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# A GREEN WORK OFFICE PROPOSAL

Data analysis of air quality  
in European Parliament offices

Pilot project

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**renew europe.**

# Nature Calls Nature - A Green Work Office Proposal

## *Data analysis of air quality in European Parliament offices - Pilot project*

*The project “**Nature Calls Nature - A green work office proposal**” aims to develop a more natural and pleasant working environment so to foster and increase the cognitive performances of employees.*

*In this mandate, the European Union has focused its attention on aspects of sustainability and environmental regeneration, the so-called “Green Deal”. In particular, **my political group Renew Europe** plays a crucial role in promoting innovative policies to tackle the climate change and raise awareness on the current environmental challenges.*

*In this context we have often asked ourselves whether it is possible for a **policy maker** to think and devise new green practices and legislate for Nature by working in offices without any connection with natural environments.*

*For this reason, together with my staff, we decided to launch a **pilot project** to measure the air quality of our offices at the European Parliament in Brussels and evaluate whether the presence of indoor plants can improve both the healthiness of offices and work performance.*

*Therefore, we decided to create three different scenarios: we placed around twenty **indoor plants** in one of our three offices (Ufficio Verde), a few plants in another office (Ufficio Centro), and no plants in the third one (Ufficio grigio). All the plants were readily available and easy to maintain.*

*Then, in collaboration with Strobilo company, we activated some sensors for measuring several environmental parameters (humidity, temperature, PM10, CO2 concentration, etc).*

*The measurements took place from June to July 2023. In the following pages we will present the collected data and the results obtained, hoping that this study can promote greater environmental awareness among policy makers inside the European Parliament, and other private companies and work spaces.*

*This is just an example of **how we can legislate “with and for” Nature**. Further studies may be implemented in the future, adding neurological tests in order to study stress levels, productivity, and employee satisfaction.*

*However, these first results already highlight the ability of plants to significantly improve the quality of air in an indoor space and show their **positive effects**.*

*We would like to point out how the implementation of sustainable policies, promoting a healthier working environment through small and low-cost actions, can have a significant impact on the **quality of daily life**.*

*MEP Marco Zullo and staff  
Renew Europe*

# «IMPACT» INDICATORS AND MEASURES

The report was broken down into **five** weeks. For each week we report the day-by-day trend and the average values of each parameter **compared among three offices**. Each parameter has its own threshold indicated by a red line. Here you find impact indicators and environmental dimensions.

**Brain Efficiency Index (BEI).** Expressed as a percentage, it measures global cognitive performance compared to the maximum that can be expressed at a given time. It varies depending on three interacting factors: CO2 concentration, temperature and noise level.

**Ambience Comfort Index (ACI).** Equal temperature levels are perceived differently depending on the humidity values present in a room, and vice versa. Expressed as a percentage, this index combines the two parameters to measure the comfort/stress perceived by the individual.

**Air Quality Index (AQI).** The index provides an estimate of the healthiness and breathability of the air as a function of the presence of pollutants. It is based on an algorithm that combines PM1, PM2.5, PM10 and VOC values.

**CO2.** An exhaled gas that affects health, and productivity. With your presence and daily activities, you can increase the internal amount of carbon dioxide. Already at medium concentrations we can detect a deterioration of cognitive faculties equal to 35-40% of the overall capacity.

**Temperature.** It affects sleep, mood, concentration, comfort level and alertness.

**Humidity.** Proper humidity monitoring helps prevent mold, dust mites, skin irritation, and the spread of viruses.

**Noise.** Acoustic stress is a tremendously underestimated index, but it can generate strong repercussions on our body and our ability to concentrate. In addition, repeated exposure to excessive noise thresholds can cause the onset and chronicity of even serious diseases. To give a parameter, above 60 decibels the noise corresponds to that of a busy street, the chatter of a crowded restaurant or a loud radio.

**VOC.** It is considered the main value of indoor air quality and represents the amount of volatile chemicals from everyday objects, including cleaning products and paints. High concentrations have serious health repercussions.

**Particulate Matter.** PM is made up of a mixture of solids and liquids, both organic and inorganic, including dust, pollen, soot, smoke, complex chemicals, sulfates, minerals, and more. Many believe that PM only accumulates outdoors, but it can be released and become trapped indoors as well.

Week 25

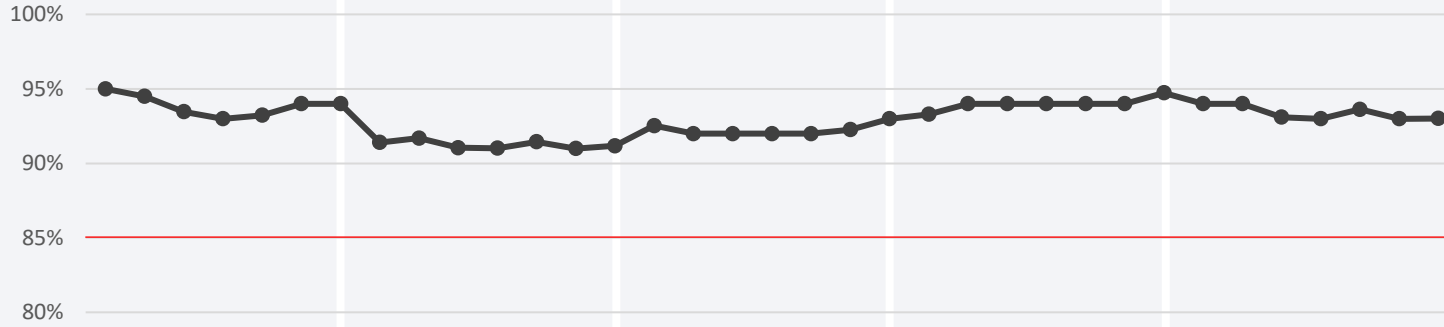
# First week

19/06/2023 - 23/06/2023

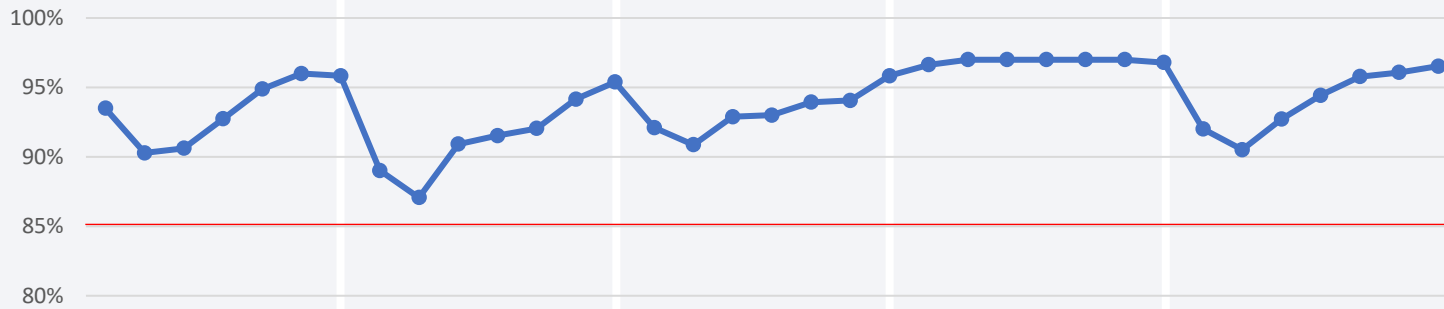
# BRAIN EFFICIENCY INDEX

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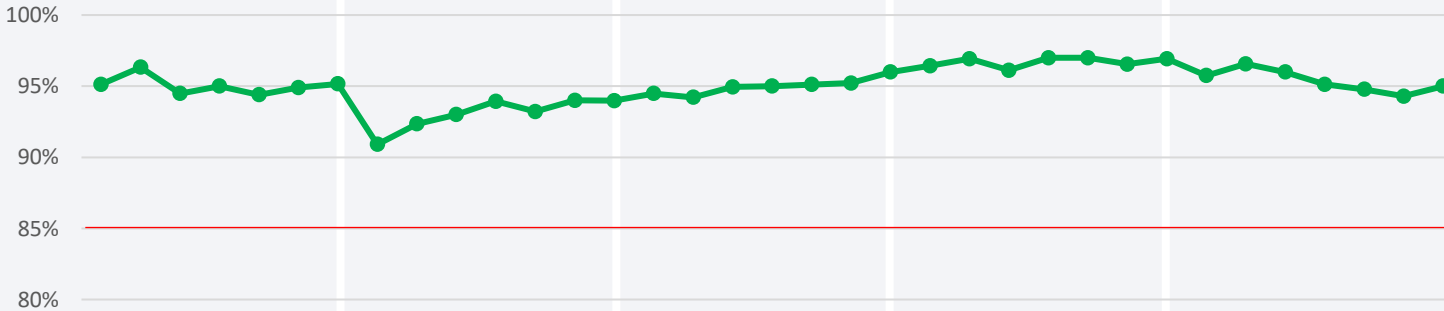
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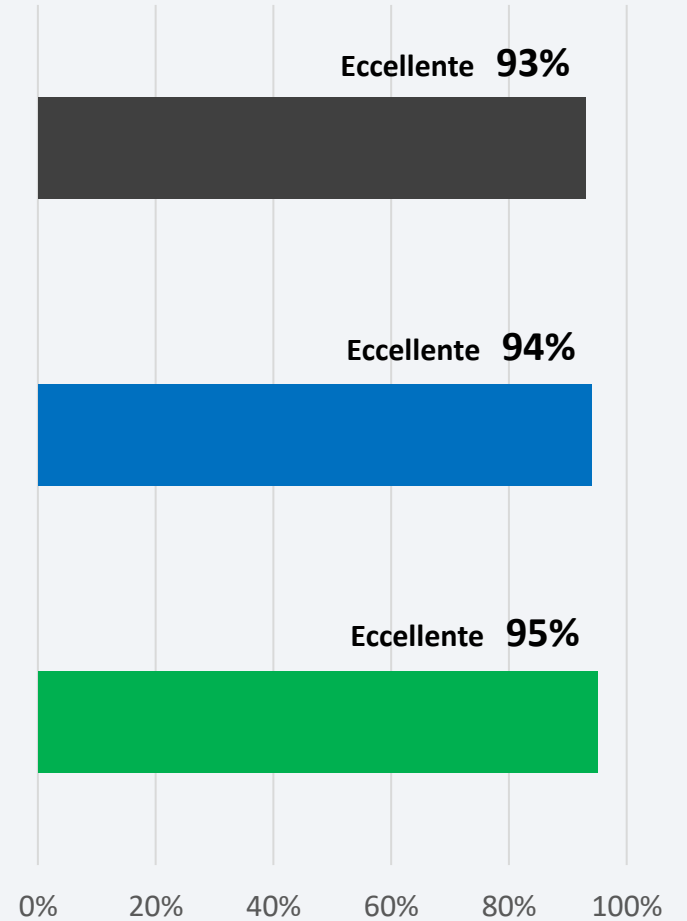
Ufficio centro



Ufficio verde

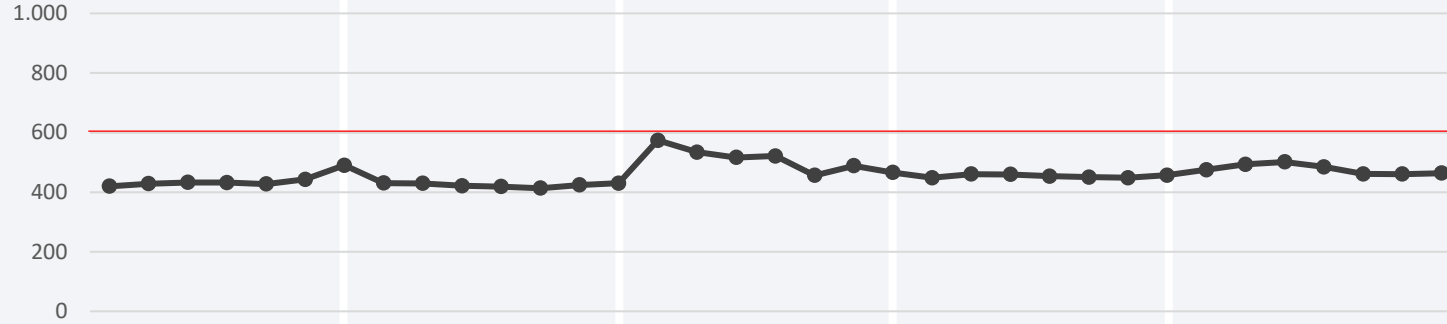


## MEDIA week 25

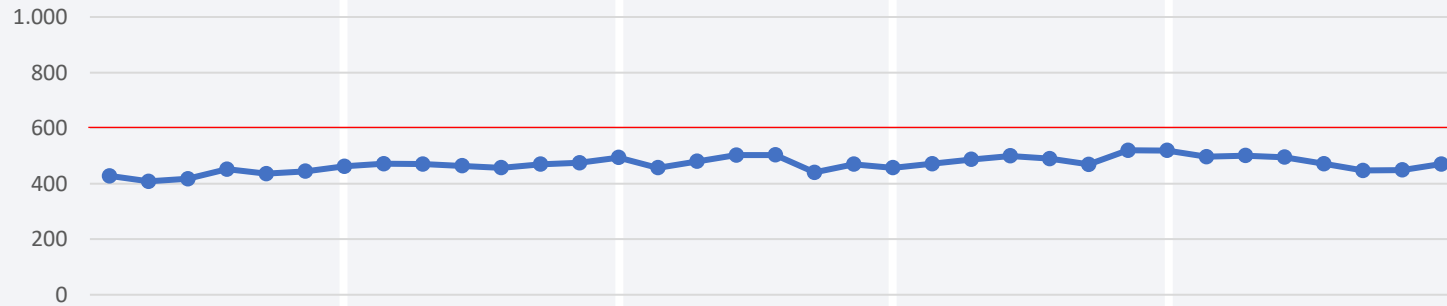


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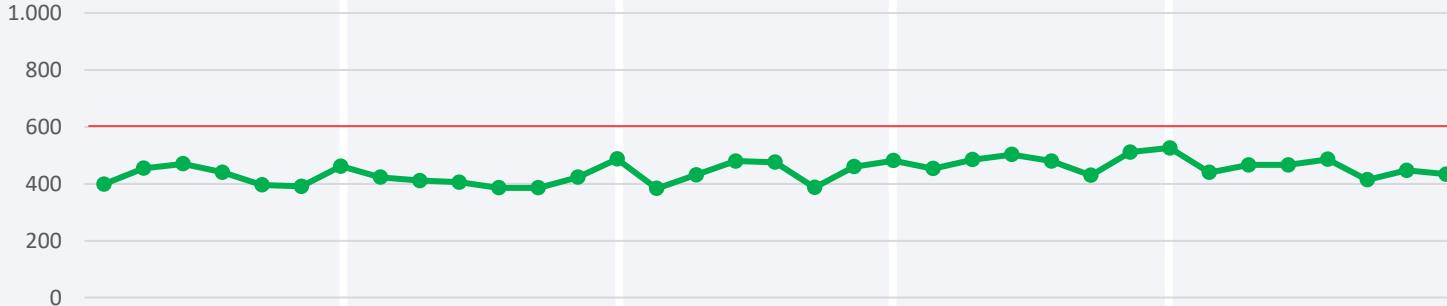
Ufficio grigio



Ufficio centro

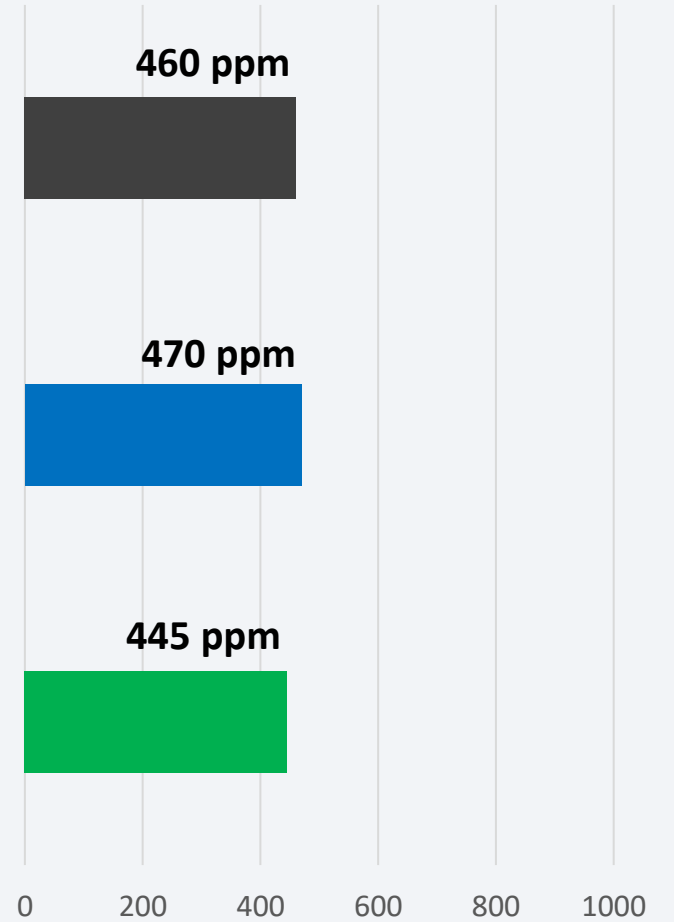


Ufficio verde



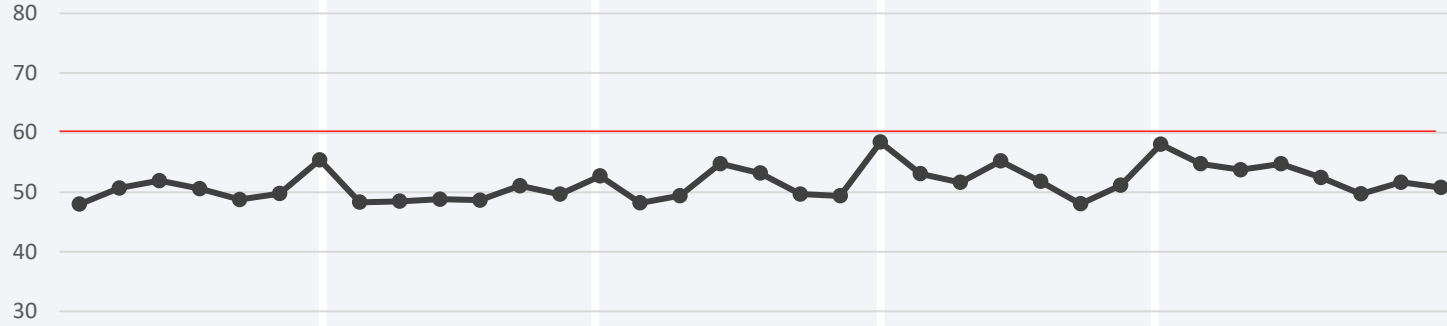
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### MEDIA week 34

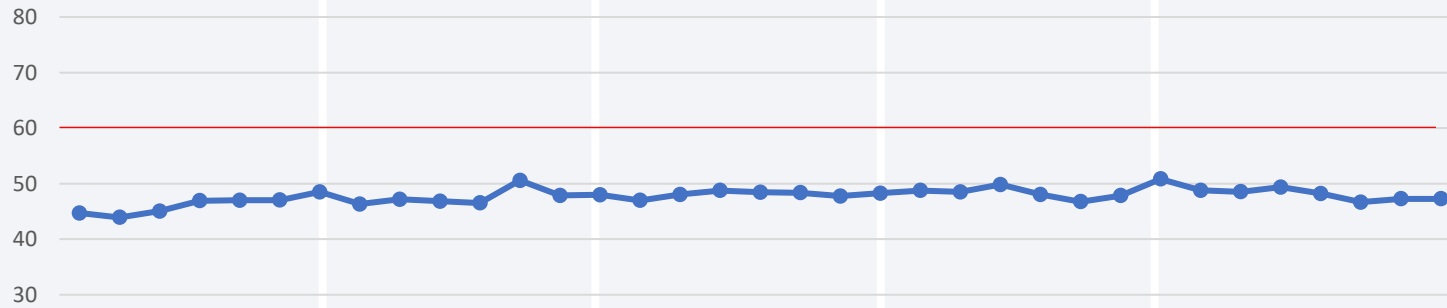


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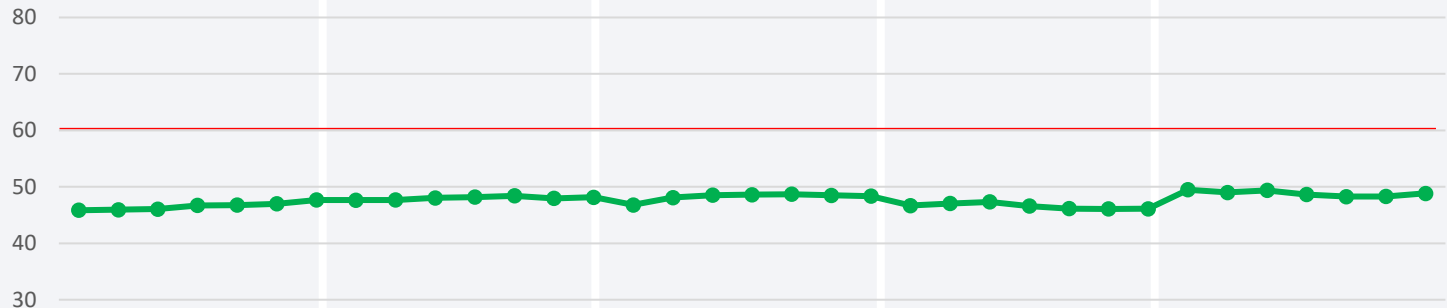
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Ufficio centro

