



Green  
Building  
Council  
Italia

18 luglio 2023

# La decarbonizzazione dell'ambiente costruito: strumenti e buone pratiche

Carlotta Cocco, Edoardo Giorgio

**La Sostenibilità a ESA - ESRIN**

[www.gbcitalia.org](http://www.gbcitalia.org)

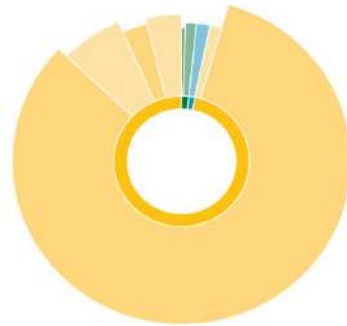
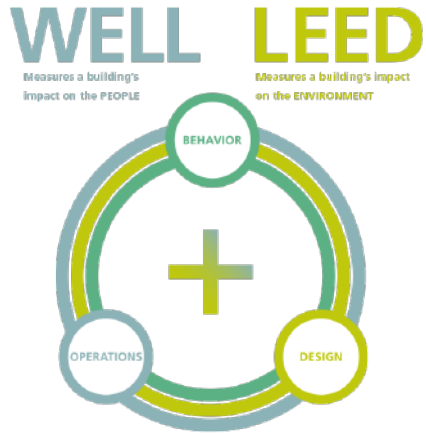
IN COLLABORAZIONE CON

**R2M**  
RESEARCH TO MARKET  
SOLUTION

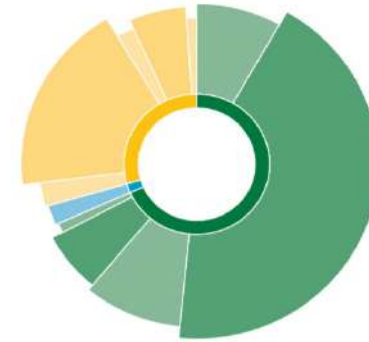
IN COLLABORATION WITH

**esa**

## SOSTENIBILITÀ CON PROTOCOLLI ENERGETICI AMBIENTALI



**WELL**  
Social 97%  
Environmental 2%  
Economic 1%



**LEED**  
Environmental 68%  
Social 30%  
Economic 2%



Digitalizzazione con gemello digitale in supporto alla progettazione, al cantiere e alla gestione



LEED E WELL: SISTEMI COMPLEMENTARI



Working together to optimize building performance  
for *human health* and our *environment*.

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# SOSTENIBILITÀ A ESA – ESRIN

## Gli edifici certificati LEED e WELL a ESA – ESRIN a Roma



ESA B12 450 m2

- LEED Gold nel 2019



test qualità:  
aria  
acqua  
comfort  
termico

ESA B14 1350 m2

- LEED Platinum nel 2023
- WELL Platinum nel 2023



ESA B9 5000 m2

- LEED Platinum in corso
- WELL Platinum in corso



## Il Protocollo LEED



In base alla tipologia di progetto possono essere applicati 5 protocolli di certificazione differenti (**LEED rating systems**):

- LEED Building Design & Construction;
- LEED Interior Design & Construction;
- LEED Operation & Maintenance;
- LEED Neighborhood;
- LEED Homes.

Il sistema LEED è composto da **9 categorie** (LEED categories):

- Integrative Process;
- Location and Transportation;
- Sustainable Sites;
- Water Efficiency;
- Energy and Atmosphere;
- Material and Resources;
- Indoor Environmental Quality;
- Innovation;
- Regional Priority.

Ogni categoria è poi suddivisa in **prerequisiti** (prerequisites) e **crediti** (credits):

- I **prerequisiti sono obbligatori** affinché l'intero edificio possa essere certificato e non assegnano punti
- I **crediti** possono essere scelti in funzione delle caratteristiche del progetto e assegnano un totale di **110 punti**.

Dalla somma dei punti ottenuti deriva il **livello di certificazione** raggiunto:

- Certified 40-49 Punti
- Silver 50-59 punti
- Gold 60-79 punti
- Platinum >80 punti



## Il Protocollo LEED – Le Categorie



### **INTEGRATIVE PROCESS**

Favorire risultati ad alte prestazioni ed economicamente efficaci dei progetti attraverso le analisi iniziali delle interrelazioni tra i sistemi.



### **LOCATION AND TRANSPORTATION**

Favorire uno sviluppo compatto attraverso un'adeguata scelta del sito, incoraggiare l'uso del trasporto alternativo.



### **SUSTAINABLE SITES**

Ripristinare gli elementi locali, integrare il sito con l'ecosistema locale e regionale, salvaguardare la biodiversità.



### **WATER EFFICIENCY**

Ridurre l'utilizzo di acqua potabile e promuovere strategie integrate di recupero.



### **ENERGY & ATMOSPHERE**

Ridurre il consumo di energia attraverso strategie progettuali di efficienza energetica, promuovere le fonti rinnovabili, ridurre le emissioni di gas e l'utilizzo di fonti fossili.



### **MATERIALS & RESOURCES**

Selezione delle risorse e trasparenza nei processi per migliorare la conoscenza e l'impatto delle componenti dell'edificio sulla salute e sull'ambiente. Gestione dei rifiuti e approccio per ciclo di vita.



### **INDOOR ENVIRONMENTAL QUALITY**

Promuovere la qualità dell'aria interna, il comfort ed il benessere delle persone.



### **INNOVATION IN DESIGN**

Riconoscere i progetti per le caratteristiche innovative, le pratiche e le strategie sostenibili.



### **REGIONAL PRIORITY**

Valorizzare particolari questioni ambientali che sono legate al luogo.

# Edifici ESA e i protocolli dei Green Building

## Inquadramento – ESA Building 14





## Integrative Process & Location and Transportation

Location and Transportation		16	B12	B14	B9
Credit	LEED for Neighborhood Development Location	16	0	0	0
Credit	Sensitive Land Protection	1	1	1	1
Credit	High Priority Site	2	1	0	0
Credit	Surrounding Density and Diverse Uses	5	0	4	4
Credit	Access to Quality Transit	5	2	2	2
Credit	Bicycle Facilities	1	0	0	0
Credit	Reduced Parking Footprint	1	1	1	1
Credit	Green Vehicles	1	1	1	1
<b>TOTALE</b>			<b>6</b>	<b>9</b>	<b>9</b>

