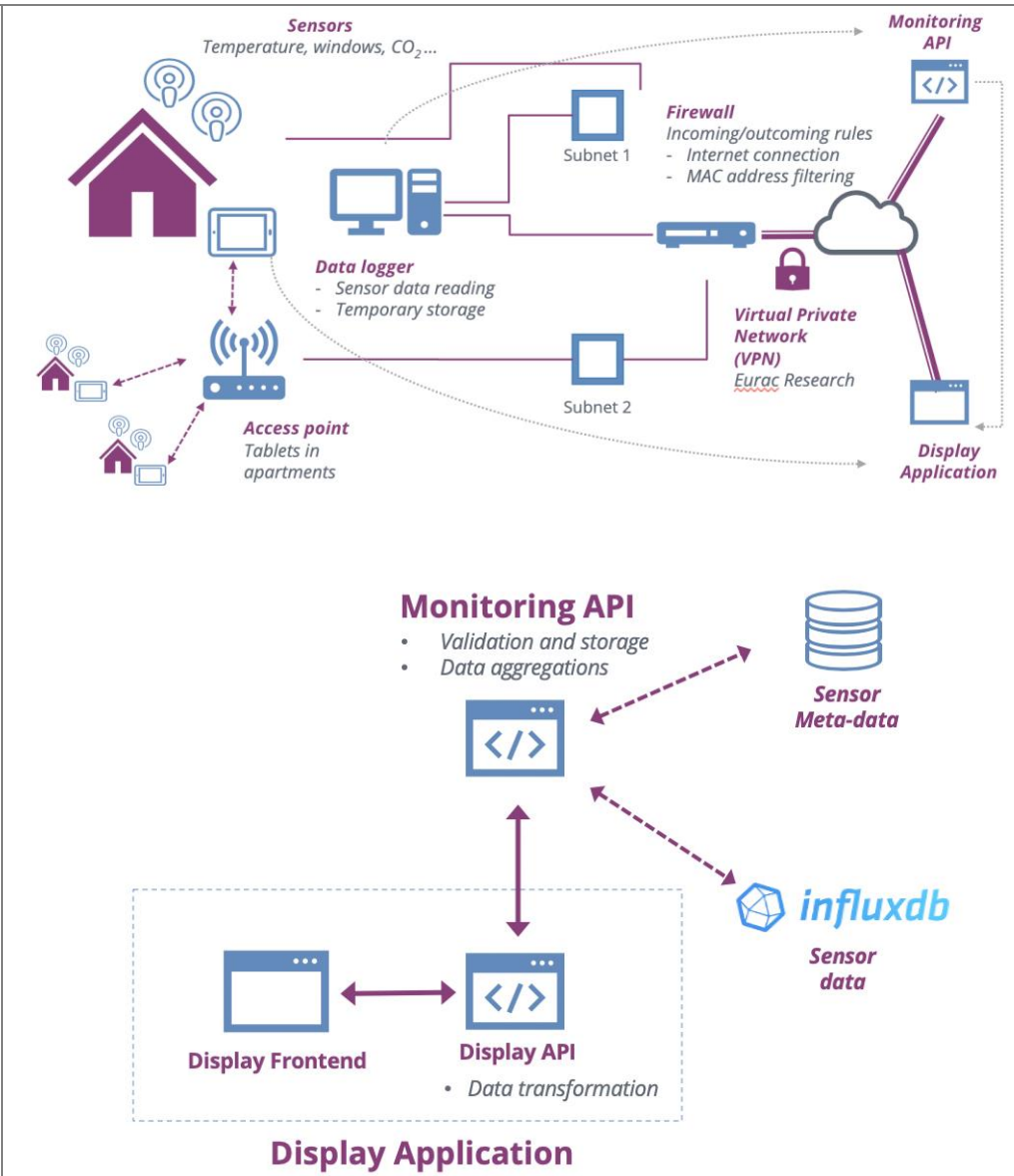
5 - PERFORMANCE MONITORING

Monitoring System	Sometimes refurbishment works alone are not enough to reach high goals in terms of energy savings. Monitoring systems can help boost the effectiveness of retrofit interventions by assessing the performance of specific technologies while encouraging tenants to reduce their energy consumption. The monitoring system installed in the housing complex of via Passeggiata dei Castani collects data produced by existing appliances, measures conditions from internal areas, and at the same time, stores such data for further assessment and future improvements. The monitoring system is made up of different sensors that collect data from different signal inputs. All sensors are connected to the same network, making it possible to collect data through a data logger; which can also store data on a temporary basis. The data logger transfers the collected data to Eurac Research servers via an Application Programming Interface (API) to be validated and stored in a time-series database. Once data are transferred, they are erased from the data logger. The interface that stores data in Eurac Research servers allows researchers to retrieve data and perform calculations that are used to provide other services. Specifically, a web application was developed to provide feedback to tenants. It allows to visualize energy consumption and environmental conditions on a real-time basis and sends messages to raise the awareness of tenants of possible consumption misbehaviors, suggesting how to solve them. Such application is displayed on a mobile device as an in-home display. The interface also allows to retrieve collected data in order to assess the performance of specific technologies.

Architecture from Monitoring and Feedback systems	 Images © Eurac Research

Feedback to tenants	 Images © Eurac Research

Monitored measures	The monitoring system collects data every 5 minutes and stores the following measures:
	
	(A) Measures from buildings
	• Energy consumption
	  ○ Photovoltaics
	  ○ Solar thermal
	  ○ Elevators
	  ○ Central heating
	  ○ External lightning

	• External temperature (where available)
	
	(B) Measures from apartments
	• Energy consumption
	  ○ Electricity
	  ○ Domestic hot water and Heating
	  ○ Ventilation system (where available)
	• Environmental conditions
	  ○ Temperature
	  ○ Relative humidity
	  ○ Carbon dioxide concentration
	  ○ Windows status (open or close)
	  ○ Water consumptions (hot and cold)
	
	(C) Measures from appliances in some apartments
	• Energy consumption
	  ○ Fridge
	  ○ Washing machine
	  ○ Oven
	  ○ Hob
	  ○ Dishwasher