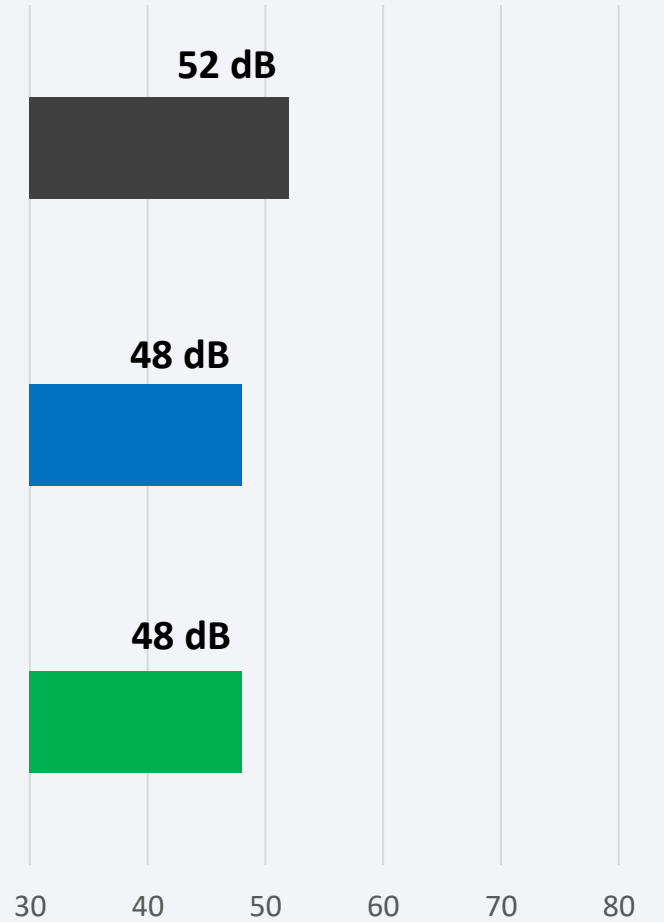


Ufficio verde



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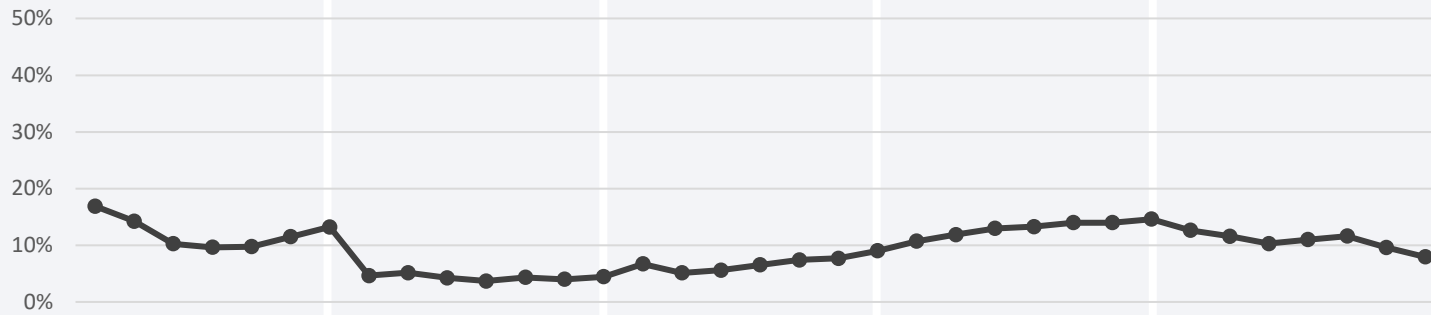
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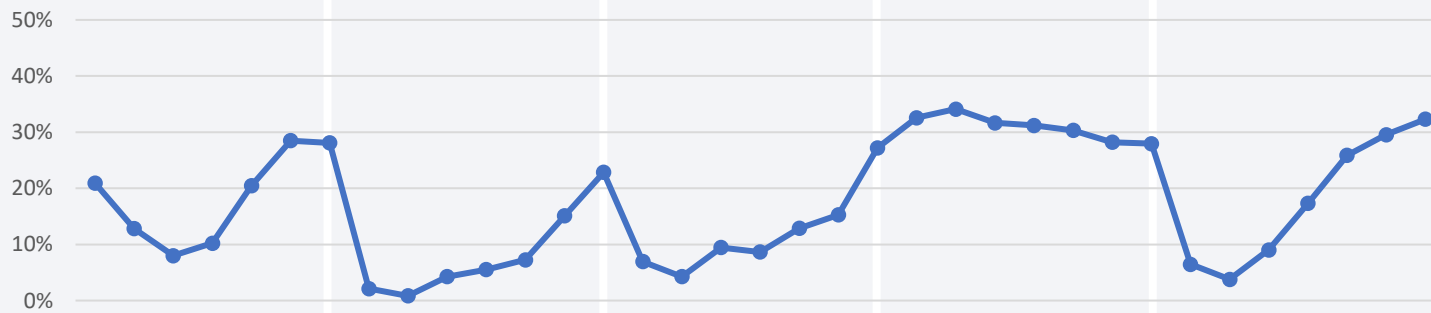
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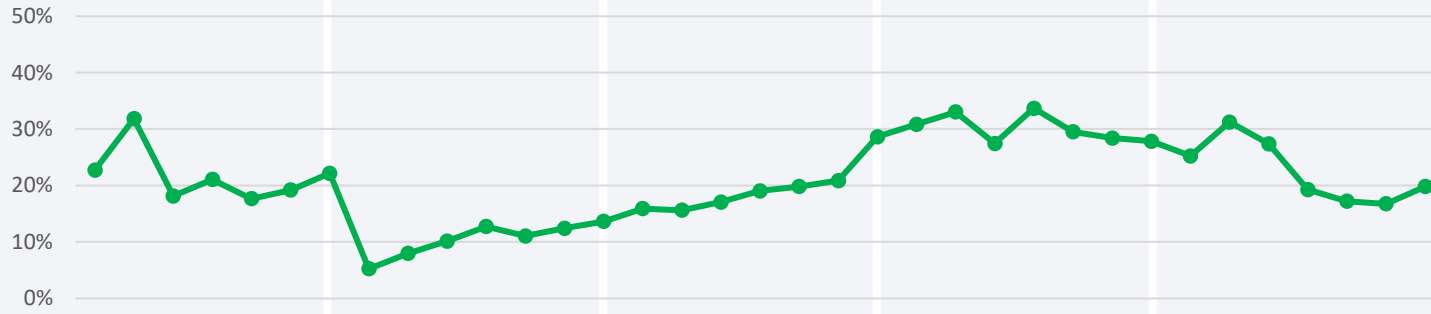
Ufficio grigio



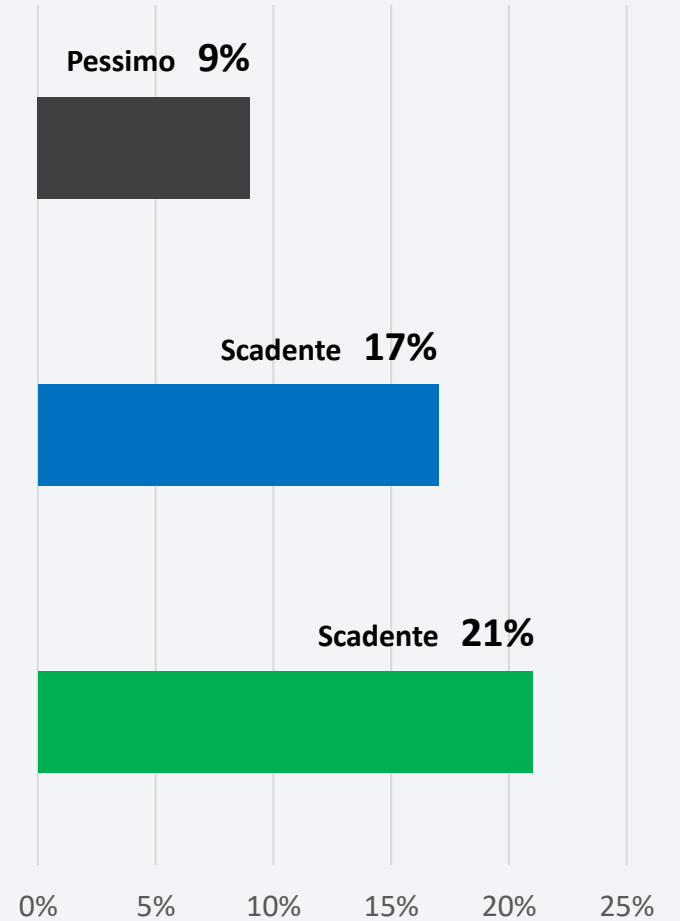
Ufficio centro



Ufficio verde



## MEDIA week 34





# AMBIENCE COMFORT INDEX

Temperatura (°C)



19/06/2023

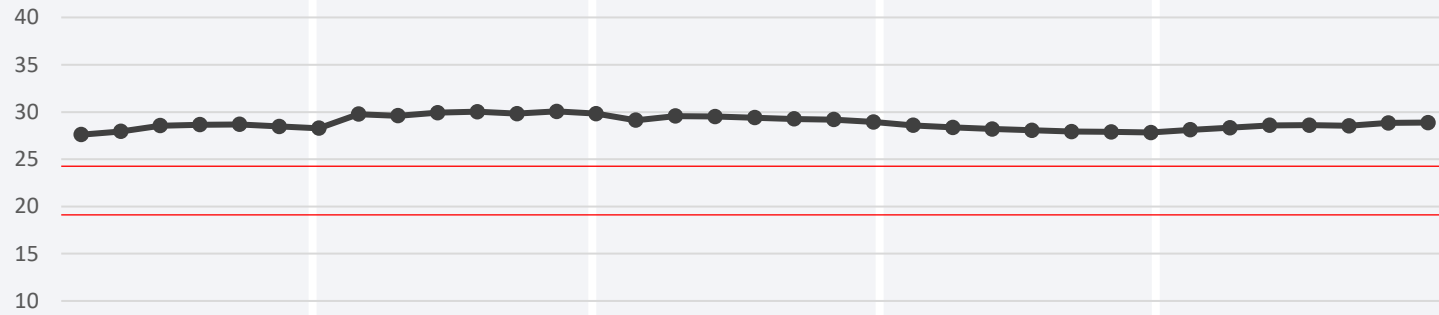
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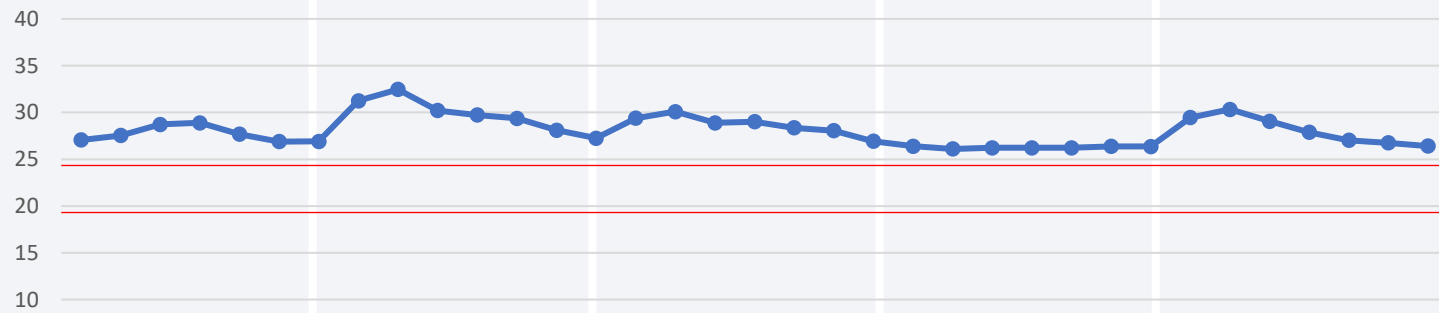
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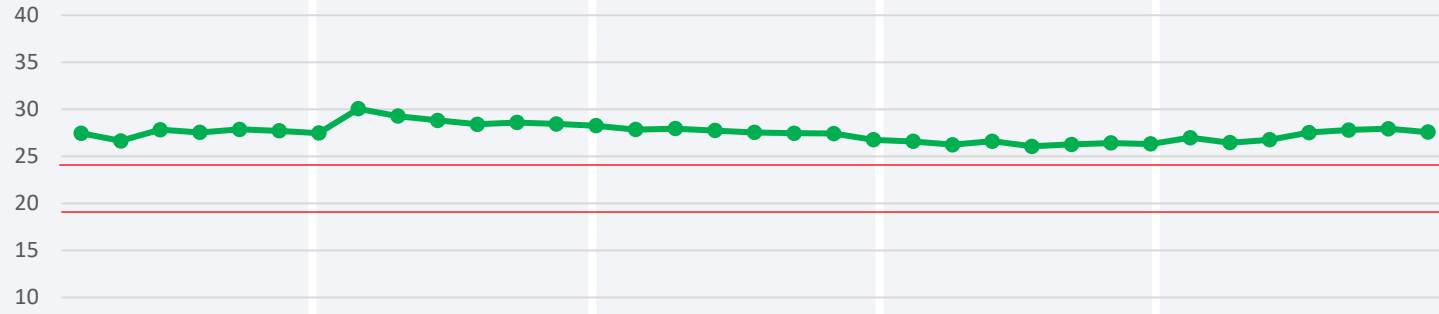
Ufficio grigio



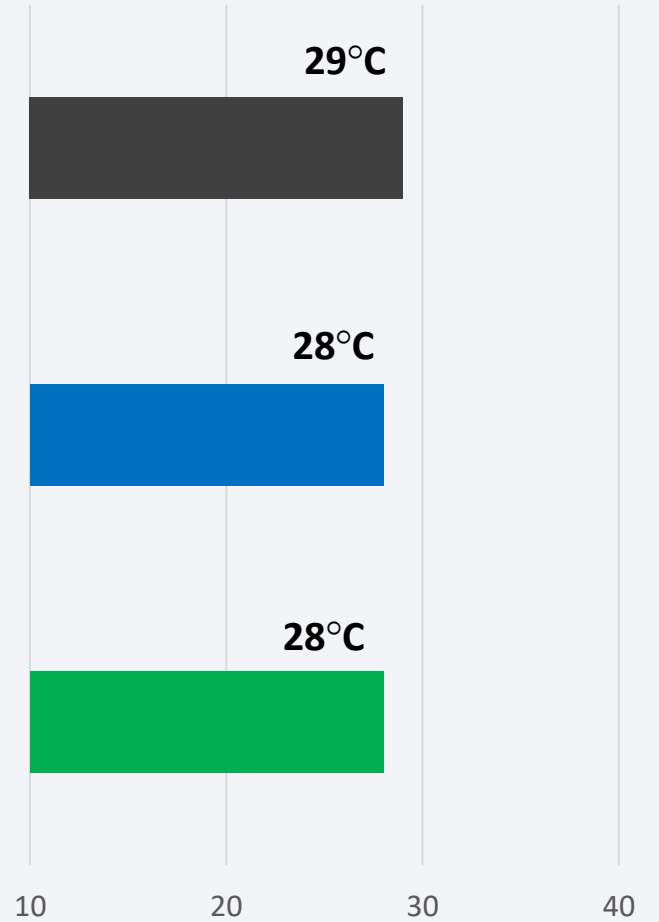
Ufficio centro



Ufficio verde



**MEDIA** week 34



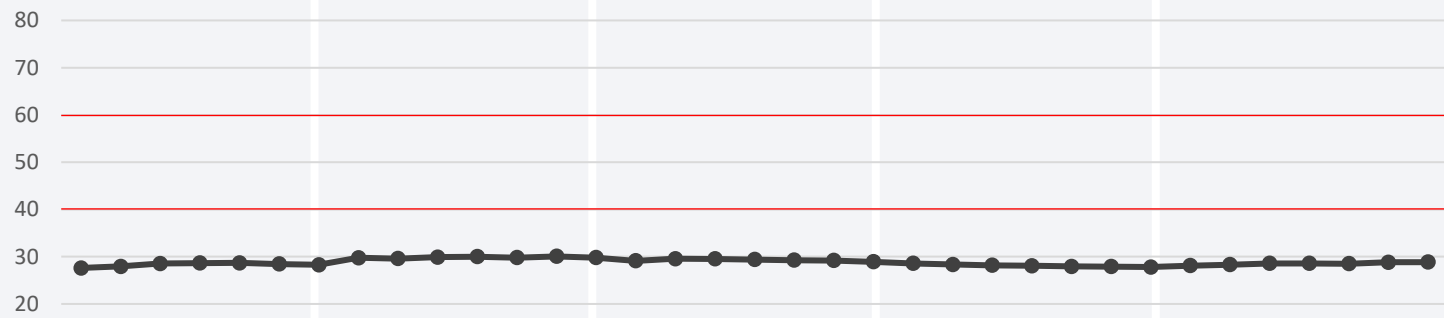
# AMBIENCE COMFORT INDEX

## Umidità (%)

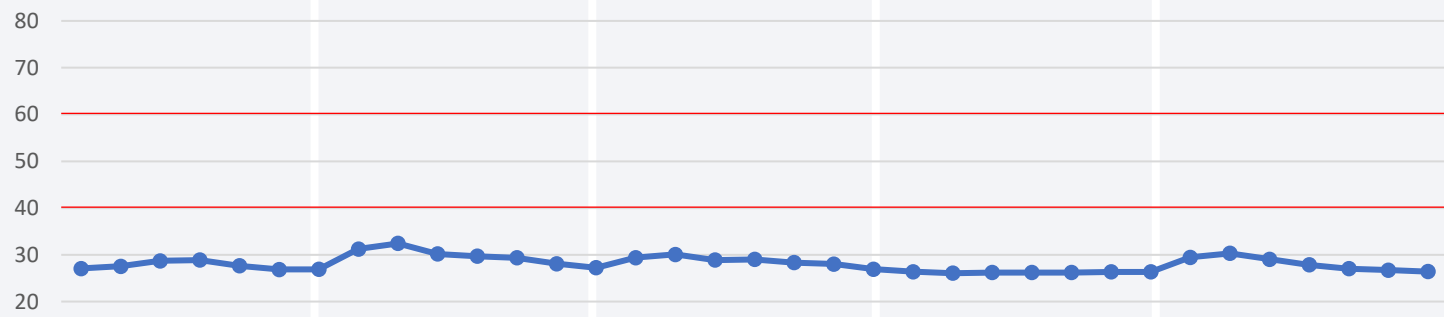


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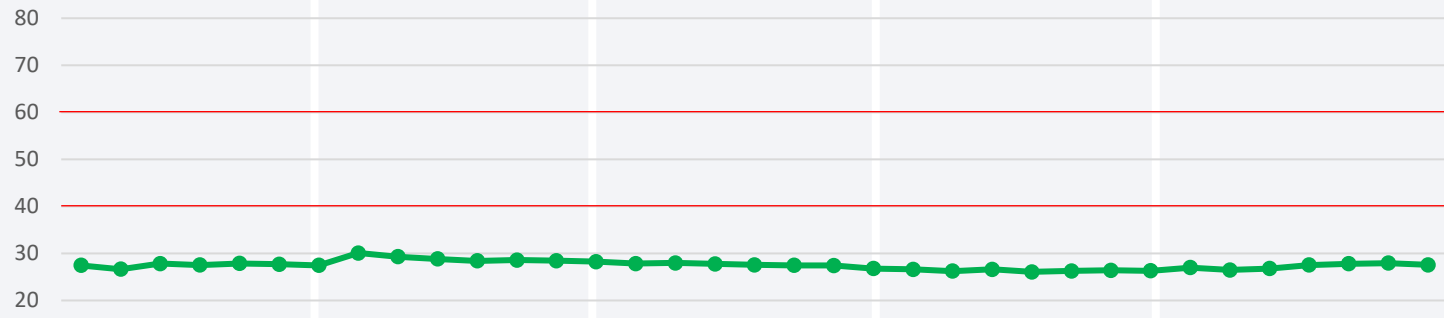
Ufficio grigio