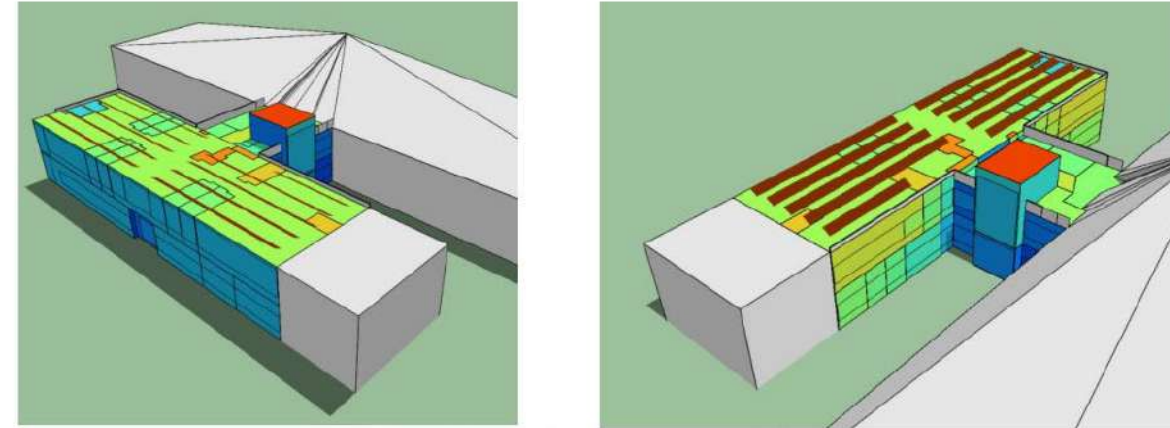


Figure 4 Annual solar energy analysis





# Edifici ESA e i protocolli dei Green Building

## Sustainable Sites

Sustainable Sites		10	B12	B14	B9
Prereq	Construction Activity Pollution Prevention	Required	Y	Y	Y
Credit	Site Assessment	1	0	1	1
Credit	Site Development - Protect or Restore Habitat	2	0	0	0
Credit	Open Space	1	1	1	1
Credit	Rainwater Management	3	3	3	3
Credit	Heat Island Reduction	2	2	2	2
Credit	Light Pollution Reduction	1	1	1	1
<b>TOTALE</b>			<b>7</b>	<b>8</b>	<b>8</b>





# Edifici ESA e i protocolli dei Green Building

## Water Efficiency

Water Efficiency		11	B12	B14	B9
Prereq	Outdoor Water Use Reduction	Required	Y	Y	Y
Prereq	Indoor Water Use Reduction	Required	Y	Y	Y
Prereq	Building-Level Water Metering	Required	Y	Y	Y
Credit	Outdoor Water Use Reduction	2	1	2	2
Credit	Indoor Water Use Reduction	6	6	6	6
Credit	Cooling Tower Water Use	2	0	0	0
Credit	Water Metering	1	1	1	1
<b>TOTALE</b>			<b>8</b>	<b>9</b>	<b>9</b>

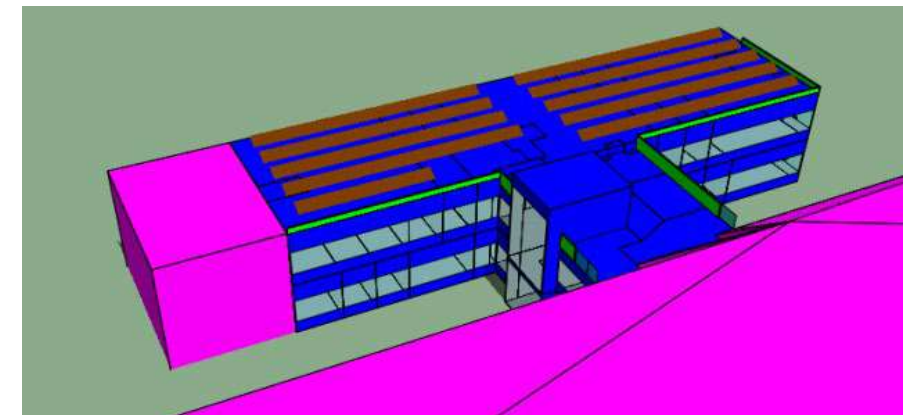
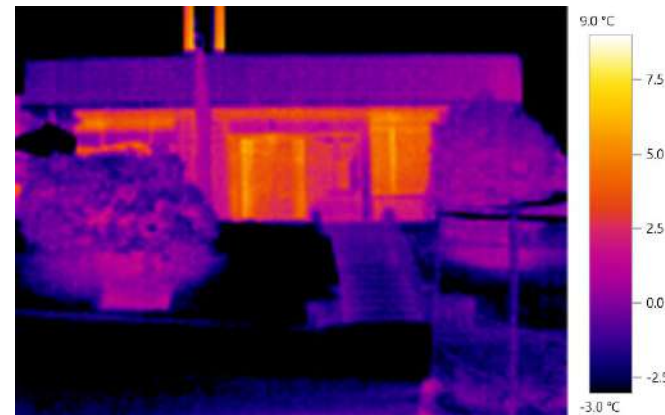




# Edifici ESA e i protocolli dei Green Building

## Energy and Atmosphere

Energy and Atmosphere		33	B12	B14	B9
Prereq	Fundamental Commissioning and Verification	Required	Y	Y	Y
Prereq	Minimum Energy Performance	Required	Y	Y	Y
Prereq	Building-Level Energy Metering	Required	Y	Y	Y
Prereq	Fundamental Refrigerant Management	Required	Y	Y	Y
Credit	Enhanced Commissioning	6	2	4	4
Credit	Optimize Energy Performance	18	18	15	15
Credit	Advanced Energy Metering	1	1	1	1
Credit	Demand Response	2	0	0	0
Credit	Renewable Energy Production	3	3	3	3
Credit	Enhanced Refrigerant Management	1	1	1	1
Credit	Green Power and Carbon Offsets	2	2	2	2
<b>TOTALE</b>			<b>27</b>	<b>26</b>	<b>26</b>



## Materials and Resources

Materials and Resources		13	B12	B14	B9
Prereq	Storage and Collection of Recyclables	Required	Y	Y	Y
Prereq	Construction and Demolition Waste Management Planning	Required	Y	Y	Y
Credit	Building Life-Cycle Impact Reduction	5	3	3	2
Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2	0	1	1
Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2	0	1	1
Credit	Building Product Disclosure and Optimization - Material Ingredients	2	0	1	1
Credit	Construction and Demolition Waste Management	2	0	2	2
		<b>TOTALE</b>	<b>3</b>	<b>8</b>	<b>8</b>

Analisi del ciclo di vita dell'intero edificio, ISO 14040 e ISO 14044 (CML 2002; Novembre 2012) [Scarica il riepilogo dei risultati](#)