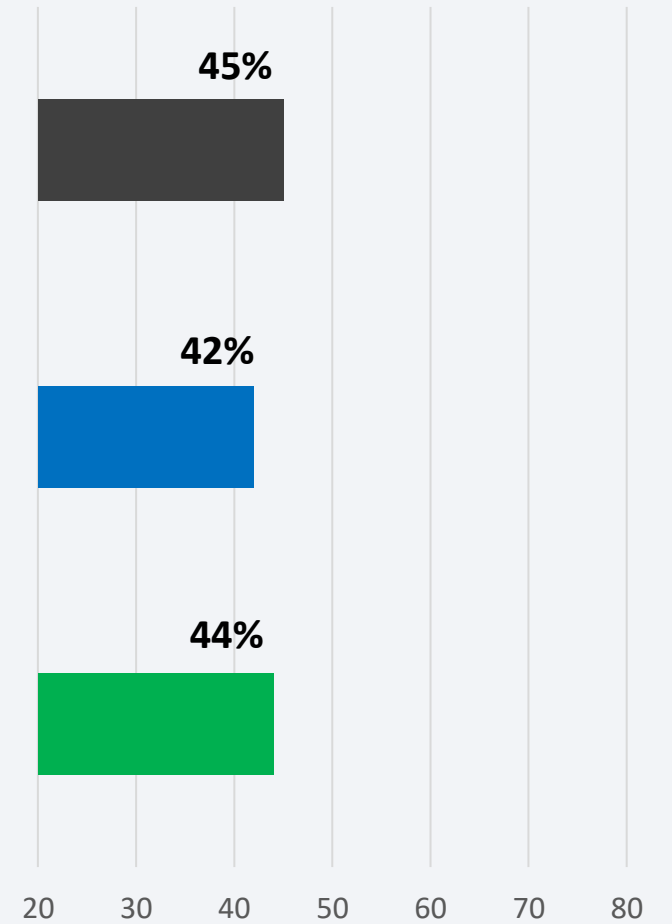
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Ufficio verde



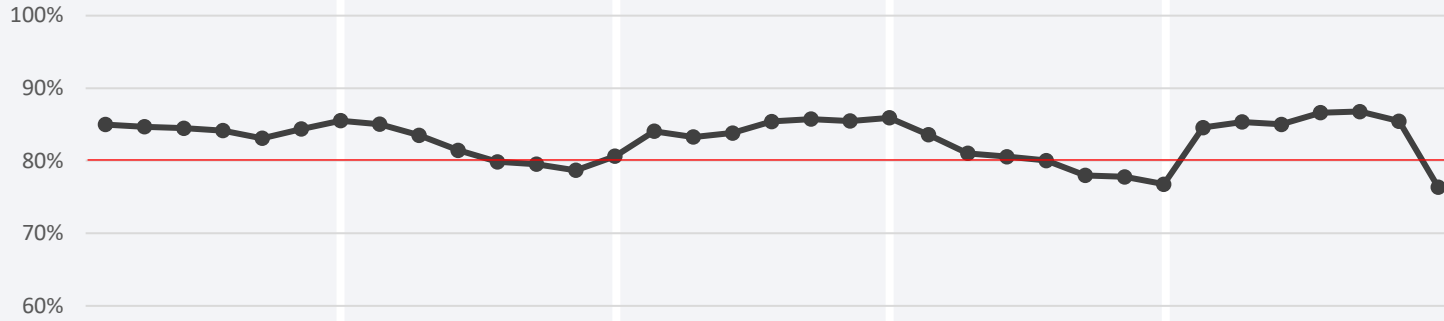
## MEDIA week 34



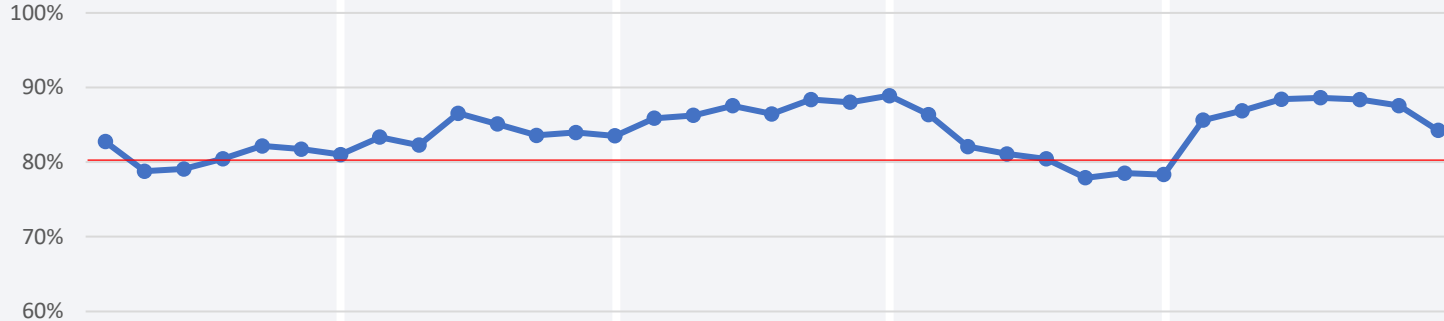
# AIR QUALITY INDEX

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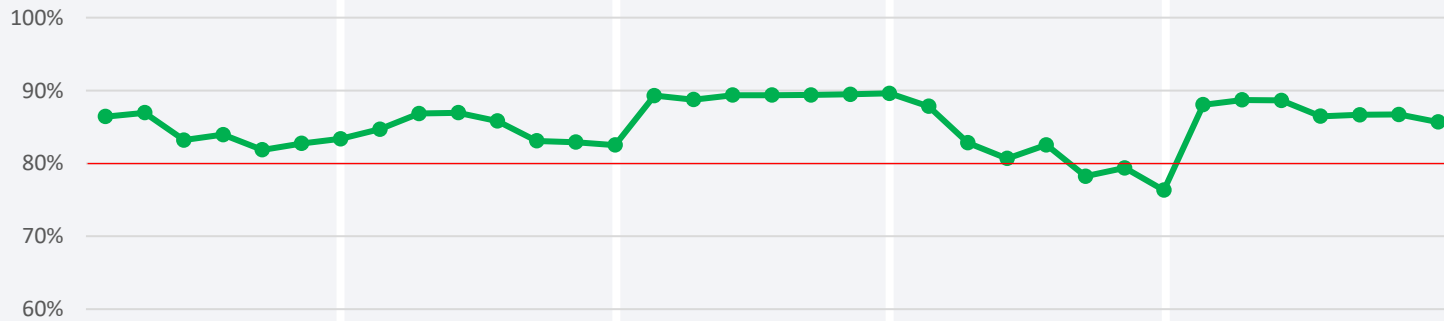
Ufficio grigio



Ufficio centro

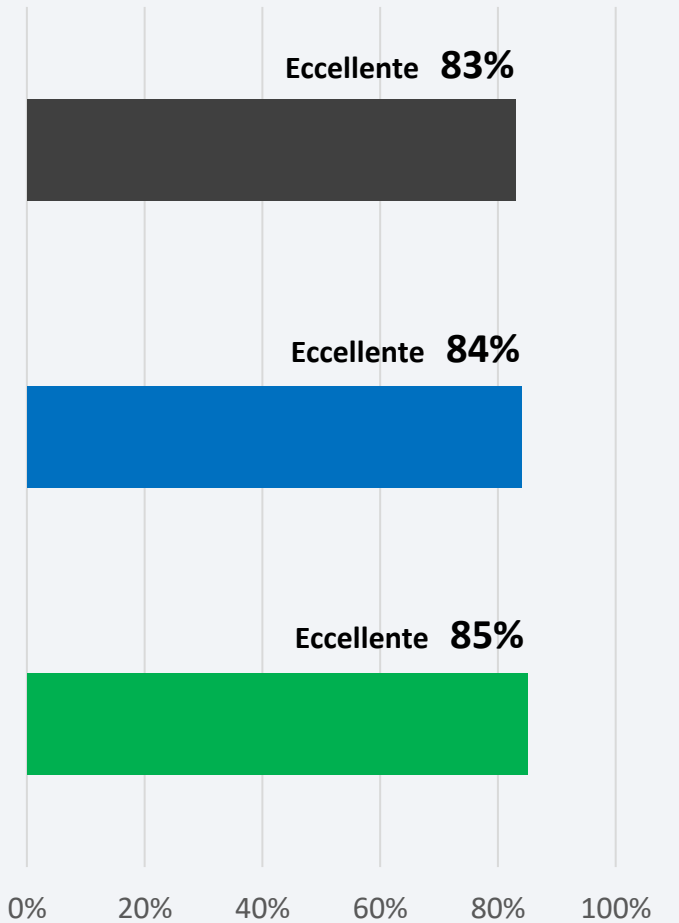


Ufficio verde



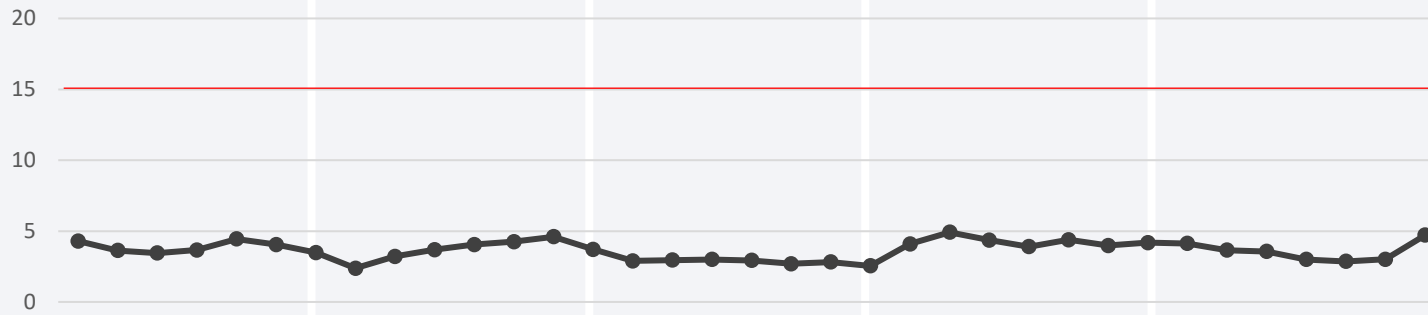
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## MEDIA week 34

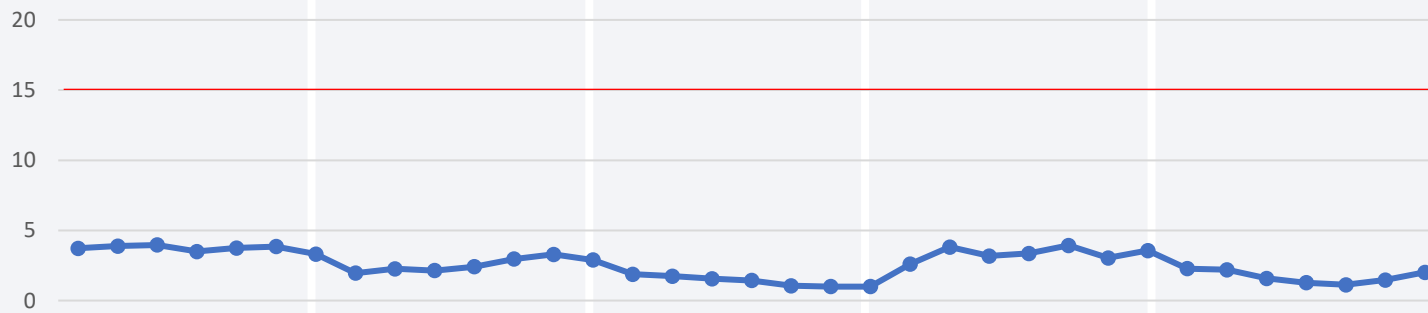


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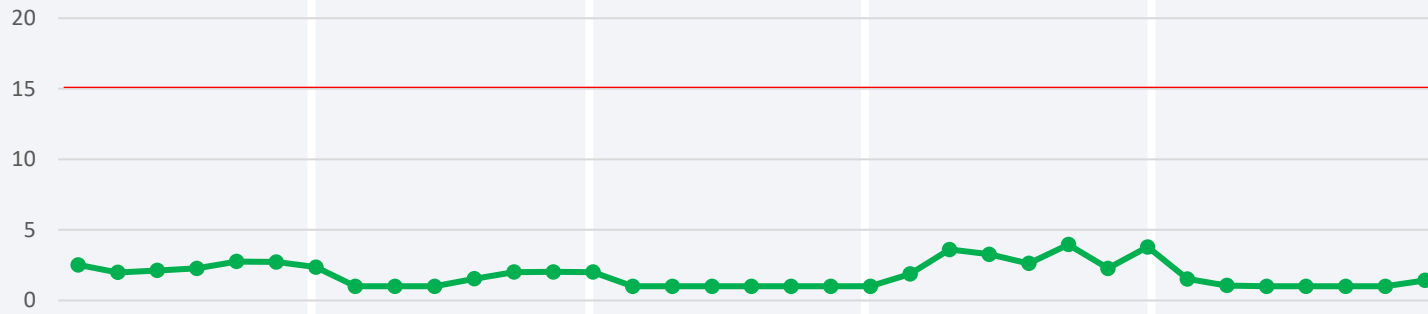
Ufficio grigio



Ufficio centro



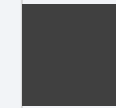
Ufficio verde



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### MEDIA week 34

3.6  $\mu\text{g}/\text{m}^3$



2.5  $\mu\text{g}/\text{m}^3$



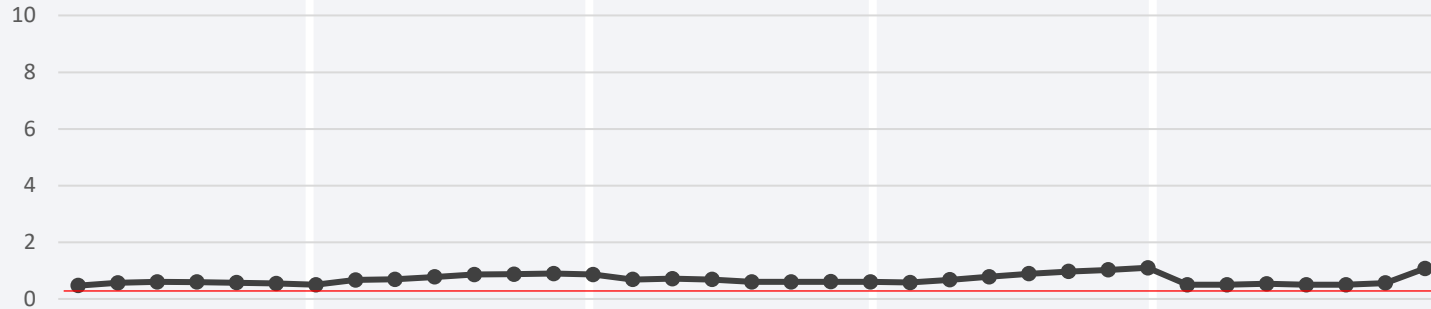
1.8  $\mu\text{g}/\text{m}^3$



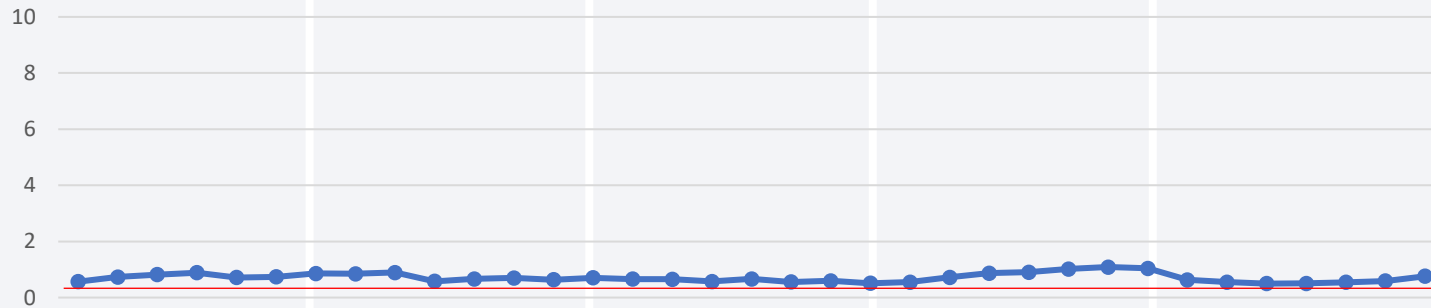
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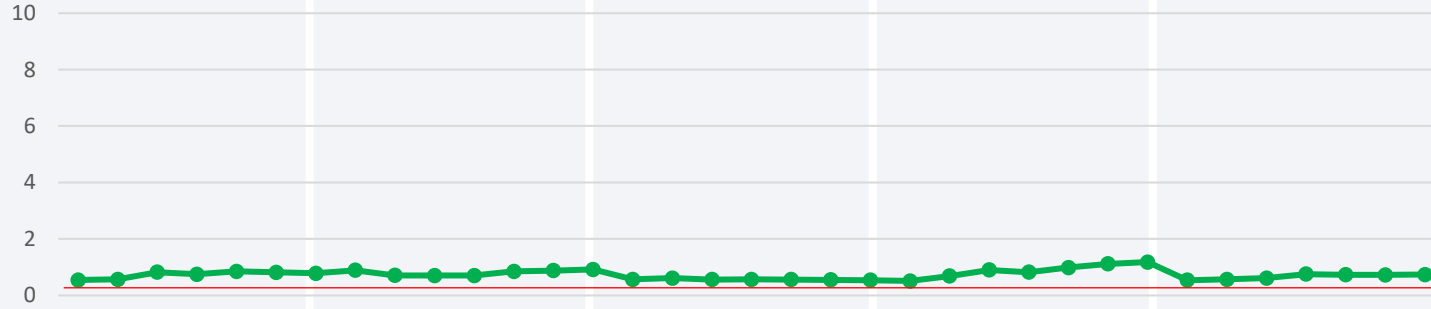
Ufficio grigio