Settore	Global warming kg CO <sub>2</sub> e	Ozone depletion potential kg CFC11e	Acidification kg SO <sub>2</sub> e	Eutrophication kg PO <sub>4</sub> e	Formation of ozone of lower atmosphere kg Ethene	Depletion of nonrenewable energy MJ	Biogenic carbon storage kg CO <sub>2</sub> e bio
A1-A3 Construction Materials	9,31E5   -14%	1,17E-1   -21%	7,9E2   -6%	2,4E2   -3%	5,88E1   -87%	5,05E6   -30%	1,13E2   0%
A4 Transportation to site	7,58E3   0.8%	1,5E-3   0.8%	3,49E-1   0.8%	7,8E0   0.8%	4,27E-1   0.8%	2,15E5   0.8%	
B3 Repair							
B4-B5 Material replacement and refurbishment	8,1E4   +12%	3,45E-3   +11%	2,32E2   +15%	4,58E1   +9%	1,96E1   +14%	7,08E5   +7.5%	
C1-C4 End of life	3,37E4   +23%	3,51E-6   -91%	4,71E1   +3.1%	8,79E0   0.4%	4,31E0   +1.2%	1,11E5   +2.1%	
<b>Totale</b>	<b>1,05E6</b>	<b>1,22E-1</b>	<b>1,1E3</b>	<b>3,02E2</b>	<b>8,31E1</b>	<b>6,08E6</b>	<b>1,13E2</b>
Confronta i risultati totali con: 5 - Baseline							
<b>5 - Baseline Totale</b>	<b>1,19E6</b>	<b>1,58E-1</b>	<b>2,26E3</b>	<b>4,22E2</b>	<b>1,58E2</b>	<b>8,98E6</b>	<b>1,13E2</b>
<b>5 - Proposed</b> confronta con 5 - Baseline	<b>-12%</b>	<b>-22%</b>	<b>-51%</b>	<b>-29%</b>	<b>-47%</b>	<b>-32%</b>	<b>0%</b>
<b>Risultati per denominatore</b>							
Gross Internal Floor Area (IPMS:RICS) 1335.66 m <sup>2</sup>	7,89E2	9,15E-5	8,26E-1	2,26E-1	6,22E-2	4,55E5	8,44E-2

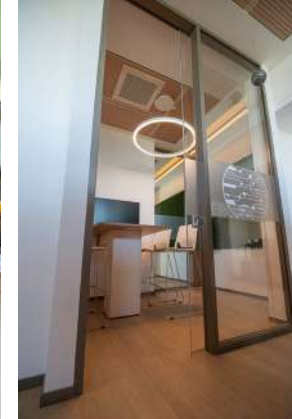
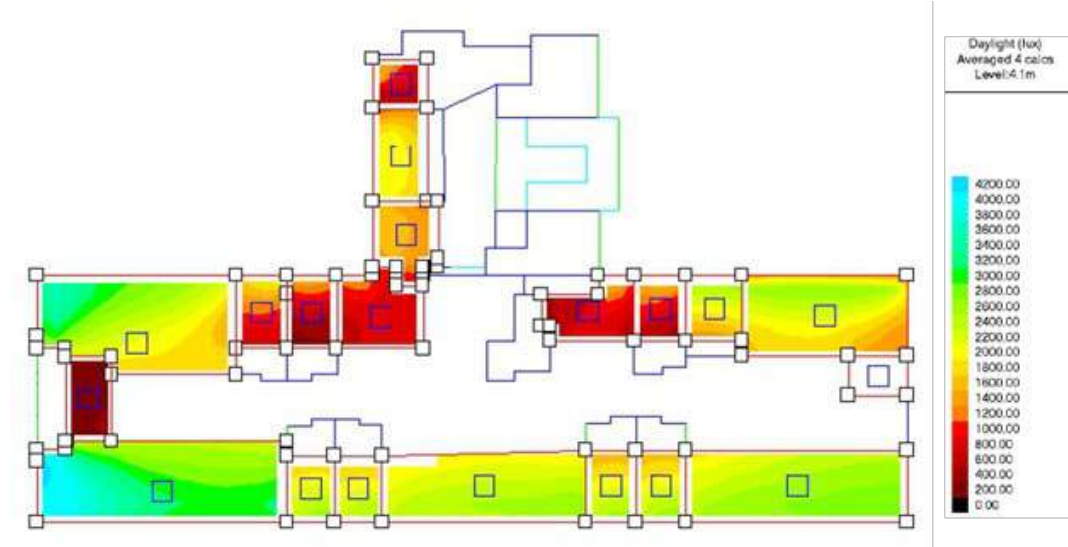
Figure 1. Impact categories - comparison





## Indoor Environmental Quality

Indoor Environmental Quality		16	B12	B14	B9
Prereq	Minimum Indoor Air Quality Performance	Required	Y	Y	Y
Prereq	Environmental Tobacco Smoke Control	Required	Y	Y	Y
Credit	Enhanced Indoor Air Quality Strategies	2	1	2	2
Credit	Low-Emitting Materials	3	0	3	3
Credit	Construction Indoor Air Quality Management Plan	1	1	1	1
Credit	Indoor Air Quality Assessment	2	2	2	2
Credit	Thermal Comfort	1	1	1	1
Credit	Interior Lighting	2	1	1	2
Credit	Daylight	3	2	2	2
Credit	Quality Views	1	1	1	1
Credit	Acoustic Performance	1	0	1	1
<b>TOTALE</b>			<b>9</b>	<b>14</b>	<b>15</b>



# Edifici ESA e i protocolli dei Green Building

## Scorecard LEED – ESA Building 14



INTEGRATIVE PROCESS CREDITS		AWARDED: 1 / 1
Credit	Integrative process	1/1



LOCATION & TRANSPORTATION		AWARDED: 9 / 20
Credit	LEED for Neighborhood Development Location	0/16
Credit	Sensitive land protection	1/1
Credit	High priority site	0/2
Credit	Surrounding density and diverse uses	4/5
Credit	Access to quality transit	2/5
Credit	Bicycle facilities	0/1
Credit	Reduced parking footprint	1/1
Credit	Green vehicles	1/1



SUSTAINABLE SITES		AWARDED: 8 / 10
Prereq	Construction activity pollution prevention	0/0
Credit	Site assessment	1/1
Credit	Site development - protect or restore habitat	0/2
Credit	Open space	1/1
Credit	Rainwater Mgmt	3/3
Credit	Heat island reduction	2/2
Credit	Light pollution reduction	1/1



WATER EFFICIENCY		AWARDED: 9 / 11
Prereq	Outdoor water use reduction	0/0
Prereq	Indoor water use reduction	0/0
Prereq	Building-level water metering	0/0
Credit	Cooling tower water use	0/2
Credit	Water metering	1/1
Credit	Outdoor water use reduction	2/2
Credit	Indoor water use reduction	6/6