Ufficio centro

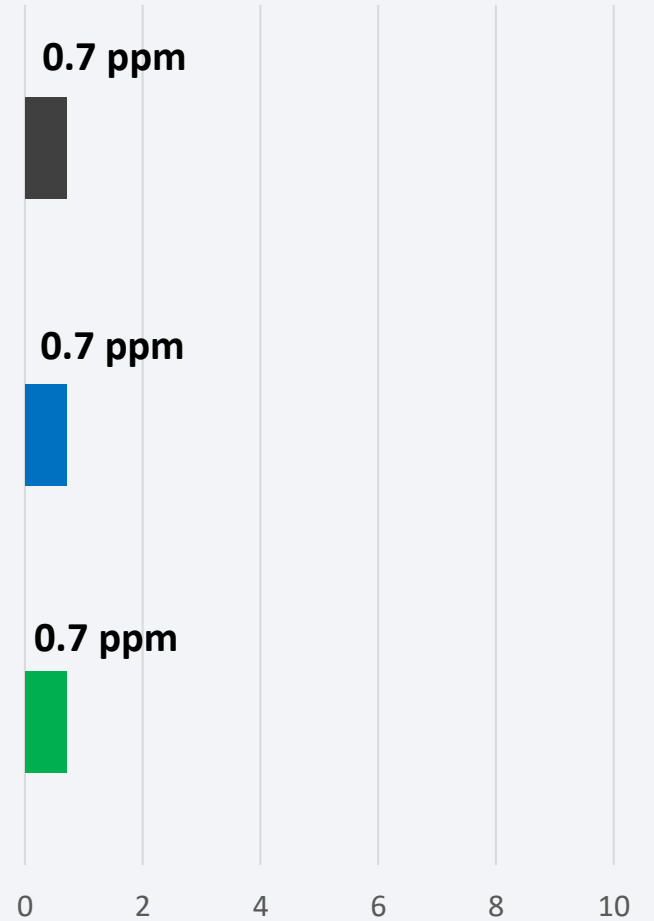


Ufficio verde



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### MEDIA week 34



Week 26

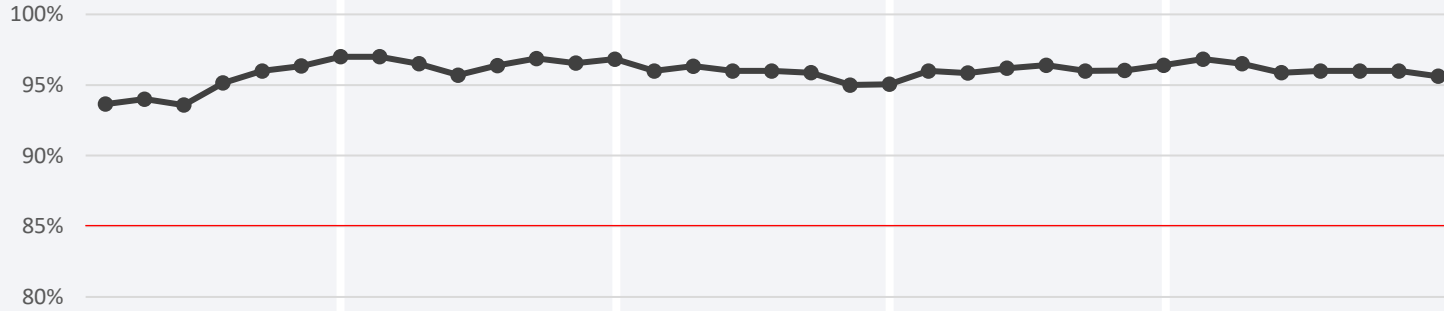
# Second week

26/06/2023 - 30/06/2023

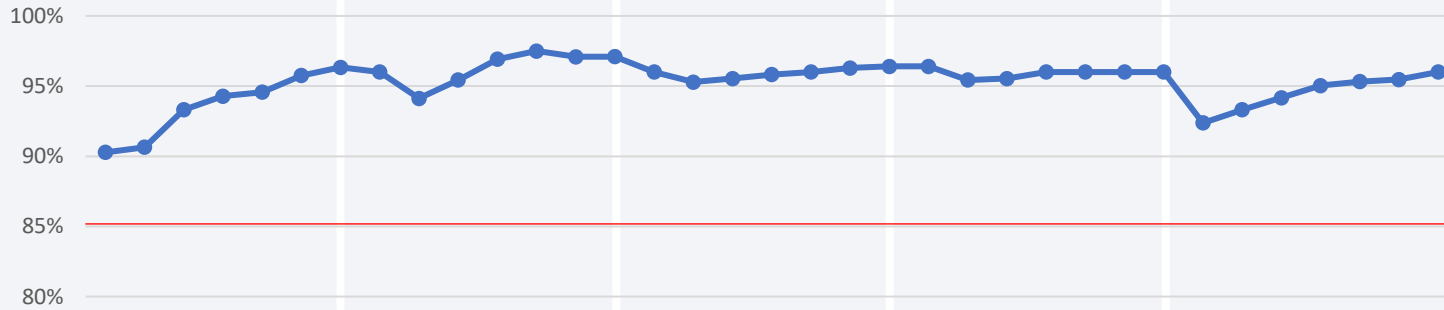
# BRAIN EFFICIENCY INDEX

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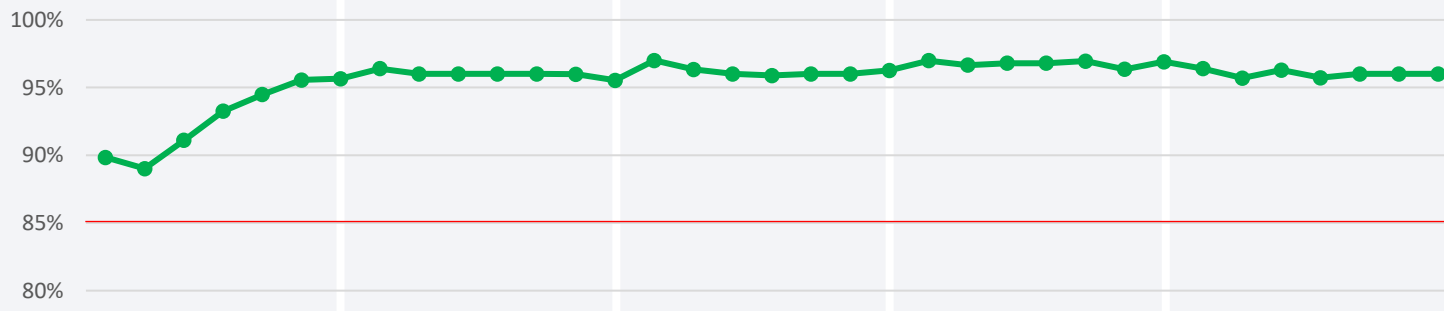
Ufficio grigio



Ufficio centro

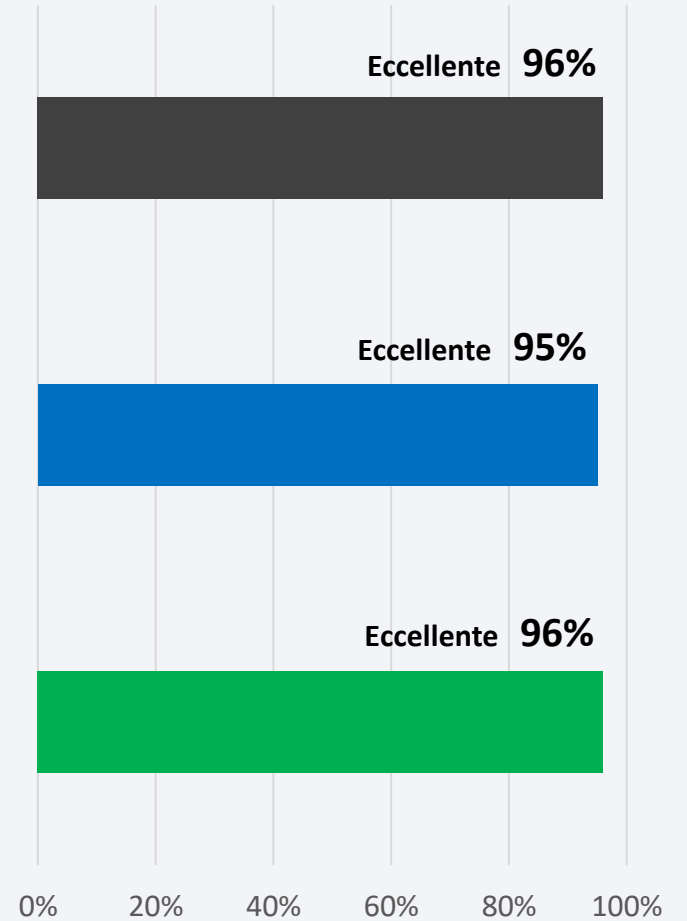


Ufficio verde



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## MEDIA week 35



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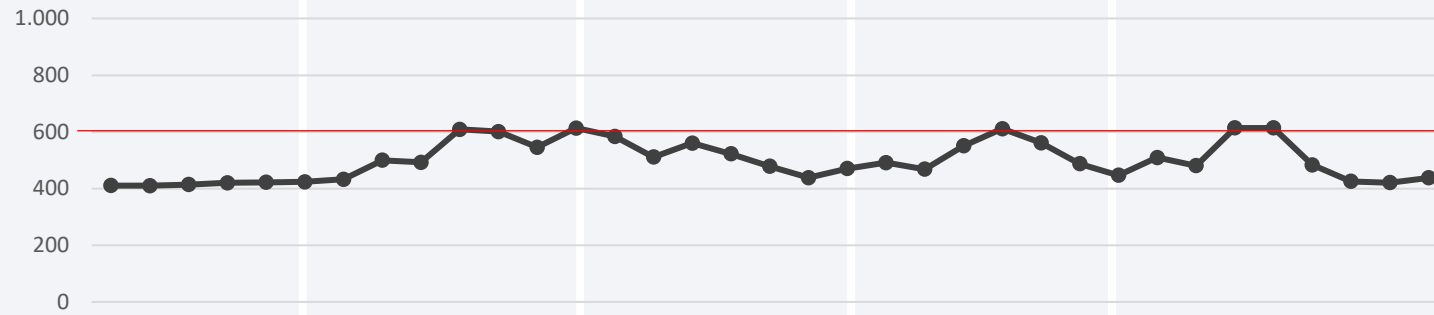
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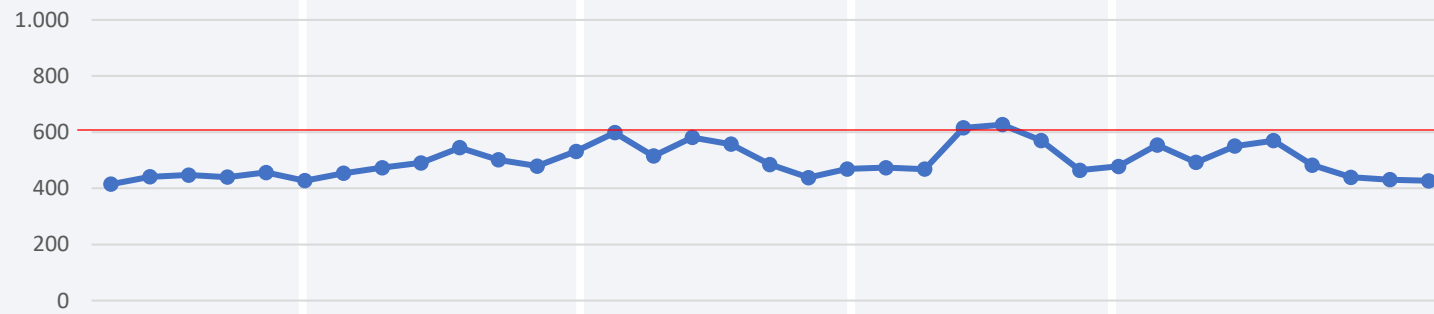
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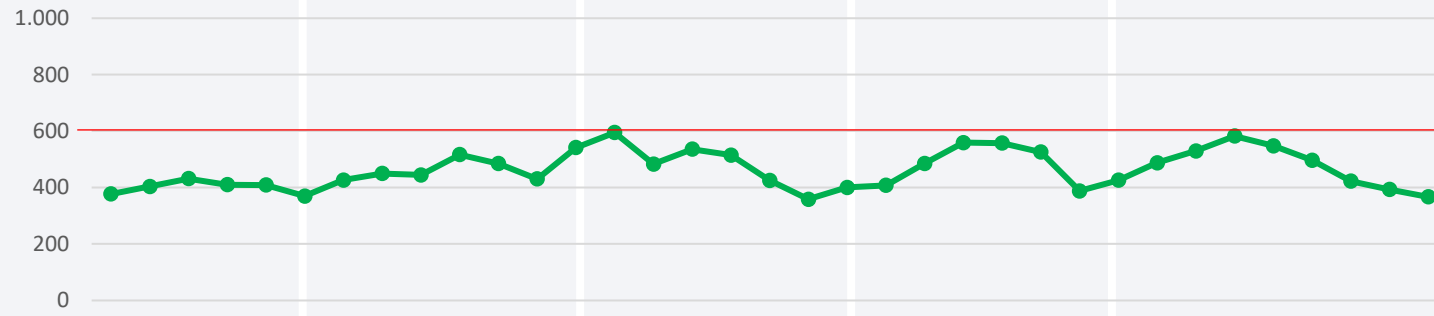
Ufficio grigio



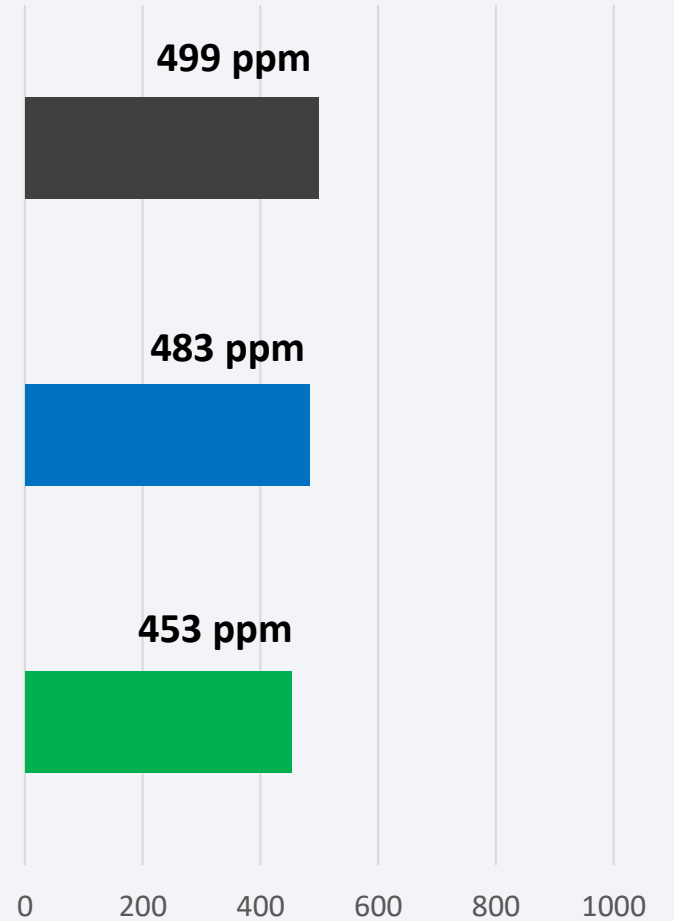
Ufficio centro



Ufficio verde



## MEDIA week 35





19/06/2023

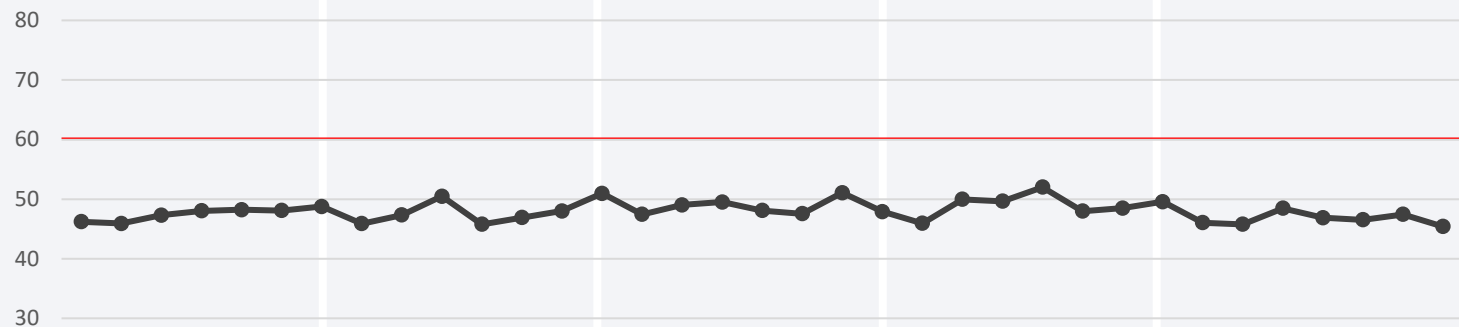
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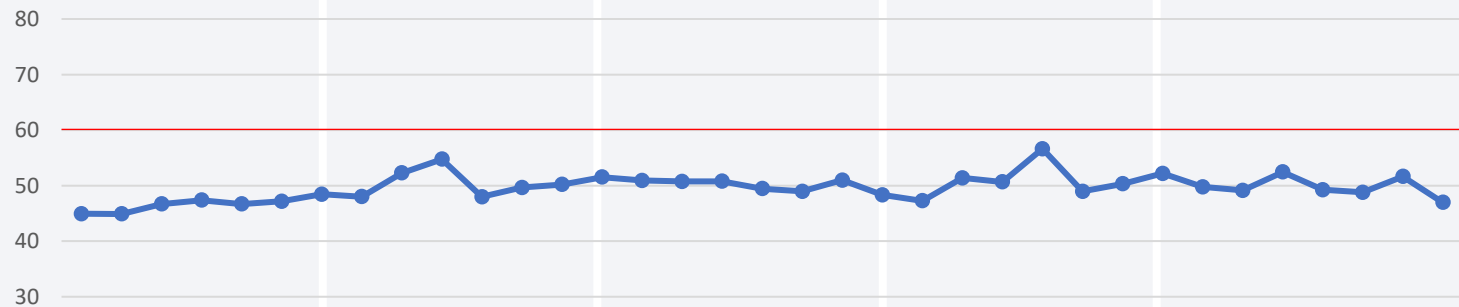
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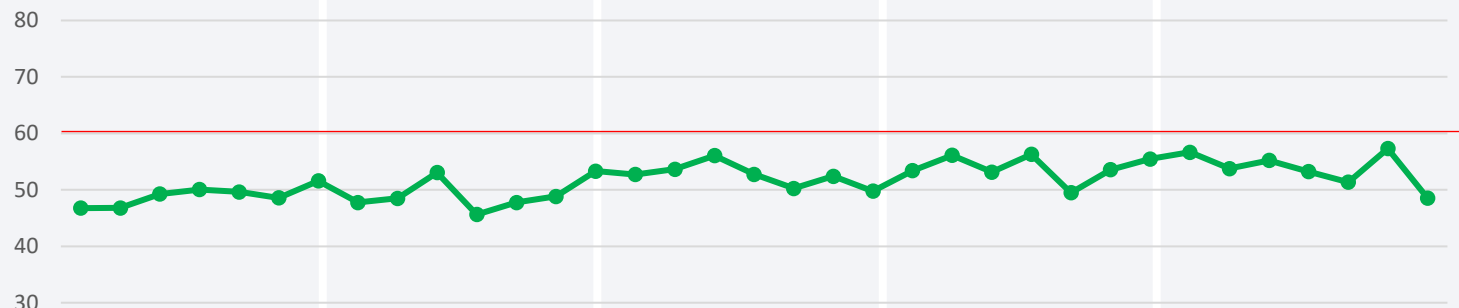
Ufficio  
grigio



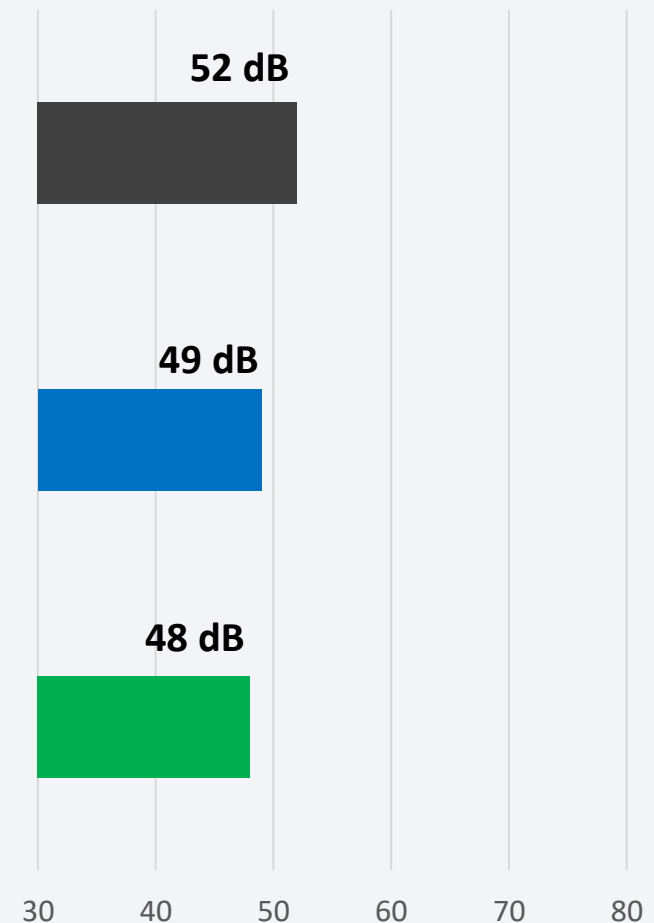
Ufficio  
centro



Ufficio  
verde



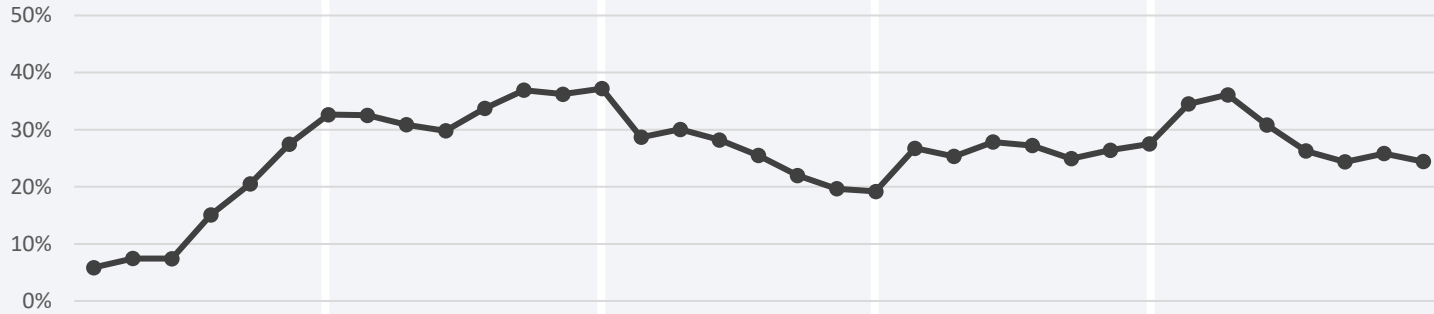
### MEDIA week 35



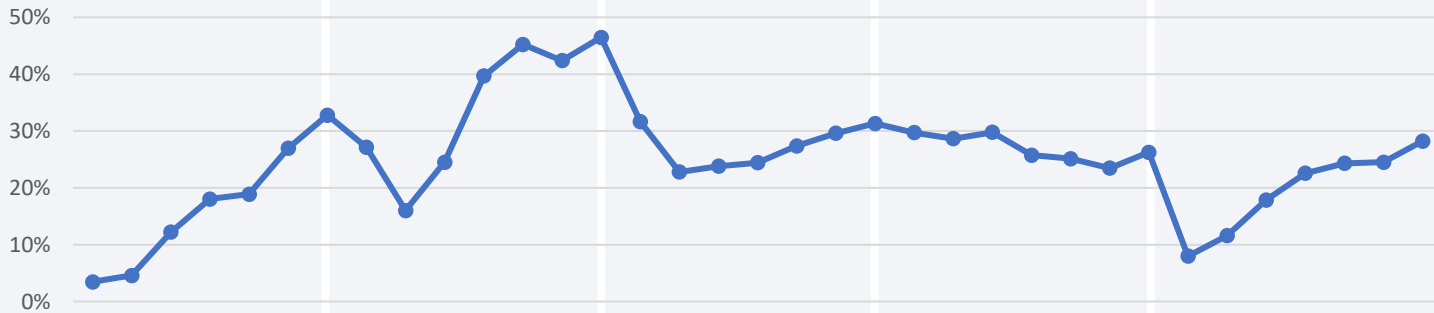
# AMBIENCE COMFORT INDEX

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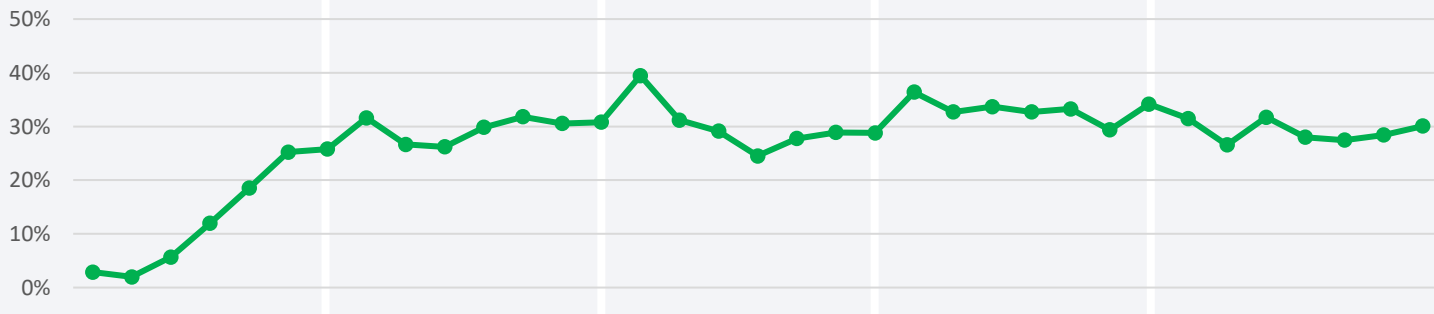
Ufficio grigio