ENERGY & ATMOSPHERE		AWARDED: 26 / 33
Prereq	Fundamental commissioning and verification	0/0
Prereq	Minimum energy performance	0/0
Prereq	Building-level energy metering	0/0
Prereq	Fundamental refrigerant Mgmt	0/0
Credit	Enhanced commissioning	4/6
Credit	Advanced energy metering	1/1
Credit	Demand response	0/2
Credit	Renewable energy production	3/3
Credit	Enhanced refrigerant Mgmt	1/1
Credit	Green power and carbon offsets	2/2
Credit	Optimize energy performance	15/18



MATERIAL & RESOURCES		AWARDED: 8 / 13
Prereq	Storage and collection of recyclables	0/0
Prereq	Construction and demolition waste Mgmt planning	0/0
Credit	Building life-cycle impact reduction	3/5
Credit	Building product disclosure and optimization - environmental product d...	1/2
Credit	Building product disclosure and optimization - sourcing of raw materia...	1/2
Credit	Building product disclosure and optimization - material ingredients	1/2
Credit	Construction and demolition waste Mgmt	2/2



INDOOR ENVIRONMENTAL QUALITY		AWARDED: 14 / 16
Prereq	Minimum IAQ performance	0/0
Prereq	Environmental tobacco smoke control	0/0
Credit	Enhanced IAQ strategies	2/2
Credit	Low-emitting materials	3/3
Credit	Construction IAQ Mgmt plan	1/1
Credit	IAQ assessment	2/2
Credit	Thermal comfort	1/1
Credit	Interior lighting	1/2
Credit	Daylight	2/3
Credit	Quality views	1/1
Credit	Acoustic performance	1/1



REGIONAL PRIORITY CREDITS		AWARDED: 4 / 4
Credit	Acoustic performance	0/1
Credit	Sensitive land protection	1/1
Credit	Reduced parking footprint	1/1
Credit	Green vehicles	1/1
Credit	Site development - protect or restore habitat	0/1
Credit	Rainwater Mgmt	1/1



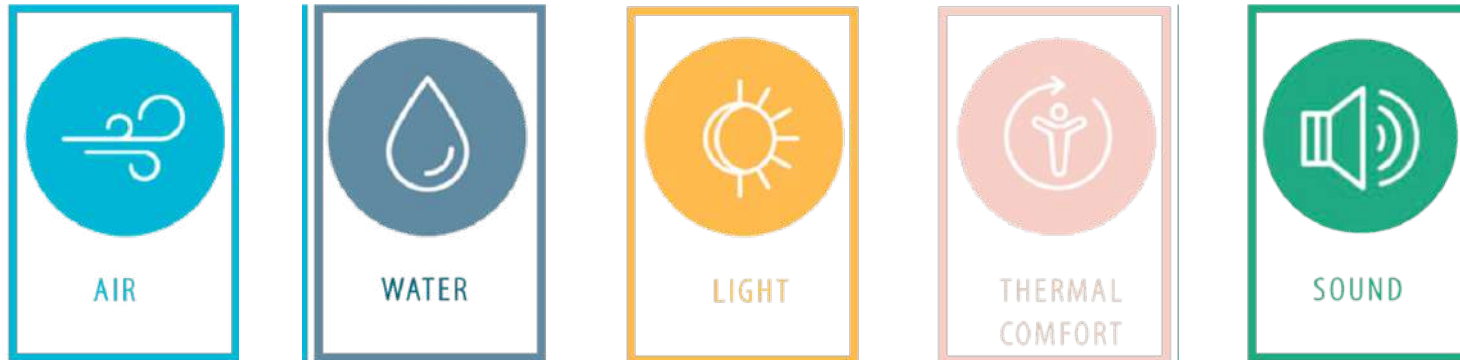
INNOVATION		AWARDED: 6 / 6
Credit	Innovation	5/5
Credit	LEED Accredited Professional	1/1

TOTAL

85 / 110



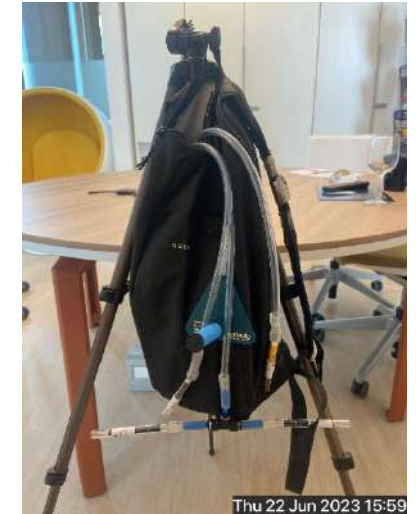
Performance Verification



## Performance Verification - Air

Contaminant	Method	Sample Time	Recording Interval
Formaldehyde	Active collection	Minimum of one continuous hour (or duration specified in referenced method)	Continuous
VOC (other than Formaldehyde)			
PM2.5 and PM10	Real-time direct reading instrument	Minimum of one continuous hour (10 mins acclimation + 50 mins measurement time)	Once per minute
Carbon Monoxide			
Ozone			
Nitrogen Dioxide			

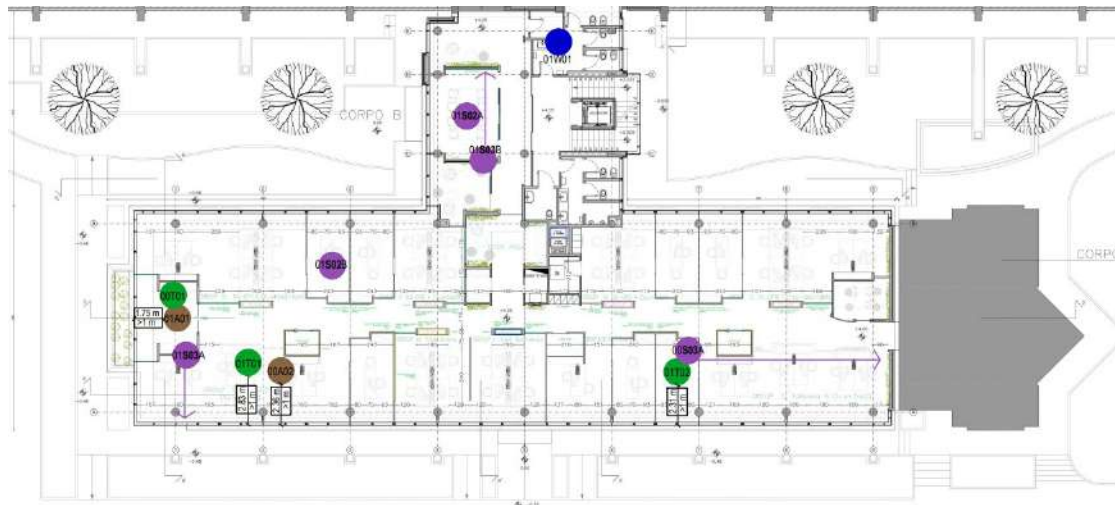
Contaminant	TVOC
VOC (other than Formaldehyde)	Benzene Carbon disulfide Carbon tetrachloride Chlorobenzene Chloroform Dichlorobenzene (1,4-) Dichloroethylene (1,1) Ethylbenzene Hexane (n-) Methyl chloroform Isopropyl Alcohol Methylene chloride Methyl tert-butyl ether Styrene Tetrachloroethene Toluene Trichloroethylene Vinyl acetate





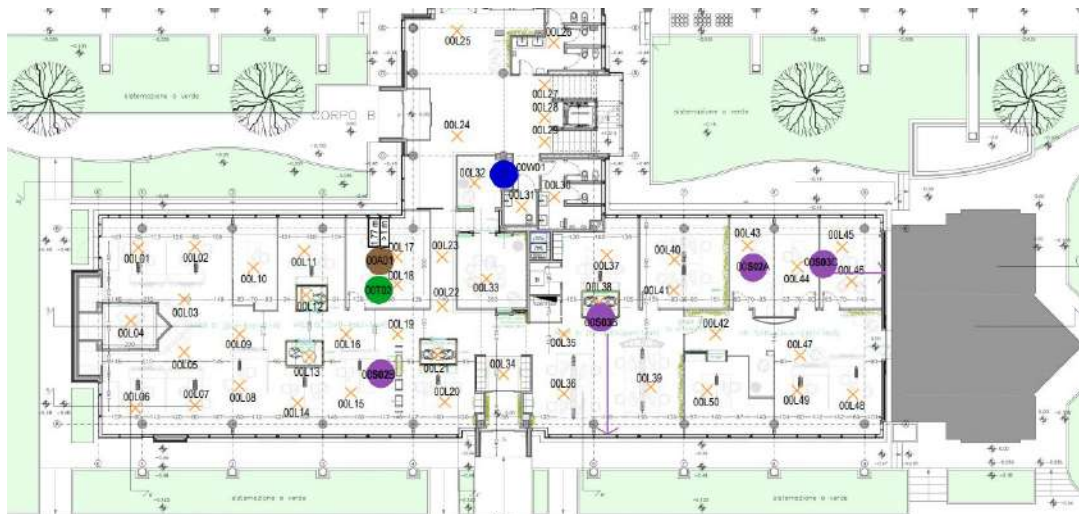
## Performance Verification - Water

5% each configuration - max 3 each	Drinking	Hand Wash	Shower	Commercial Cooking
Coliforms - W01, Part 2	X	X	X	X
Disinfectants - W02, Part 6 b and c	X			X
Laboratory-based Contaminants W02, Parts 1, 2, 3, 4, 5 and 6a; W04, Part 1	X			X



## Performance Verification - Light

Floors	Measurement Location	
1 - 4	1 Floor	*Various work planes
5 or more	2 Floors	*Various work planes



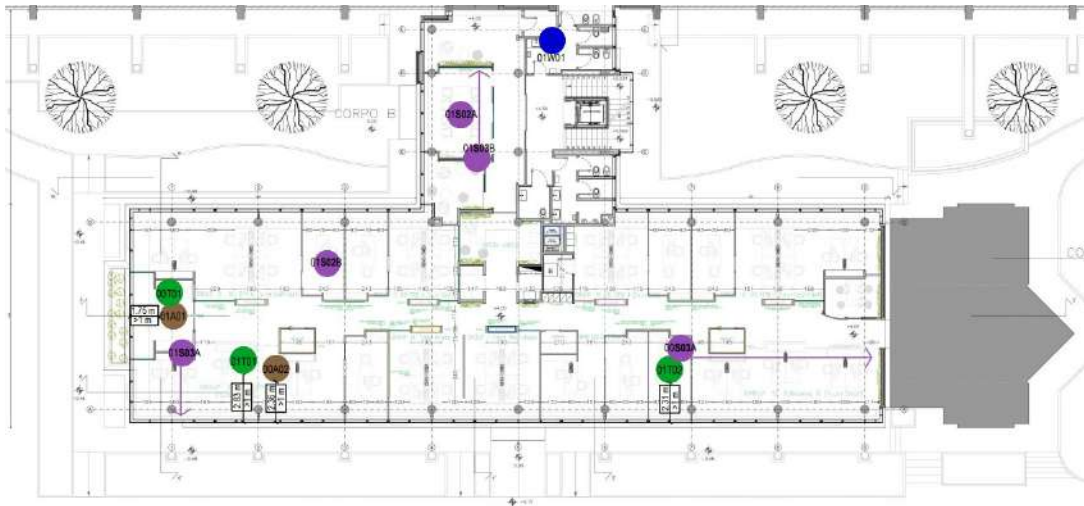
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<p>0,01 – 200.000 lux</p>	



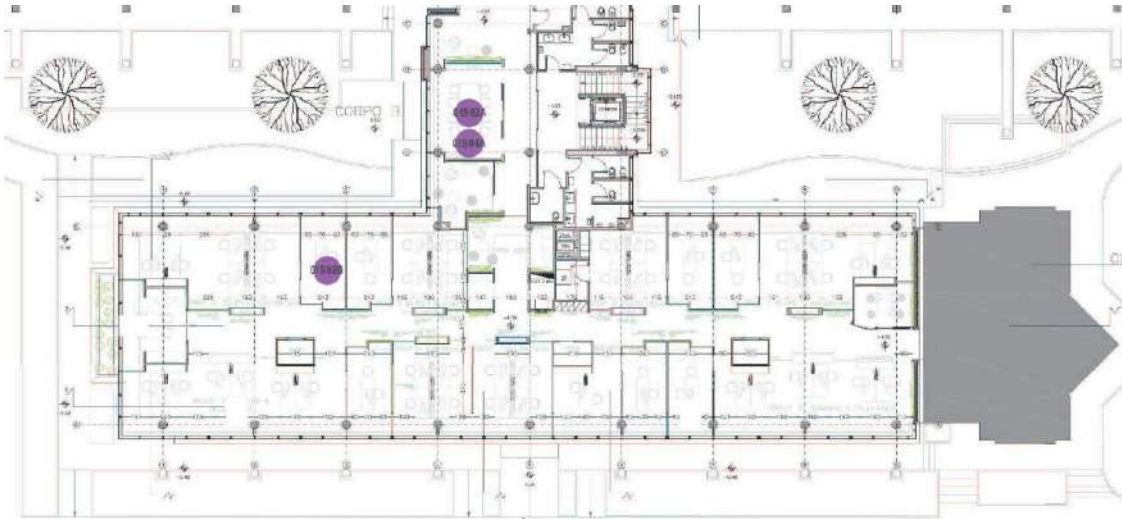
# Edifici ESA e i protocolli dei Green Building