Ufficio centro

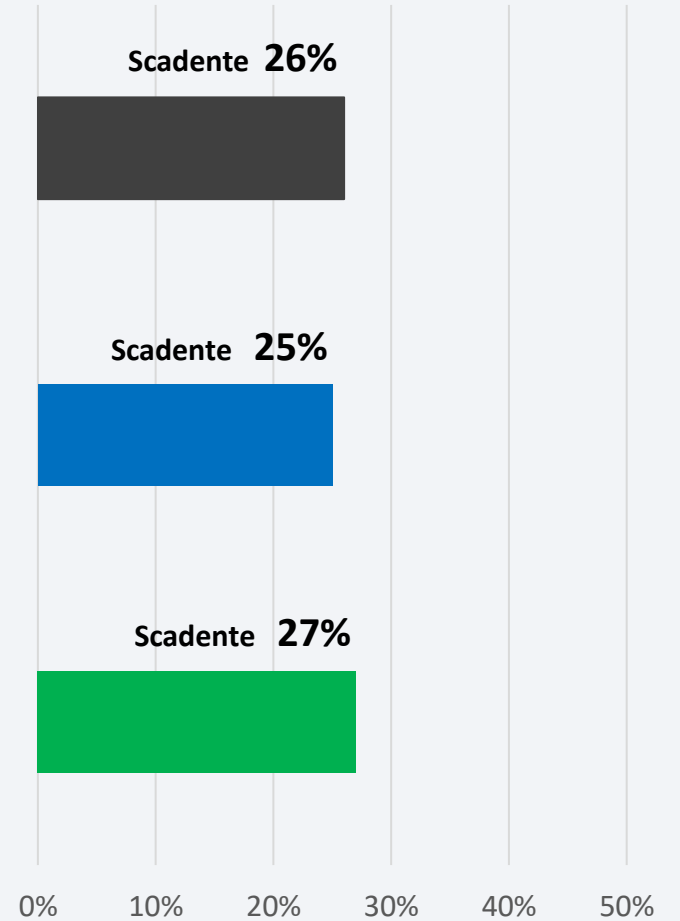


Ufficio verde



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## MEDIA week 35



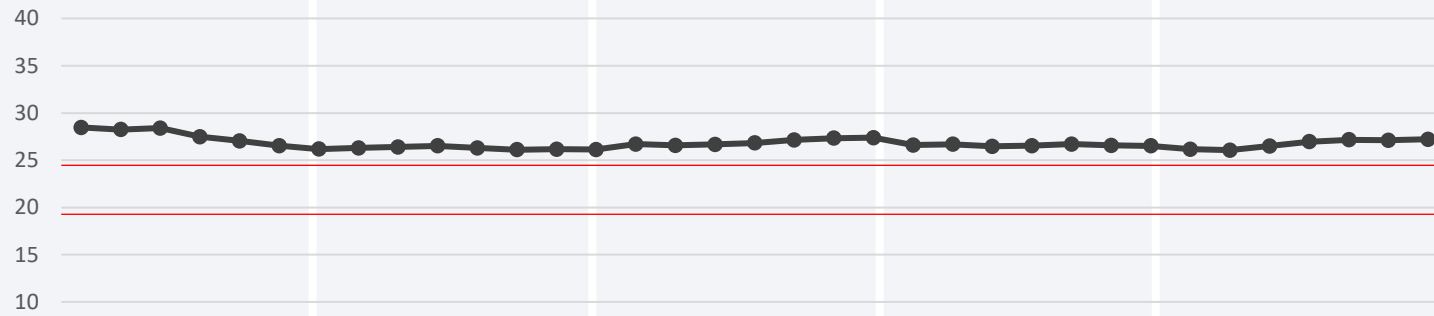
# AMBIENCE COMFORT INDEX

Temperatura (°C)

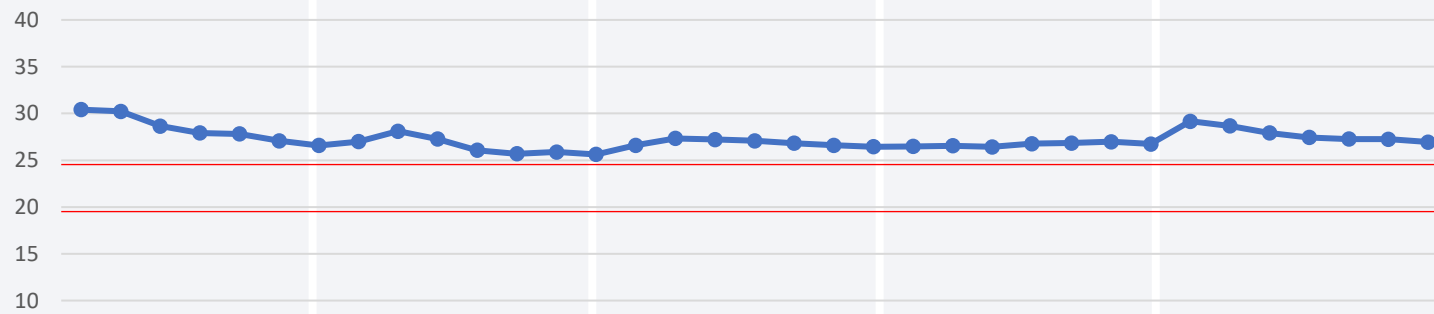


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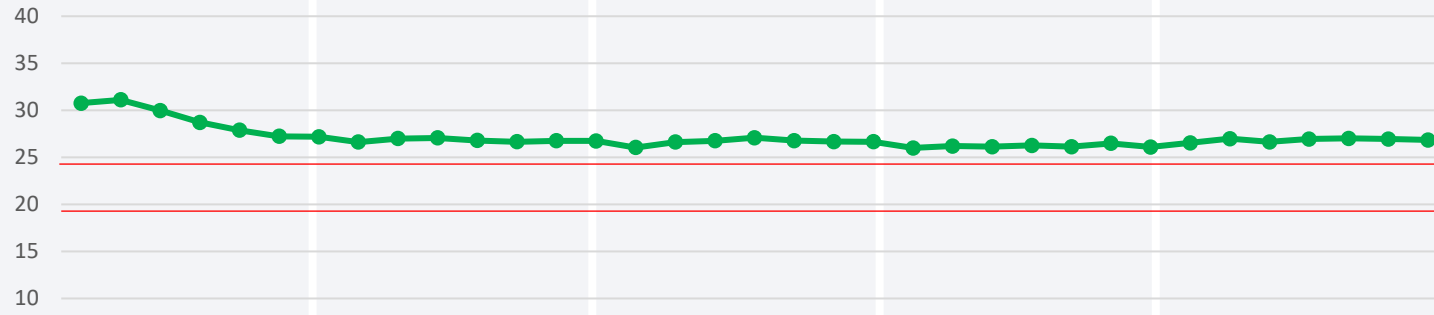
Ufficio grigio



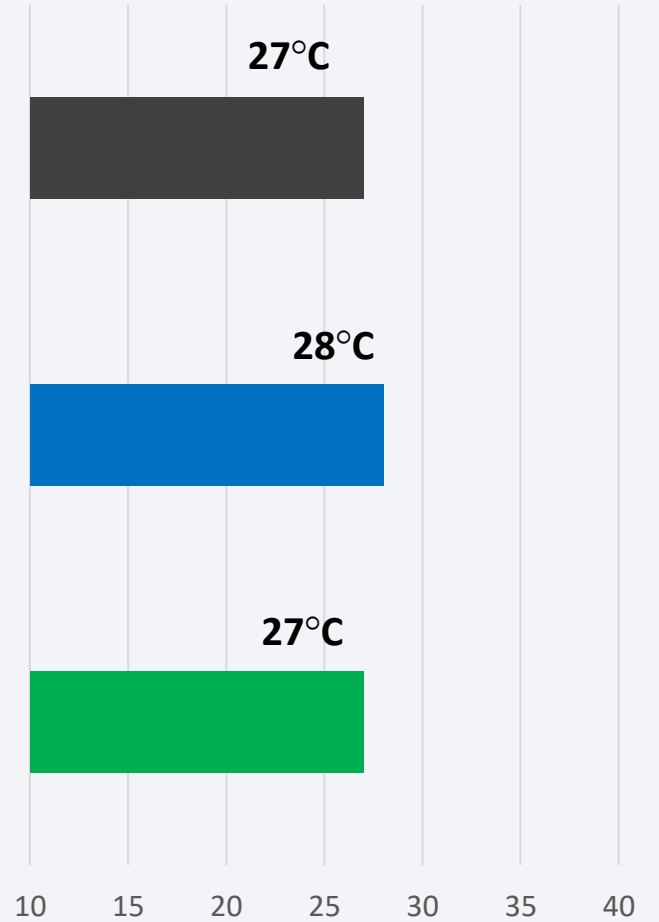
Ufficio centro



Ufficio verde



**MEDIA** week 35



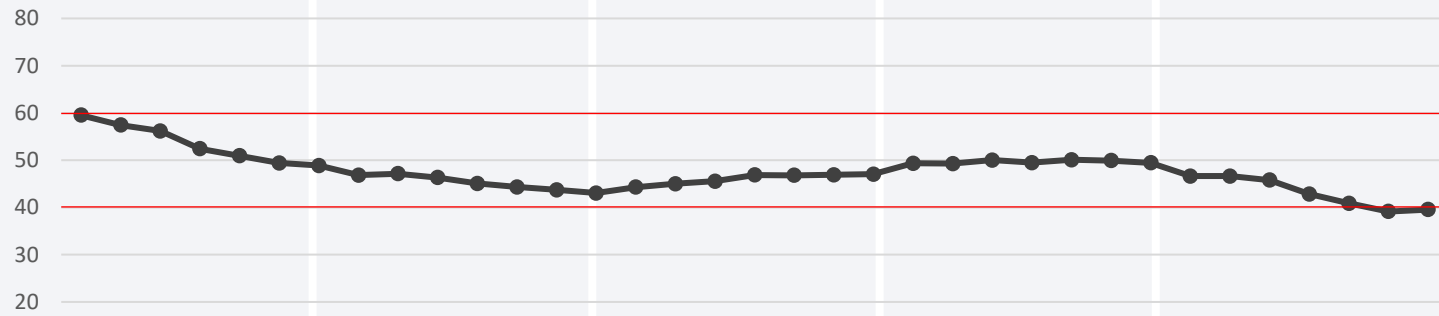
# AMBIENCE COMFORT INDEX

Umidità (%)

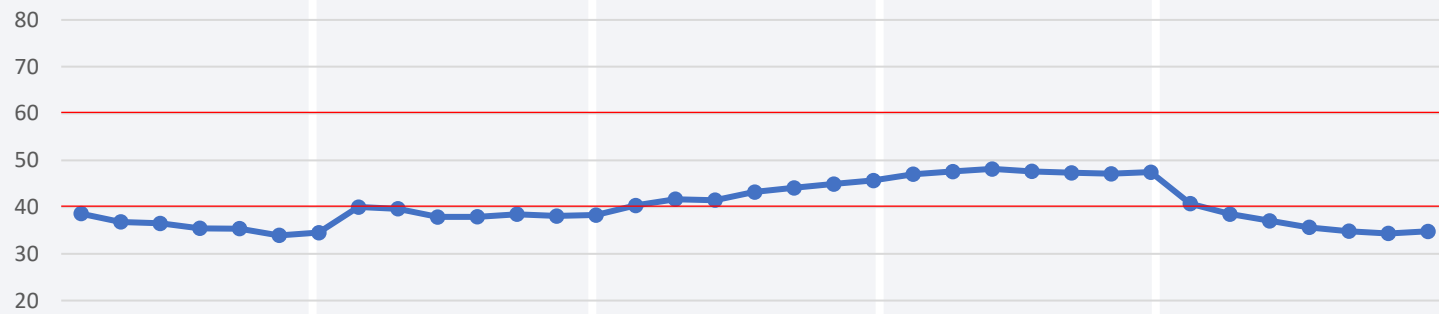


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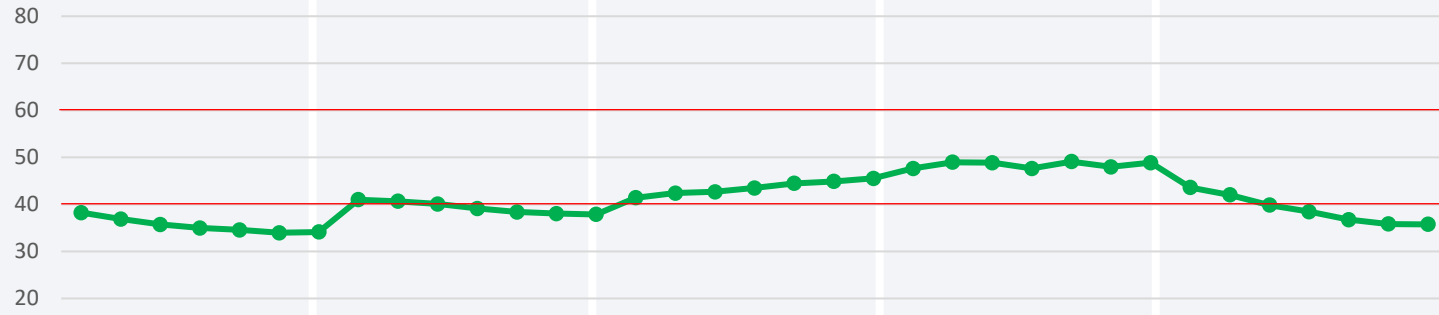
Ufficio grigio



Ufficio centro

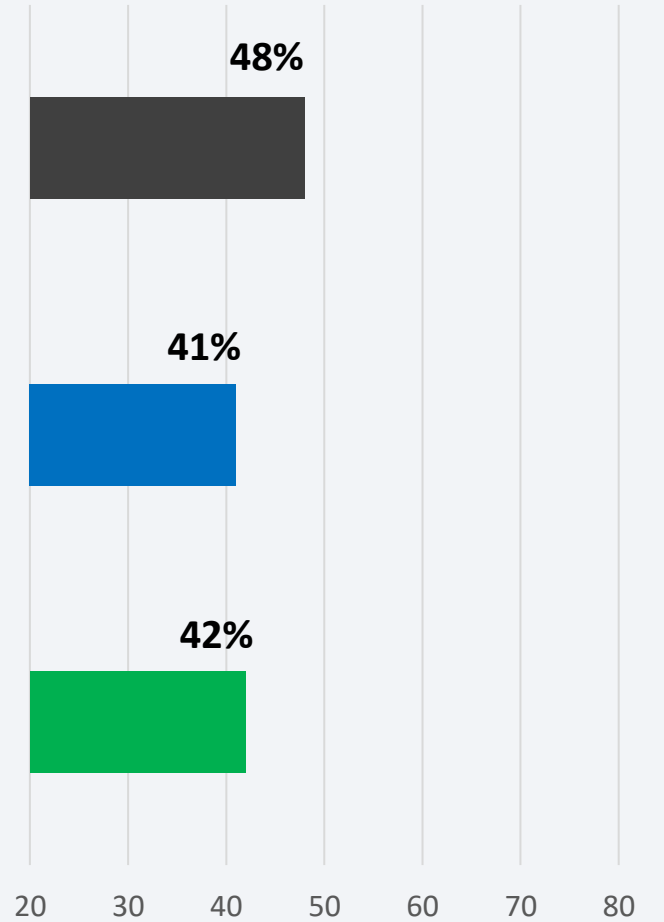


Ufficio verde



10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

## MEDIA week 35



# AIR QUALITY INDEX

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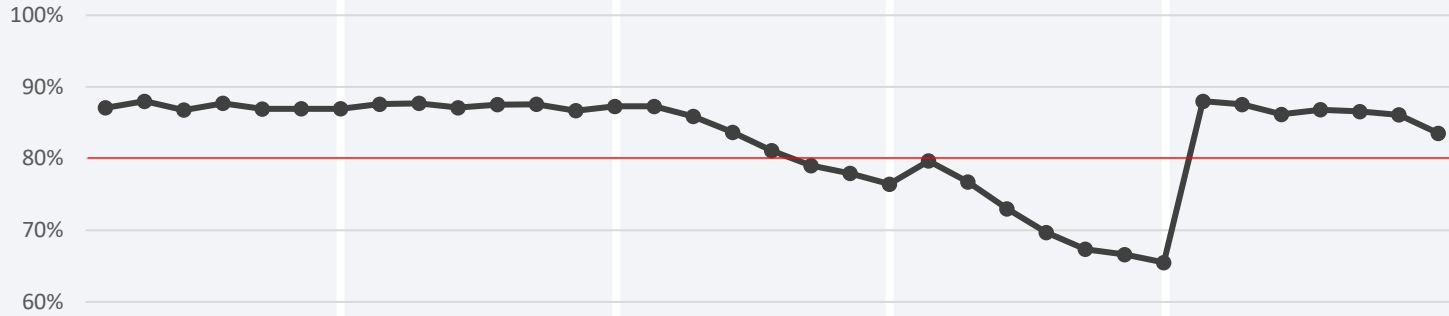
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28/06/2023

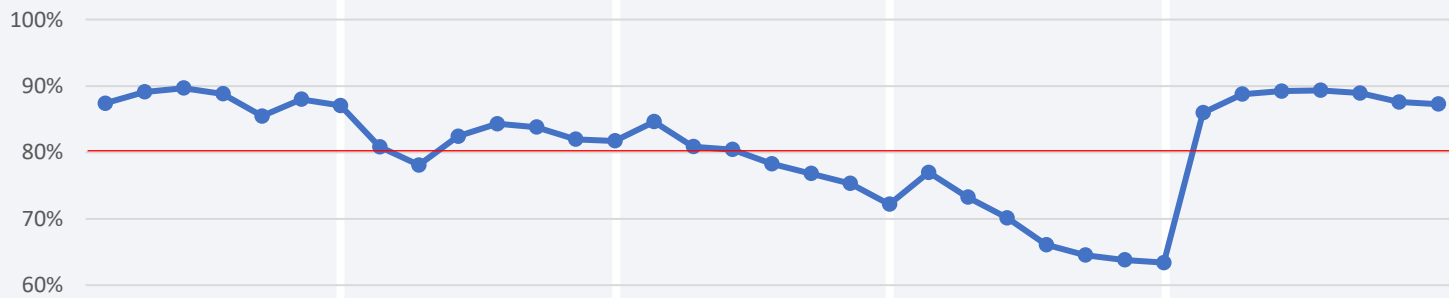
29/06/2023

30/06/2023

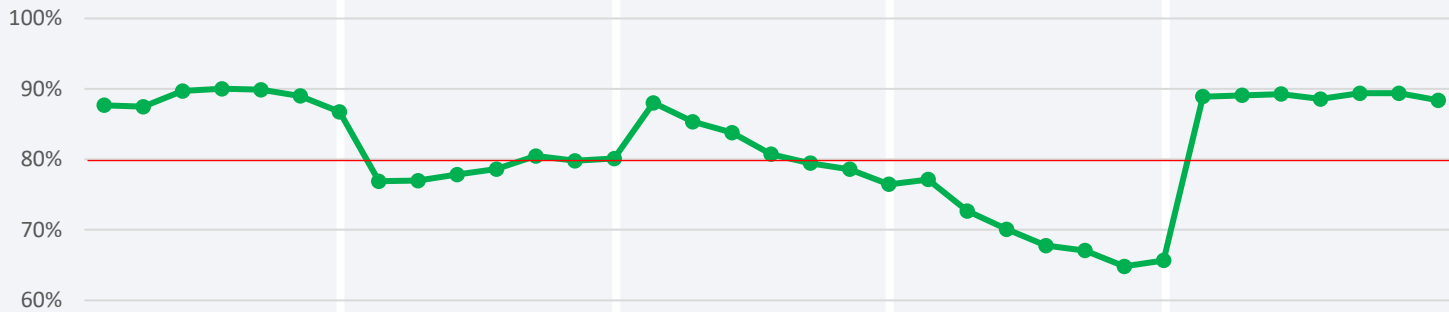
Ufficio grigio



Ufficio centro



Ufficio verde



10:00

12:00

14:00

16:00

12:00

14:00

16:00

12:00

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16:00

12:00

14:00

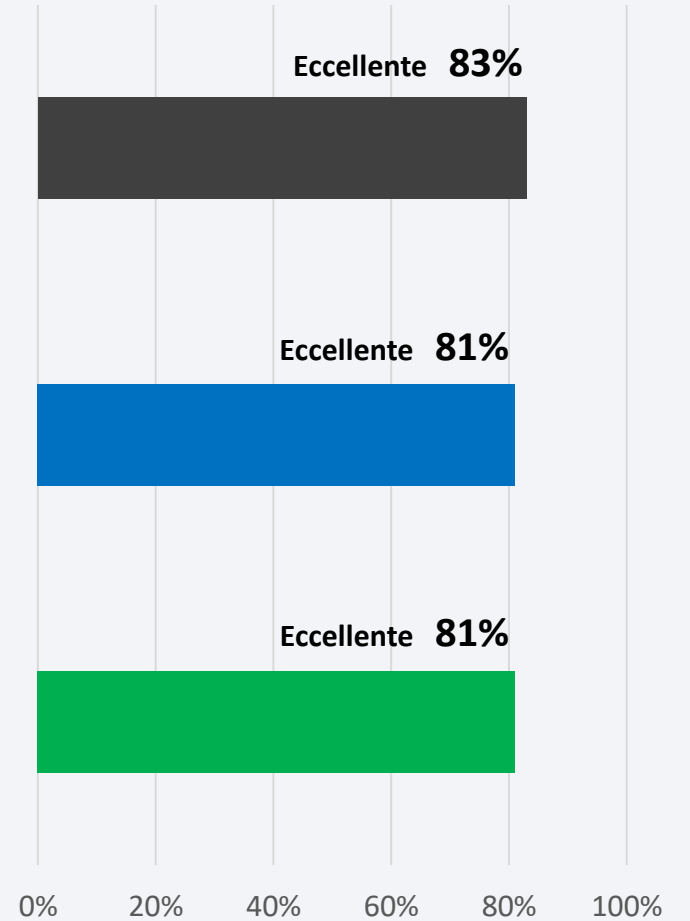
16:00

12:00

14:00

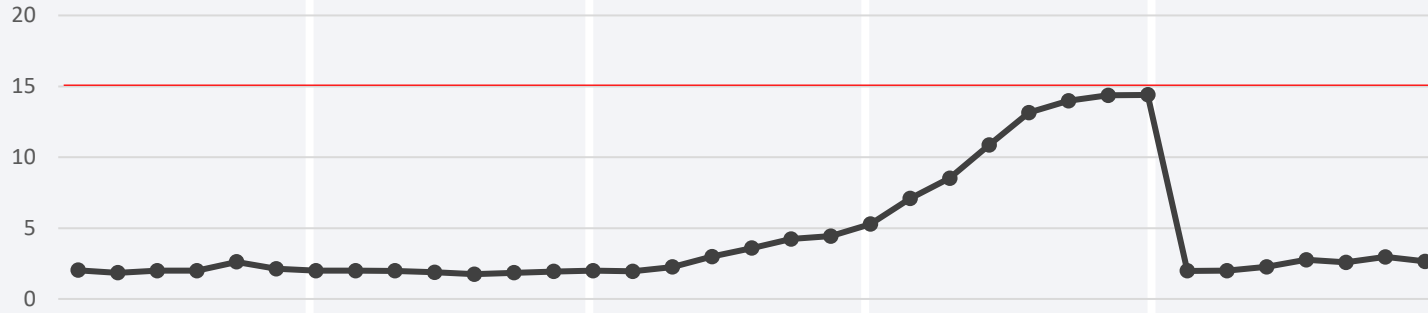
16:00

## MEDIA week 35

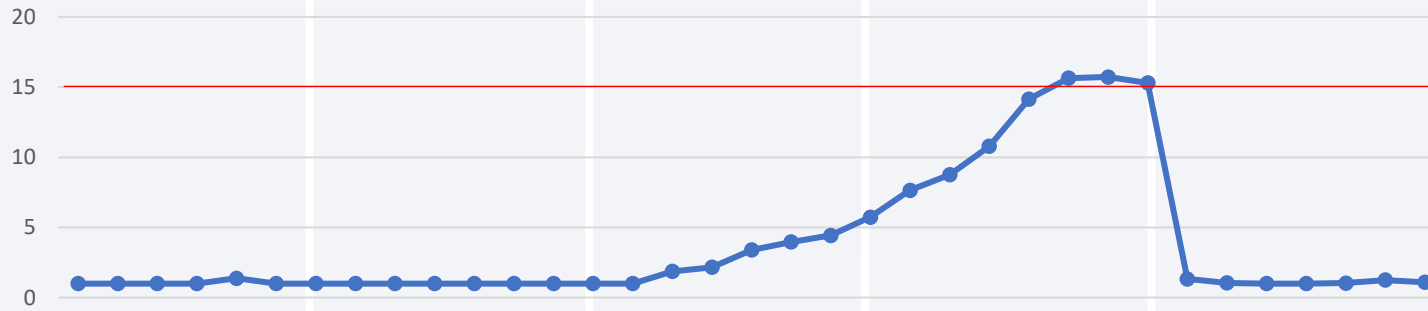


26/06/2023      27/06/2023      28/06/2023      29/06/2023      30/06/2023

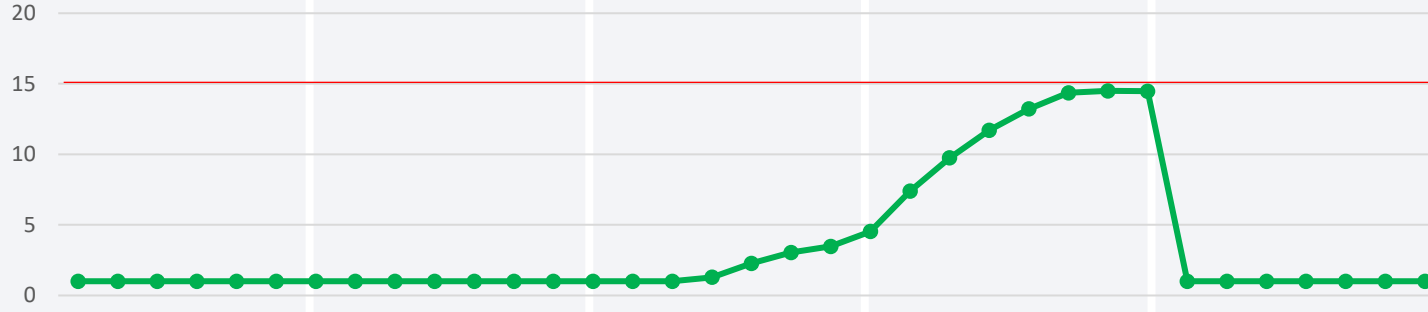
Ufficio grigio



Ufficio centro



Ufficio verde



### MEDIA week 35

4.4  $\mu\text{g}/\text{m}^3$



3.2  $\mu\text{g}/\text{m}^3$



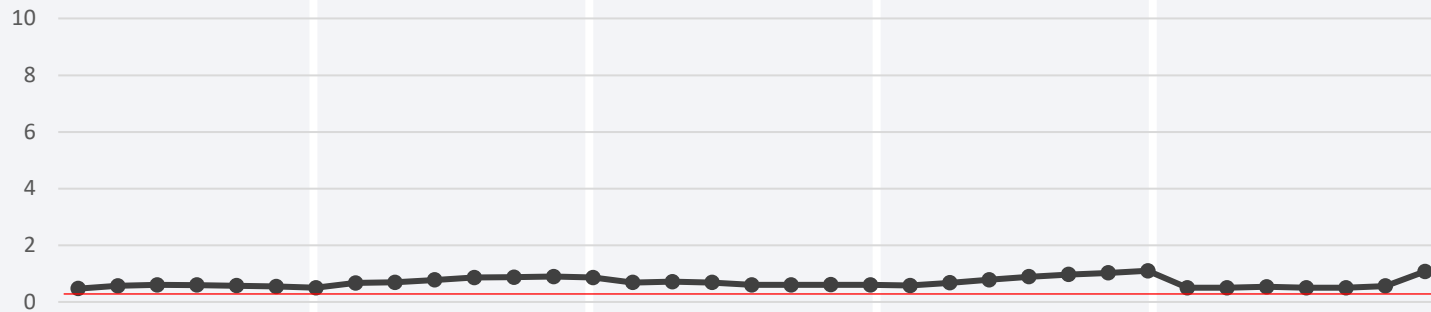
2.7  $\mu\text{g}/\text{m}^3$



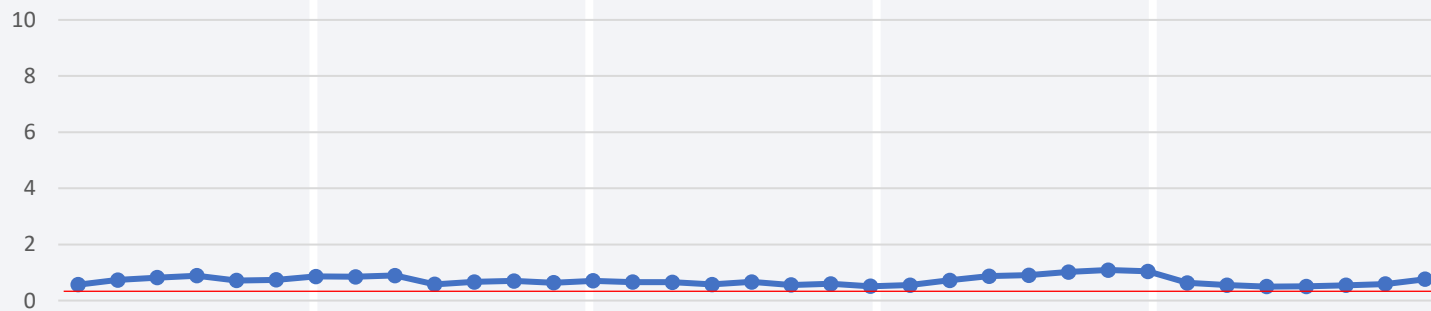
0      5      10      15      20

26/06/2023      27/06/2023      28/06/2023      29/06/2023      30/06/2023

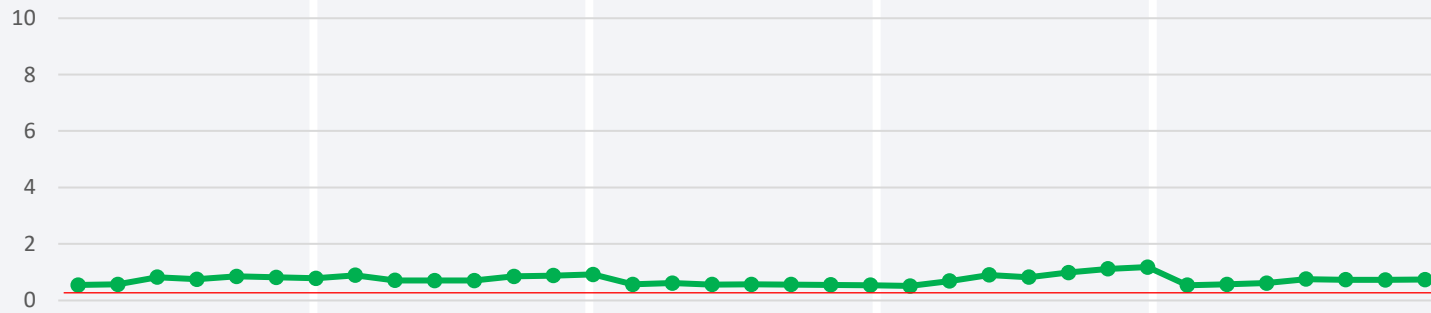
Ufficio grigio



Ufficio centro

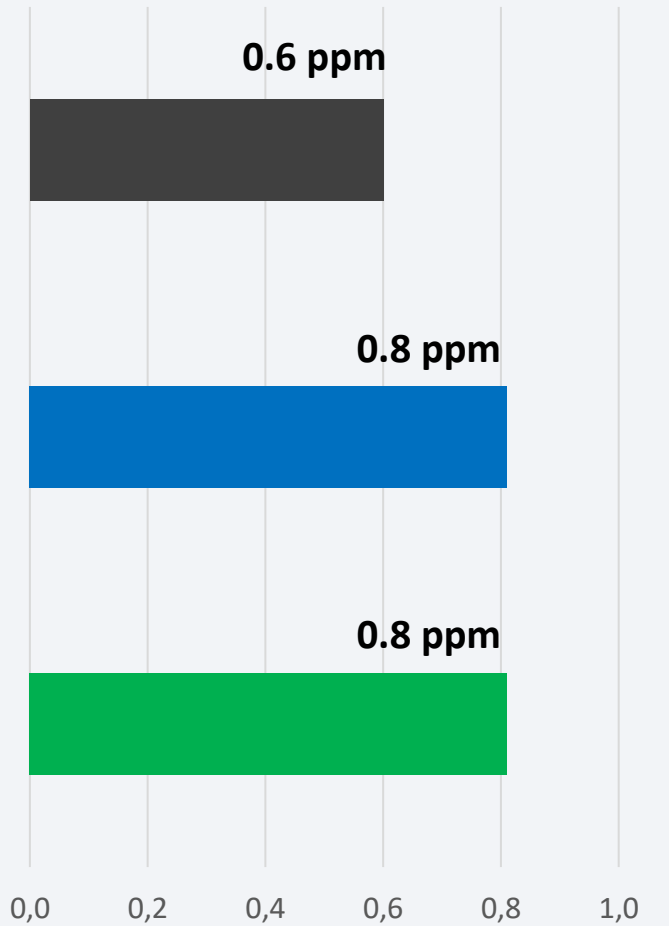


Ufficio verde



10:00 12:00 14:00 16:00      12:00 14:00 16:00      12:00 14:00 16:00      12:00 14:00 16:00      12:00 14:00 16:00

### MEDIA week 35



Week 27

# Third week

03/07/2023 - 07/07/2023



# BRAIN EFFICIENCY INDEX

03/07/2023

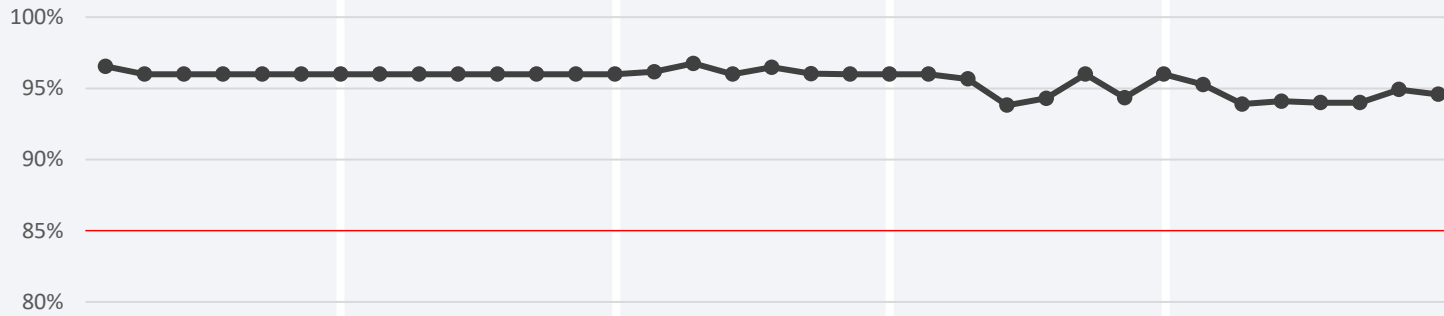
04/07/2023

05/07/2023

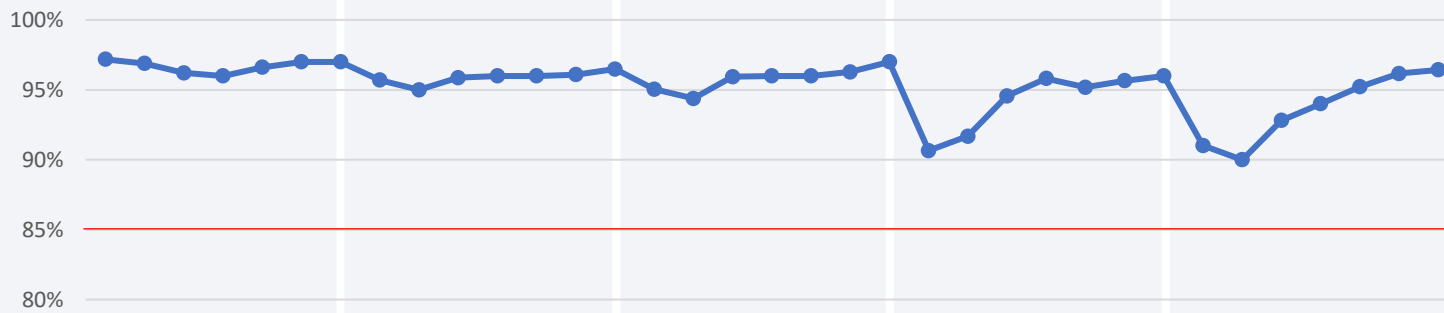
06/07/2023

07/07/2023

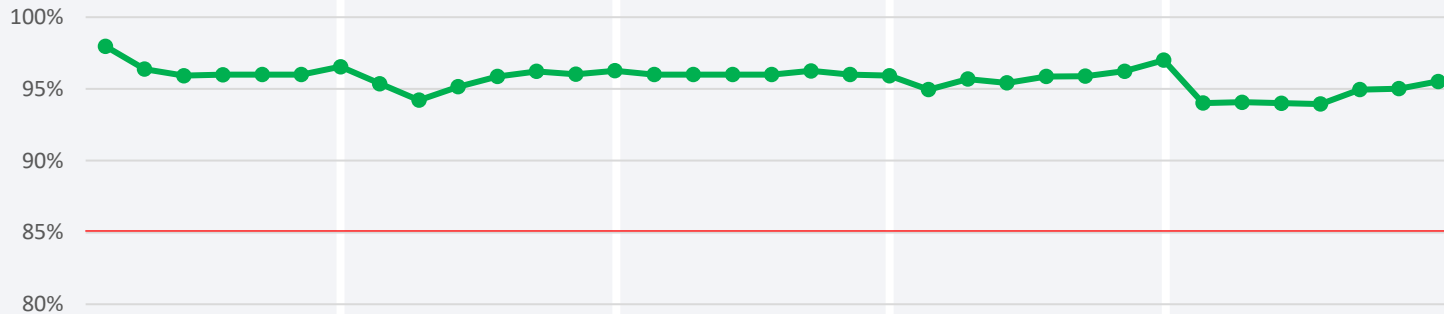
Ufficio grigio



Ufficio centro

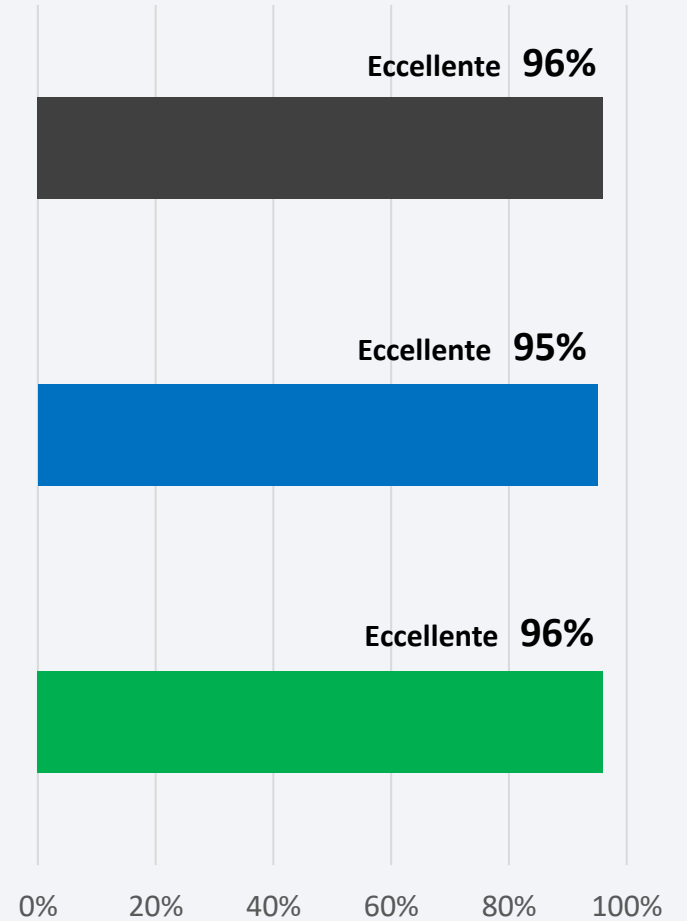


Ufficio verde



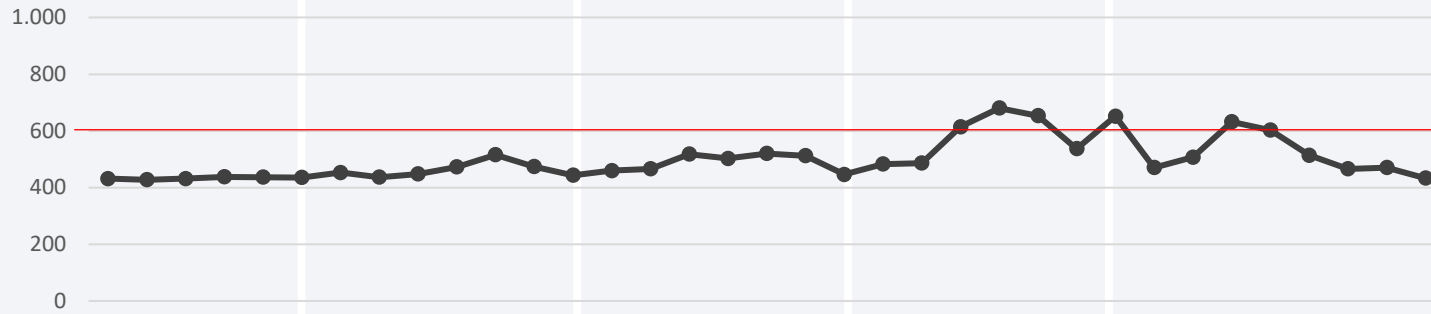
10:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00