## Performance Verification – Thermal Comfort

Measurement	Sample Locations	Height	Measurement Time
Dry-bulb Temperature	8% of regularly occupied spaces	4", 24" and 43" seated or 4", 43" and 67" standing	10 minutes
Mean Radiant Temperature		24" seated or 43" standing	
Relative Humidity	At least one of each room type	42" to 66"	



## Performance Verification - Acoustic



00S02B

P.T. - OPEN SPACE

Nome misura: WS02\_019.s

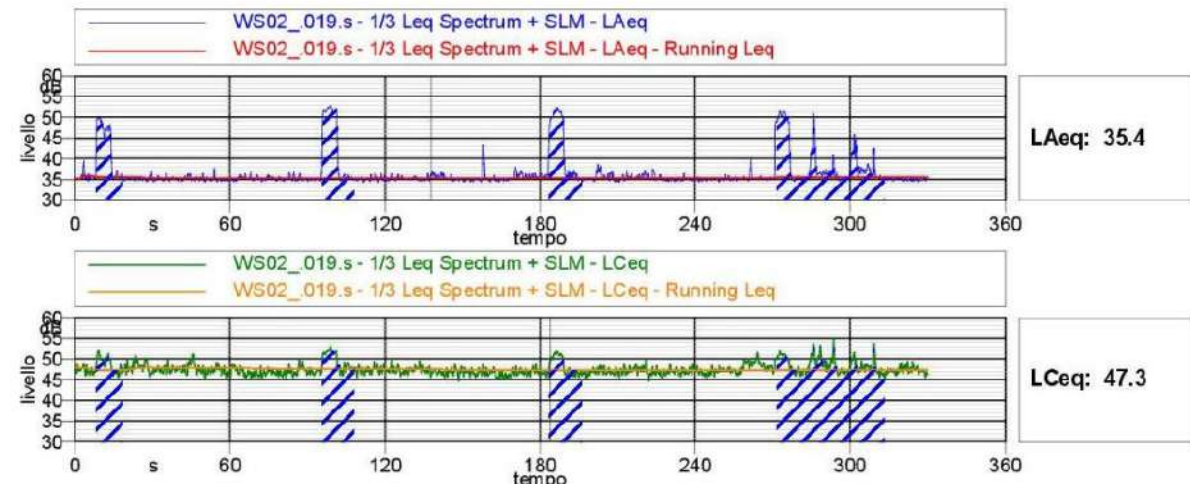
Data: 23/06/2023

Ora: 20:25:45



Misure effettuate:

- Background Noise
- Reverberation Time





# WELL BUILDING STANDARD

## UN APPROCCIO OLISTICO AL BENESSERE



- Cardiovascular
- Digestive
- Endocrine
- Immune
- Integumentary
- Muscular
- Nervous
- Reproductive
- Respiratory
- Skeletal
- Urinary



AIR



WATER



NOURISHMENT



LIGHT



MOVEMENT



THERMAL COMFORT



SOUND



MATERIALS



MIND



COMMUNITY

## ARIA



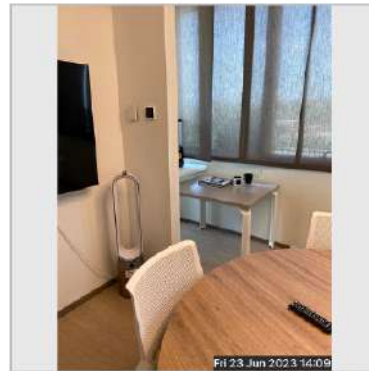
Assicurare alti livelli di qualità dell'aria interna durante l'intero ciclo di vita dell'edificio



- Misure prestazionali
- Ventilazione naturale e meccanica
- Sistemi di filtrazione
- Selezione materiali
- Protezione da agenti inquinanti
- Protezione dal fumo di tabacco
- Controllo microbico e muffe
- Gestione e manutenzione



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Friday 23 June 2023 02:16 PM



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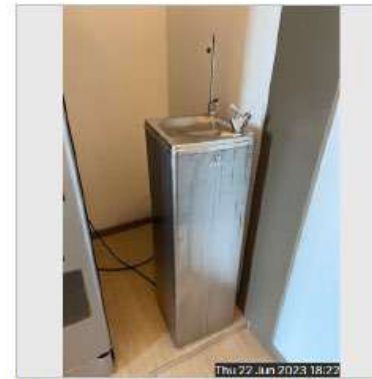




## ACQUA



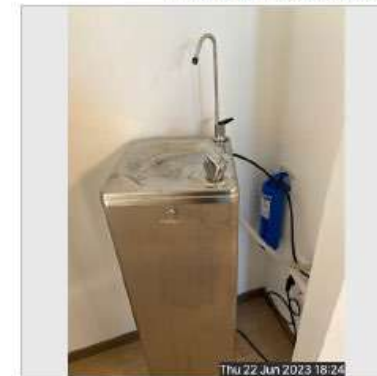
- Misure prestazionali
- Controllo legionella
- Trattamenti
- Promozione al consumo di acqua
- Gestione umidità



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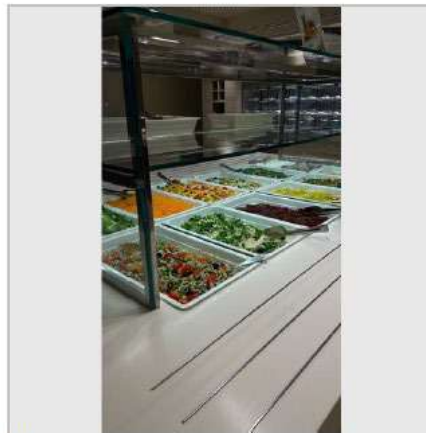
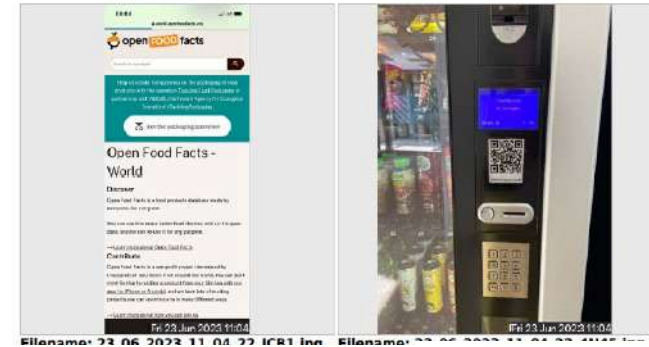


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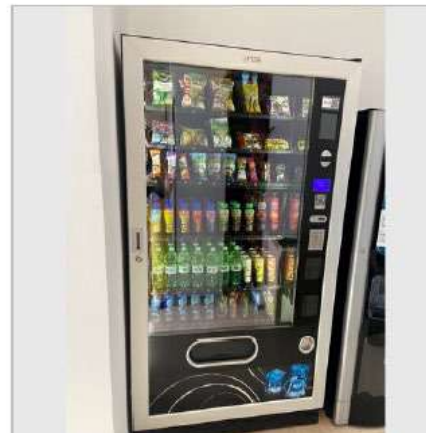
## NUTRIMENTO



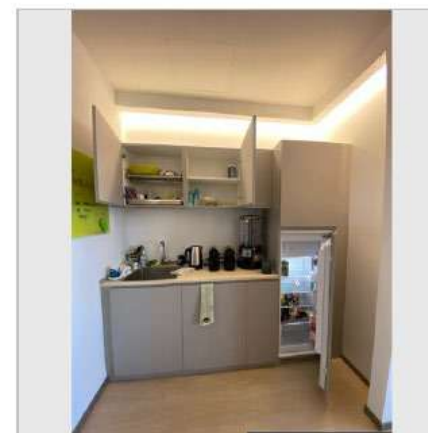
- Frutta e verdura
- Trasparenza degli ingredienti
- Soddisfare esigenze di diete speciali
- Limitazione ingredienti nocivi
- Educazione alimentare
- Spazi mensa idonei
- Linee guida preparazione dei cibi



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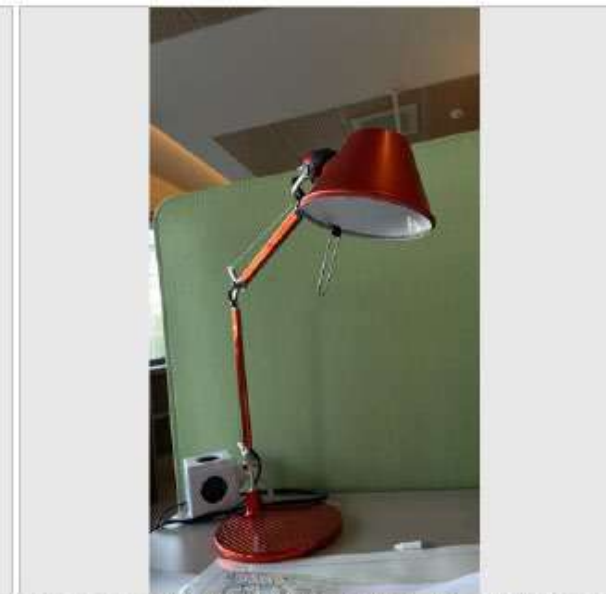
**LUCE**



- Luce naturale
- Qualità della luce
- Acuità visiva
- Equilibrio visivo
- Esposizione alla luce
- Ritmi circadiani
- Sistemi di controllo
- Controllo dell'abbagliamento



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Tuesday 11 July 2023 10:56 AM

## MOVIMENTO



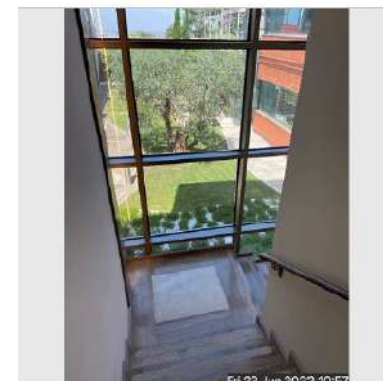
- Incentivo utilizzo bici, etc.
- Incentivo uso scale
- Ergonomia
- Postazioni attive
- Selezione del sito
- Spazi per attività fisica
- Promozione dell'attività fisica
- Self-monitoring



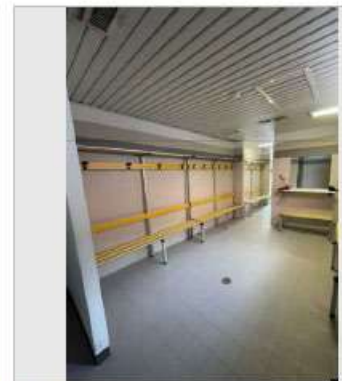
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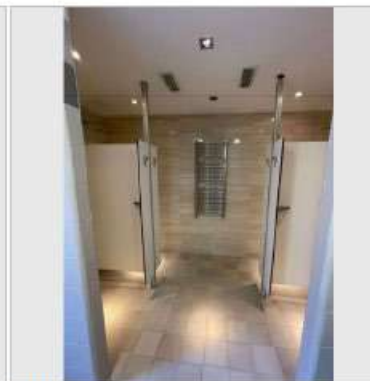
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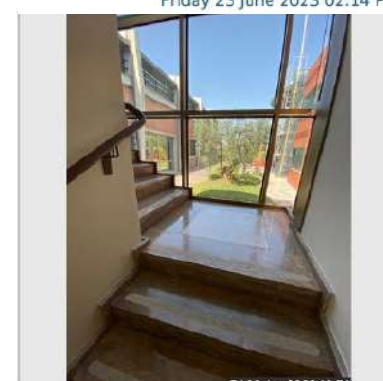
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Friday 23 June 2023 02:14 PM



Filename: 23\_06\_2023\_12\_38\_37\_WZ201.png  
Tuesday 11 July 2023 11:05 AM



Filename: 23\_06\_2023\_12\_38\_37\_WZ202.png  
Tuesday 11 July 2023 11:05 AM



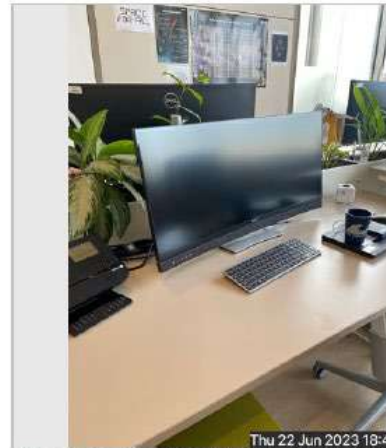
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Friday 23 June 2023 02:14 PM





# WELL BUILDING STANDARD a ESA ESRIN

## MOVIMENTO



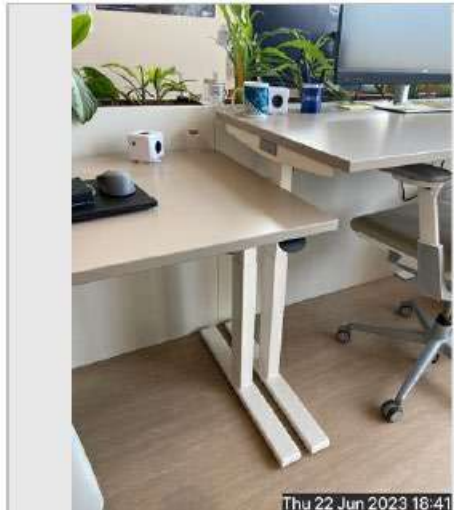
Thu 22 Jun 2023 18:40

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Friday 23 June 2023 09:55 AM



Thu 22 Jun 2023 18:40

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Friday 23 June 2023 09:55 AM