## MEDIA week 36

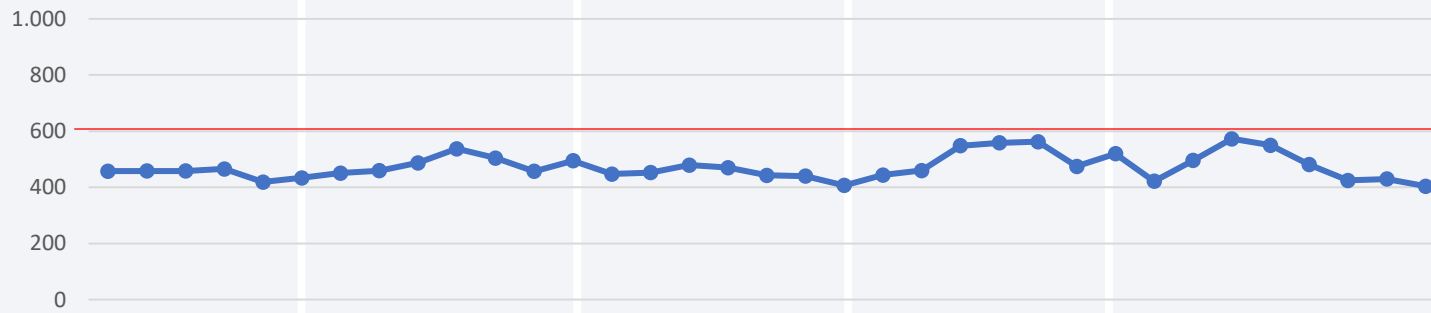


03/07/2023      04/07/2023      05/07/2023      06/07/2023      07/07/2023

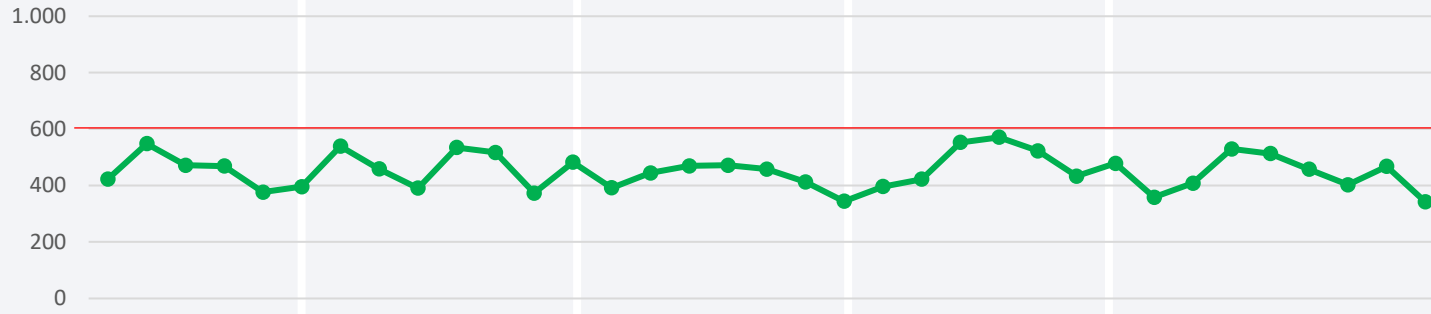
Ufficio grigio



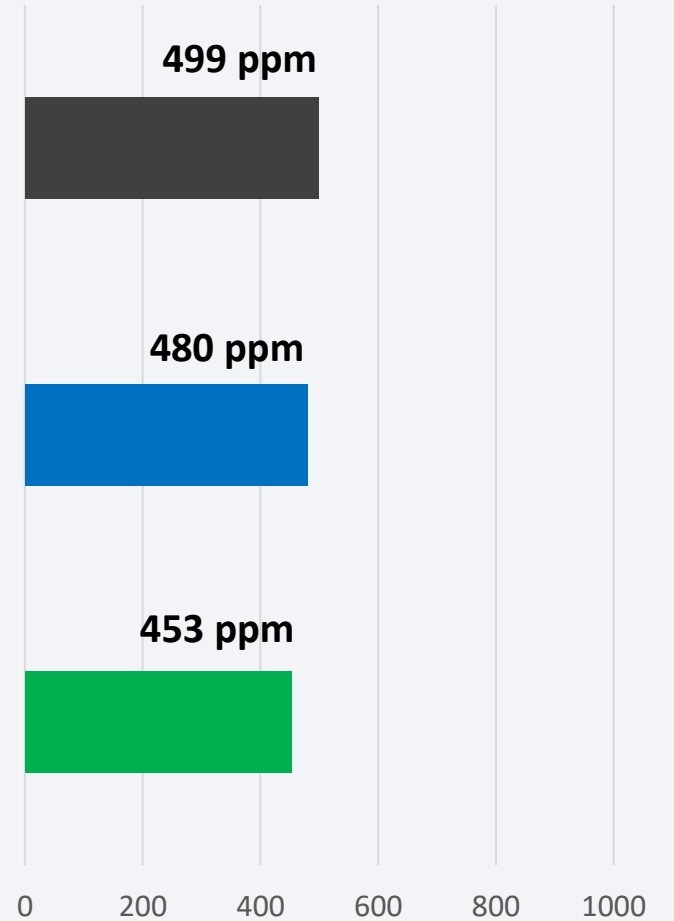
Ufficio centro



Ufficio verde



## MEDIA week 36



# BRAIN EFFICIENCY INDEX

Rumore (dB)



03/07/2023

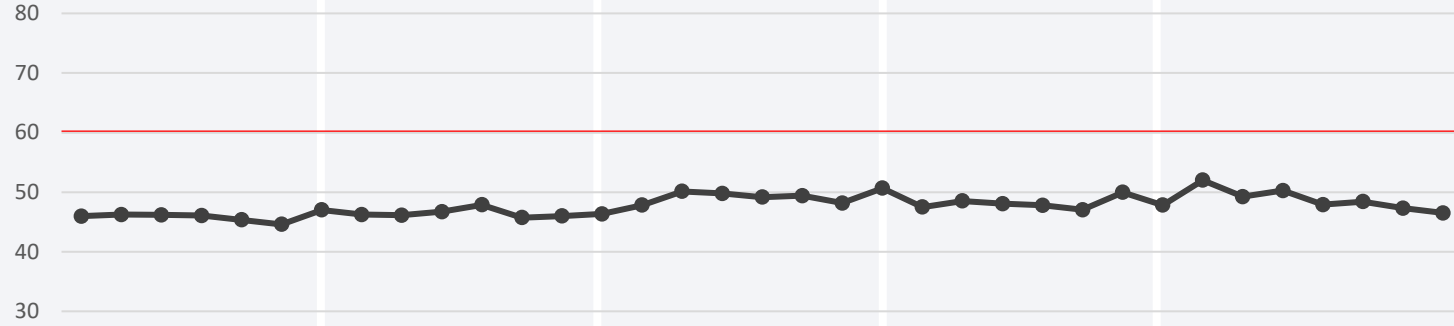
04/07/2023

05/07/2023

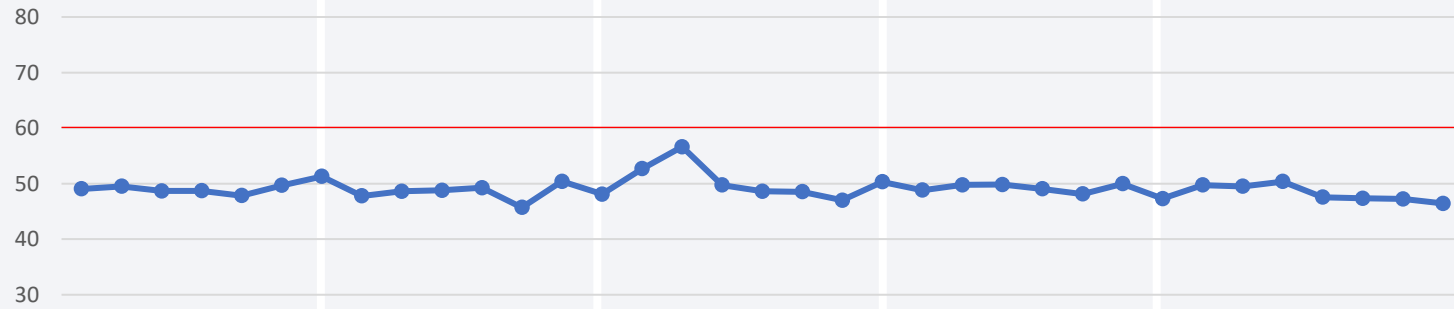
06/07/2023

07/07/2023

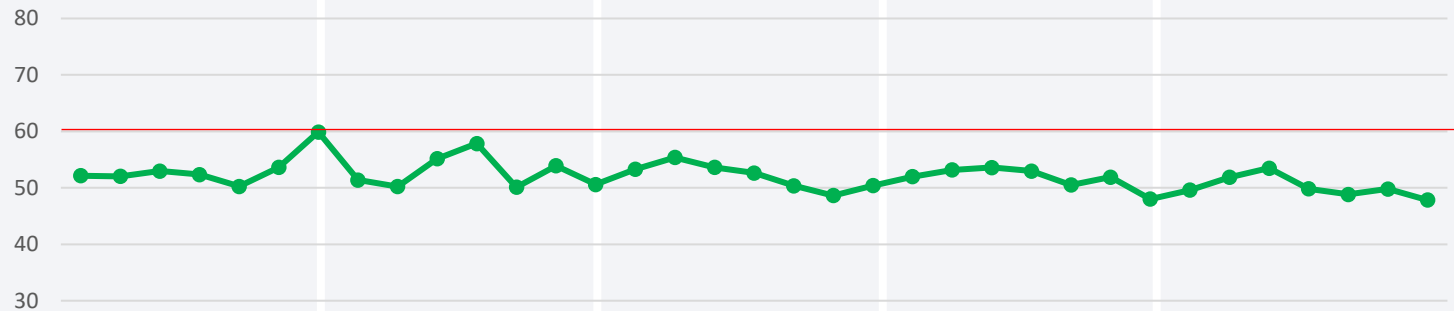
Ufficio grigio



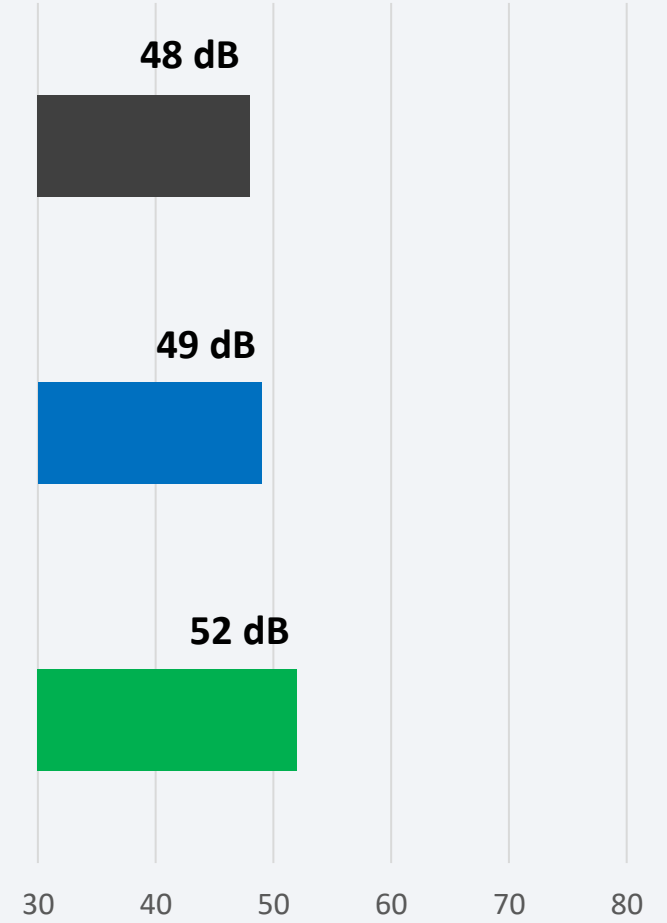
Ufficio centro



Ufficio verde



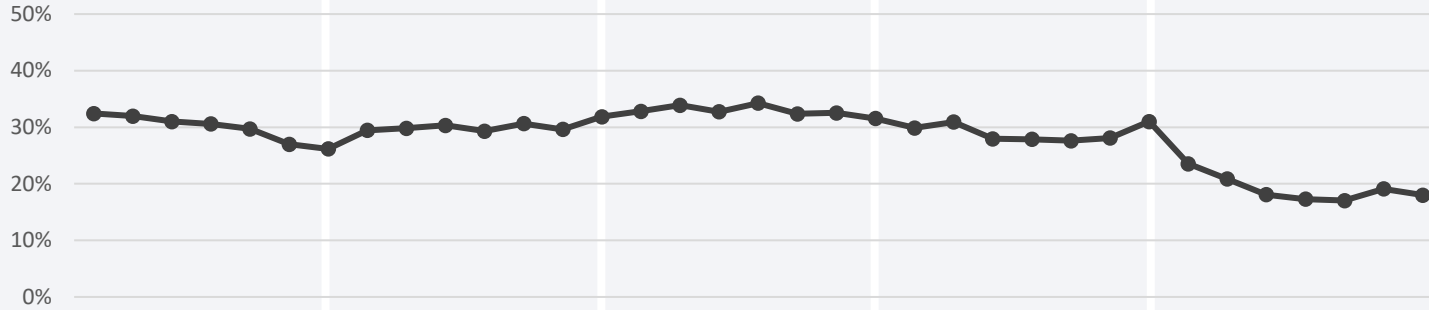
**MEDIA** week 36



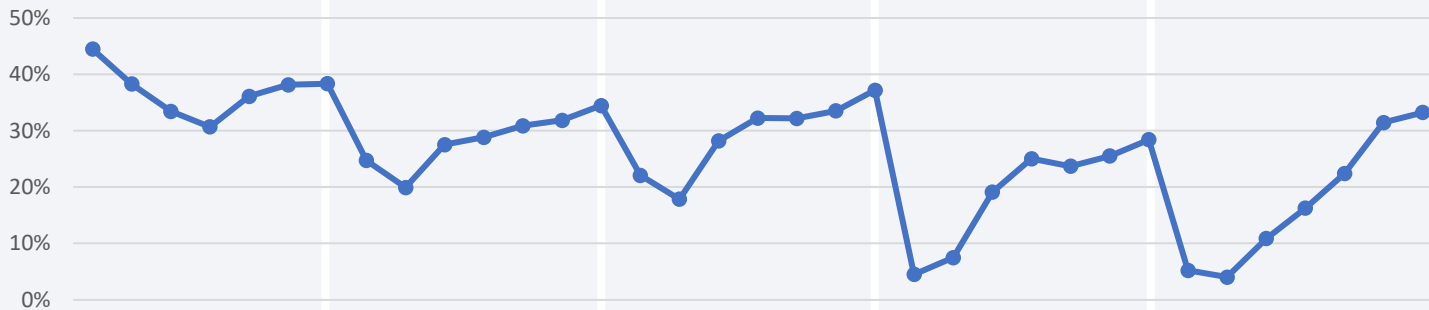
# AMBIENCE COMFORT INDEX

03/07/2023      04/07/2023      05/07/2023      06/07/2023      07/07/2023

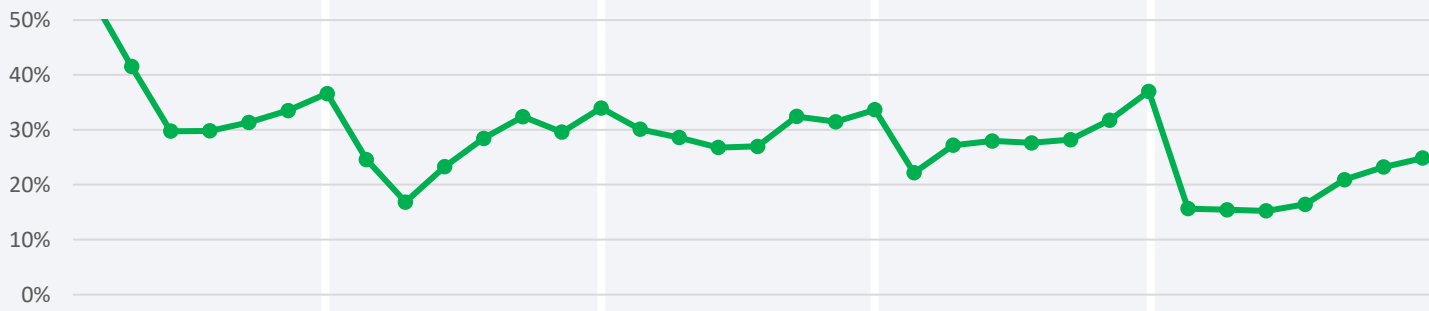
Ufficio grigio



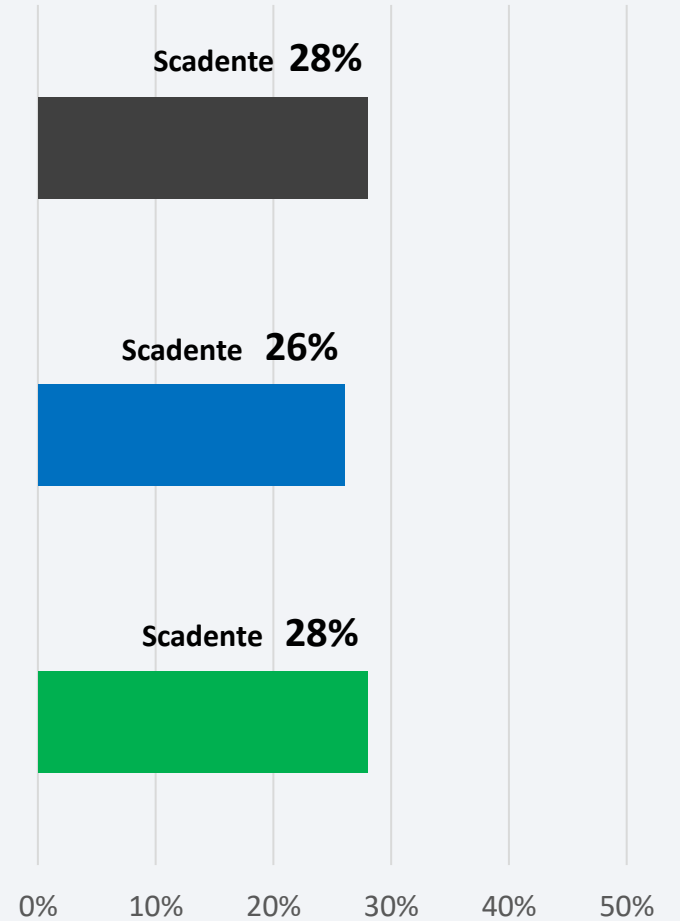
Ufficio centro



Ufficio verde



## MEDIA week 36



# AMBIENCE COMFORT INDEX

Temperatura (°C)