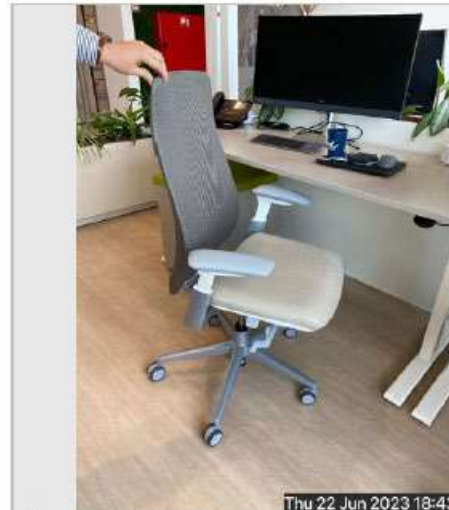
Thu 22 Jun 2023 18:41

Filename: 22\_06\_2023\_18\_41\_33\_1MQU.jpg  
Friday 23 June 2023 09:55 AM



Thu 22 Jun 2023 18:42

Filename: 22\_06\_2023\_18\_42\_02\_MTKM.jpg  
Friday 23 June 2023 09:55 AM



Thu 22 Jun 2023 18:43

Filename: 22\_06\_2023\_18\_44\_01\_DBZH.jpg  
Friday 23 June 2023 09:56 AM



Thu 22 Jun 2023 18:44

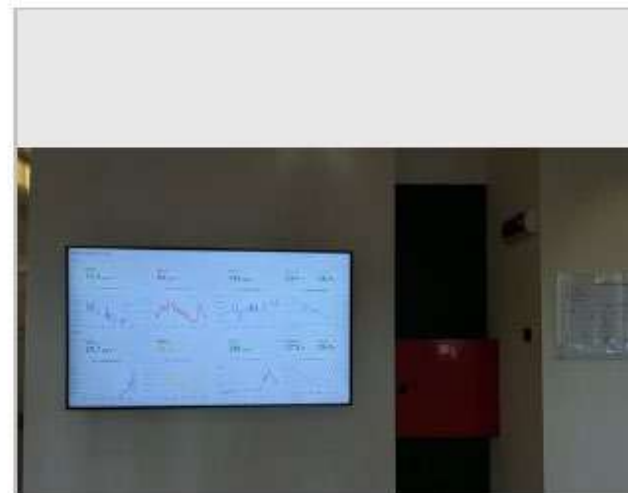
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Friday 23 June 2023 09:56 AM



## COMFORT TERMICO



- Misure prestazionali
- Zonizzazione termica
- Controlli individuali
- Comfort termico radiante
- Monitoraggio continuo
- Controllo dell'umidità



Filename:  
23\_06\_2023\_12\_38\_37\_PZ100.jpeg  
Tuesday 11 July 2023 11:02 AM



Filename:  
23\_06\_2023\_12\_38\_37\_PZ101.jpeg.jpeg  
Tuesday 11 July 2023 11:02 AM



**ACUSTICA**



- Parametri prestazionali
- Mappatura
- Barriere acustiche
- Materiali assorbenti
- Mascherature



## MATERIALI



- Bonifiche
- Piombo, amianto, PCB, mercurio
- Uso di pesticidi
- Prodotti e policy per la pulizia
- Riduzione VOC ed emissioni nocive
- Controllo delle emissioni
- Trasparenza dei materiali impiegati
- Gestione dei rifiuti





MENTE



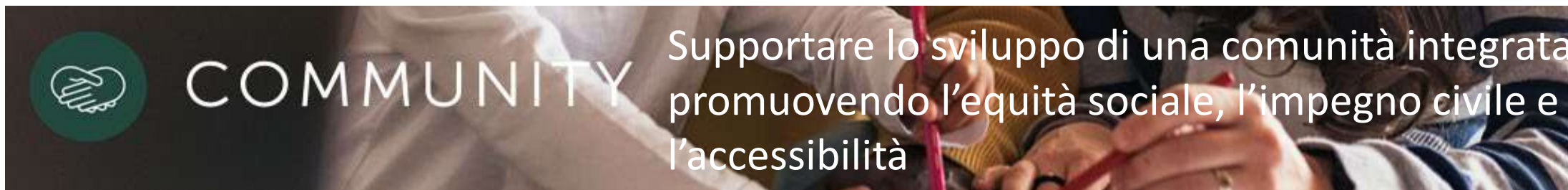
Supportare il benessere emotivo



- Accesso ad elementi naturali
- Supporto al miglioramento del sonno
- Supporto alla cessazione del fumo
- Policy per i viaggi di lavoro

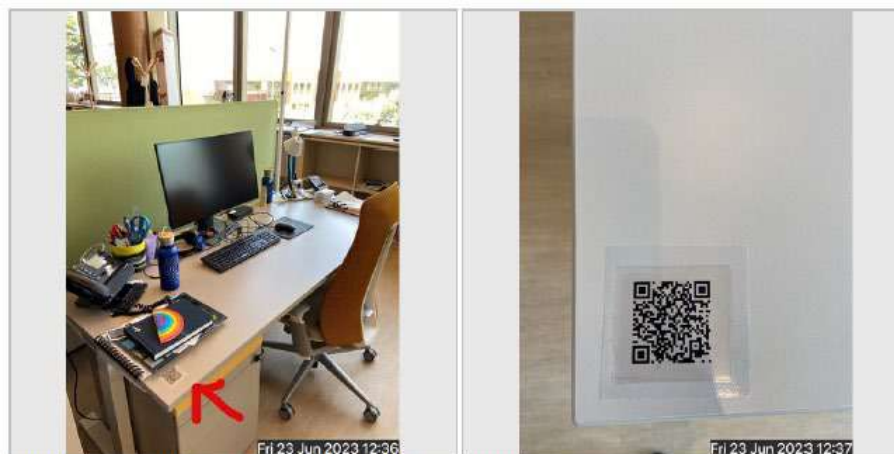


## COMUNITA'



Supportare lo sviluppo di una comunità integrata promuovendo l'equità sociale, l'impegno civile e l'accessibilità

- Supporto alla famiglia
- Supporto alla maternità
- Impegno civile e sociale
- Accessibilità degli spazi
- Universal design
- Bagni per disabili
- Gestione emergenze



Filename: 23\_06\_2023\_12\_37\_06\_DJ7R.jpg    Filename: 23\_06\_2023\_12\_37\_39\_M4WC.jpg  
Friday 23 June 2023 02:19 PM    Friday 23 June 2023 02:19 PM





## LEVEL'S A COMMON LANGUAGE

Linking Europe's main green building rating tools to Level(s)





Green  
Building  
Council  
Italia

18 luglio 2023

**La decarbonizzazione  
dell'ambiente costruito:  
strumenti e buone pratiche**

**Grazie.**

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