03/07/2023

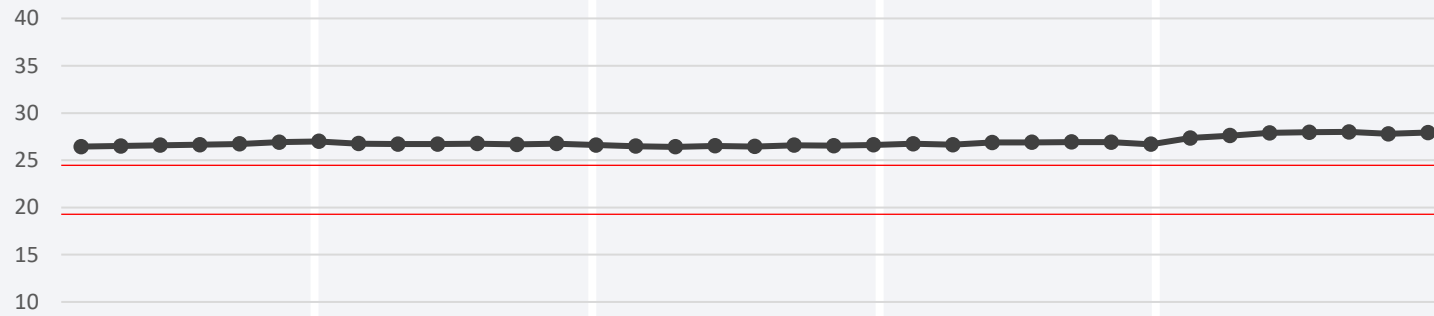
04/07/2023

05/07/2023

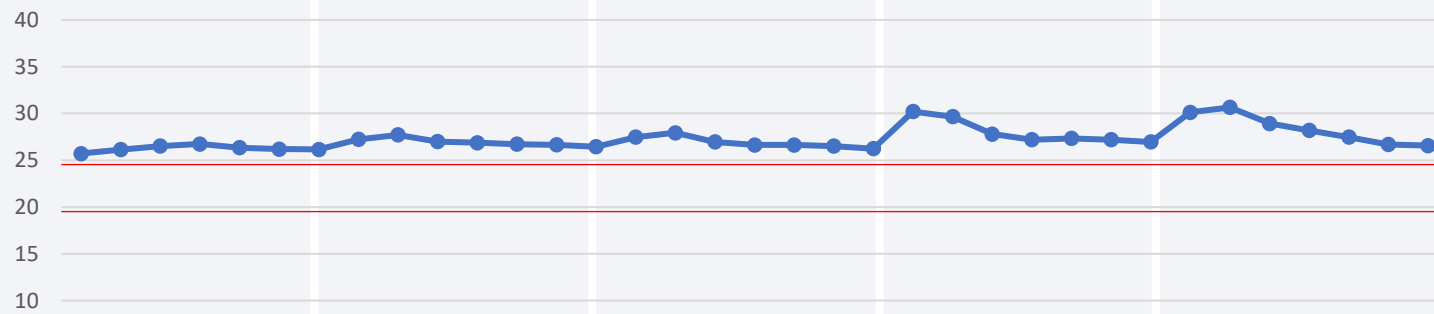
06/07/2023

07/07/2023

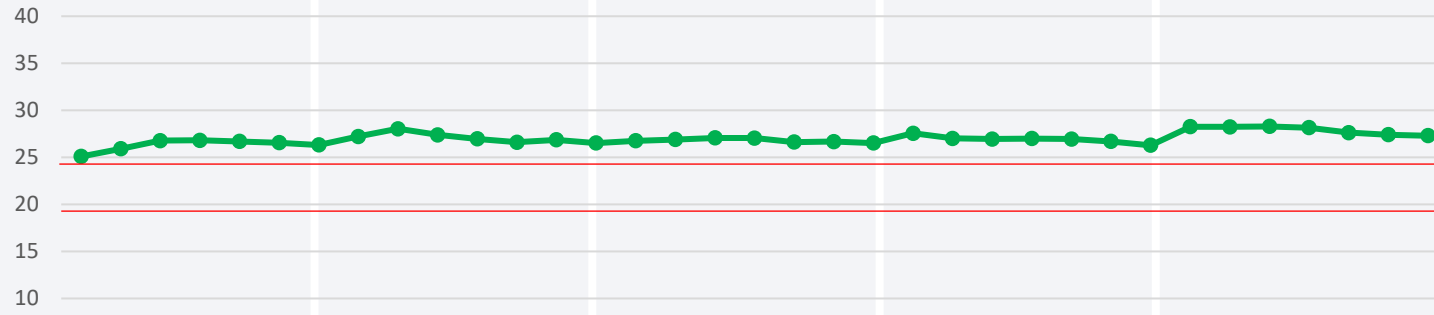
Ufficio grigio



Ufficio centro

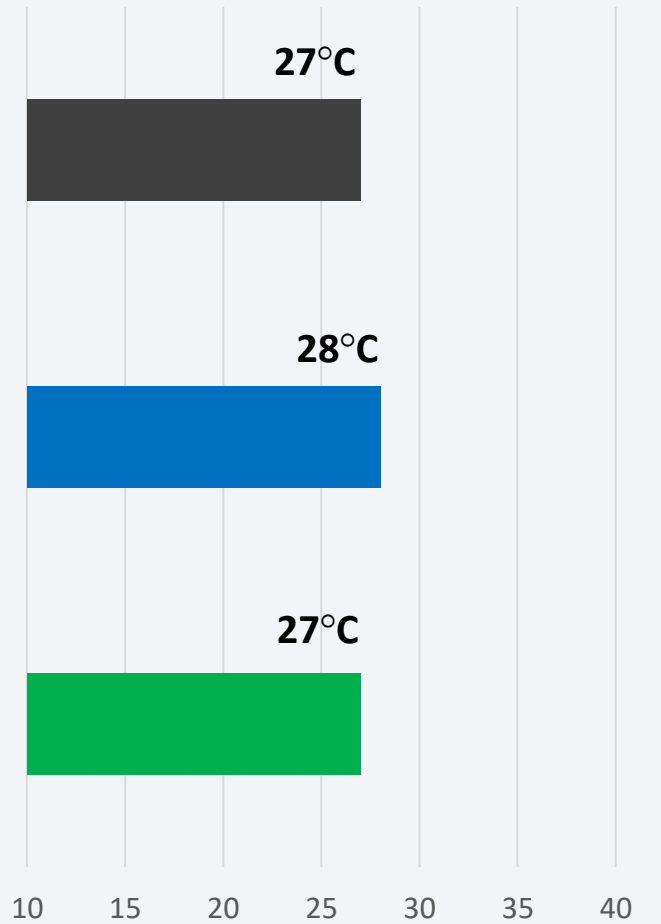


Ufficio verde



10:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00

**MEDIA** week 36



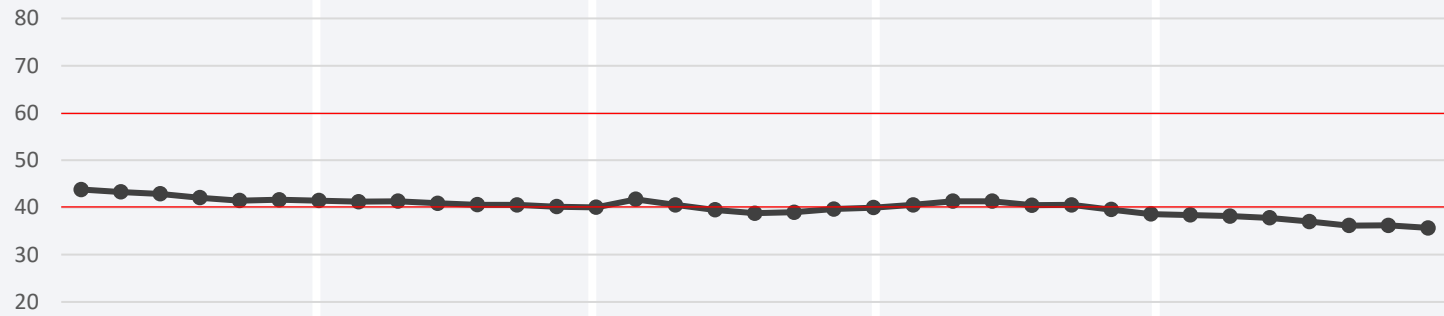
# AMBIENCE COMFORT INDEX

Umidità (%)

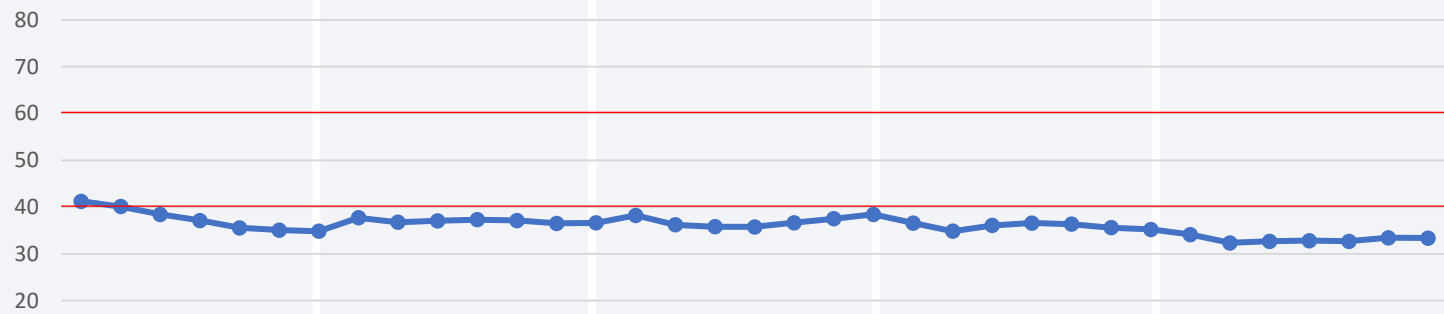


03/07/2023      04/07/2023      05/07/2023      06/07/2023      07/07/2023

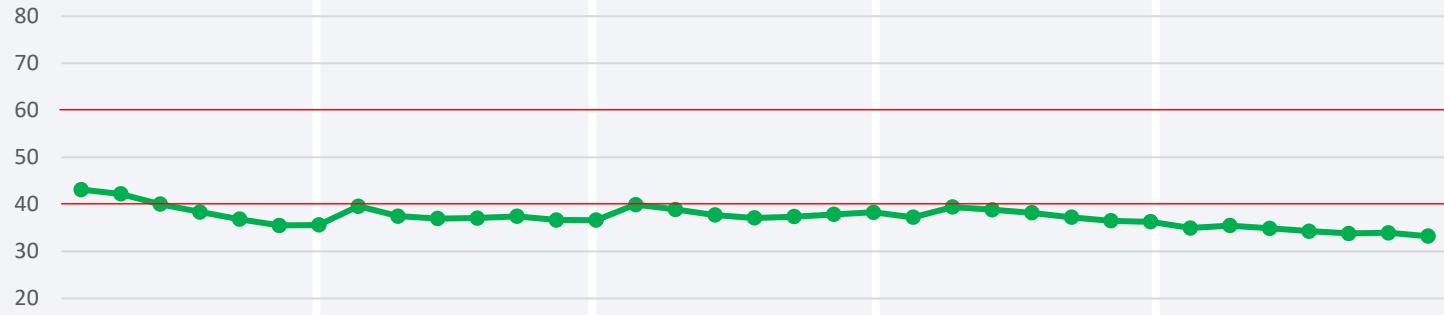
Ufficio grigio



Ufficio centro

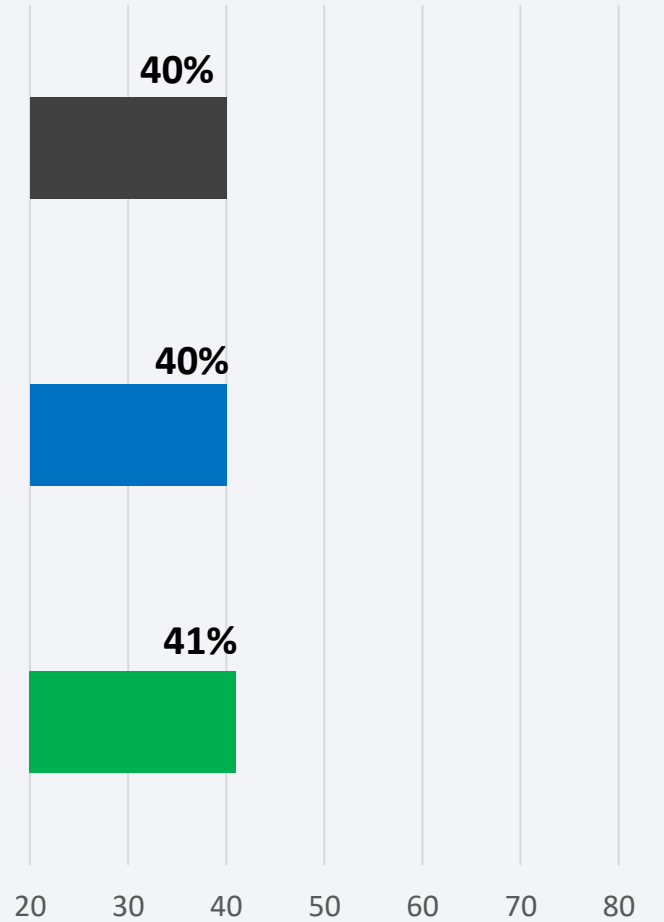


Ufficio verde



10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

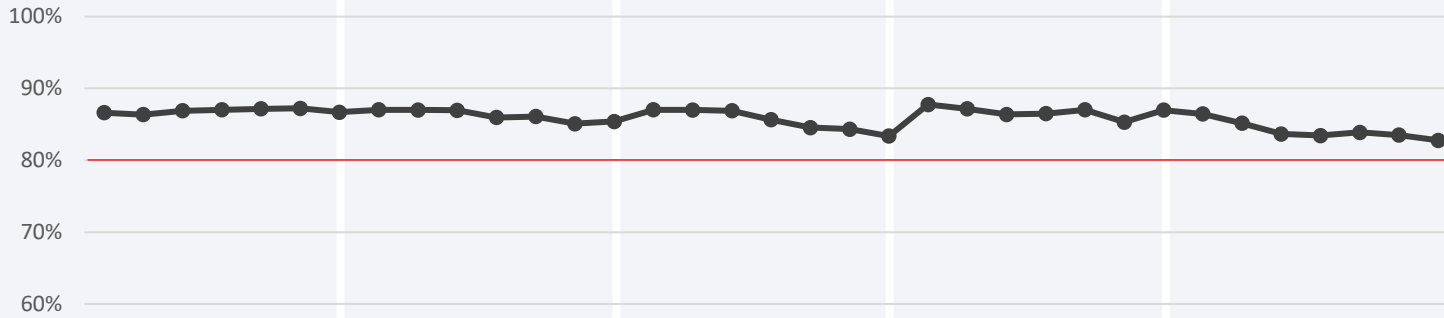
**MEDIA** week 36



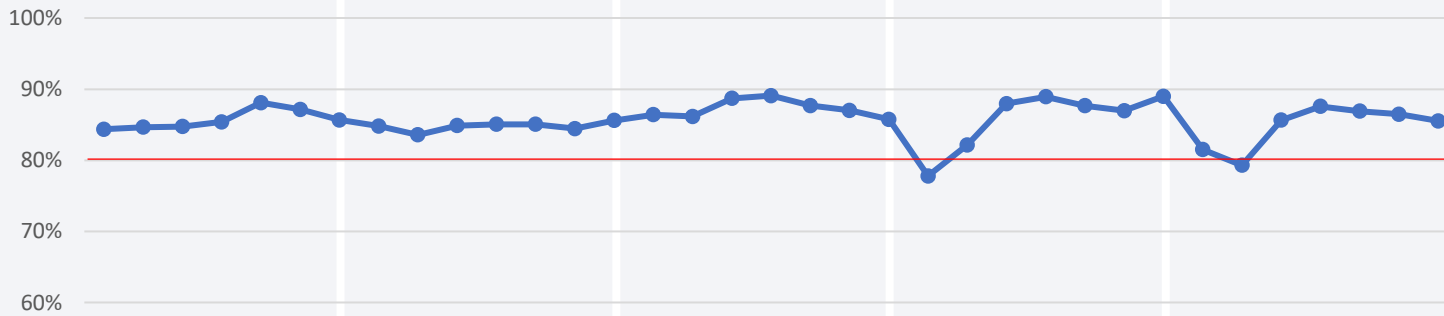
# AIR QUALITY INDEX

03/07/2023      04/07/2023      05/07/2023      06/07/2023      07/07/2023

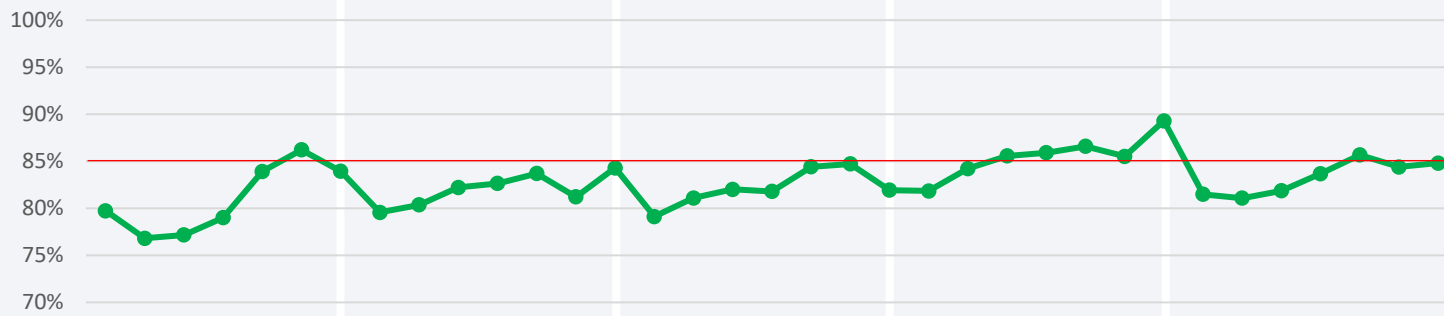
Ufficio grigio



Ufficio centro

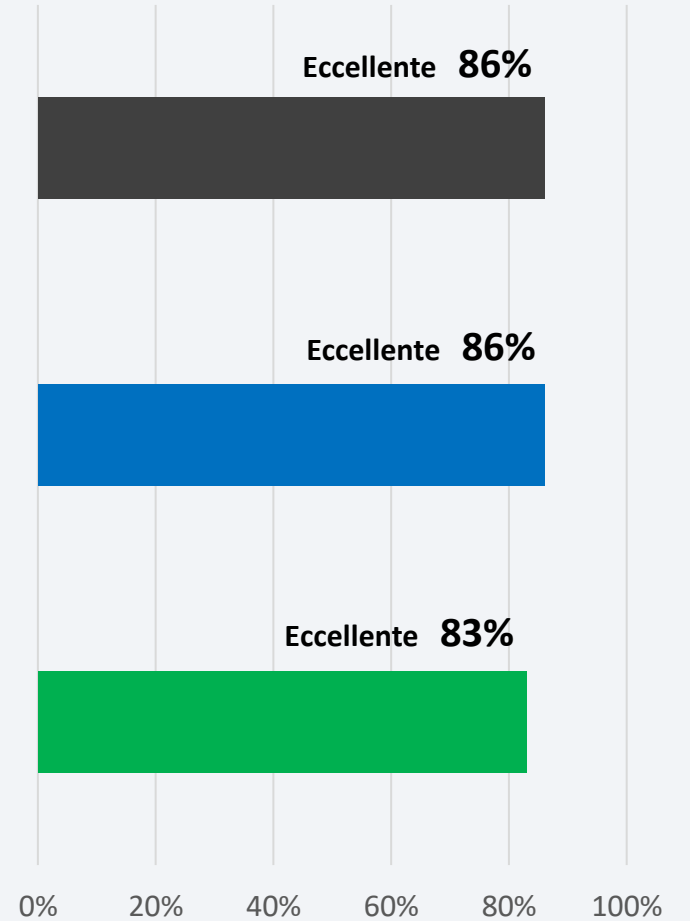


Ufficio verde



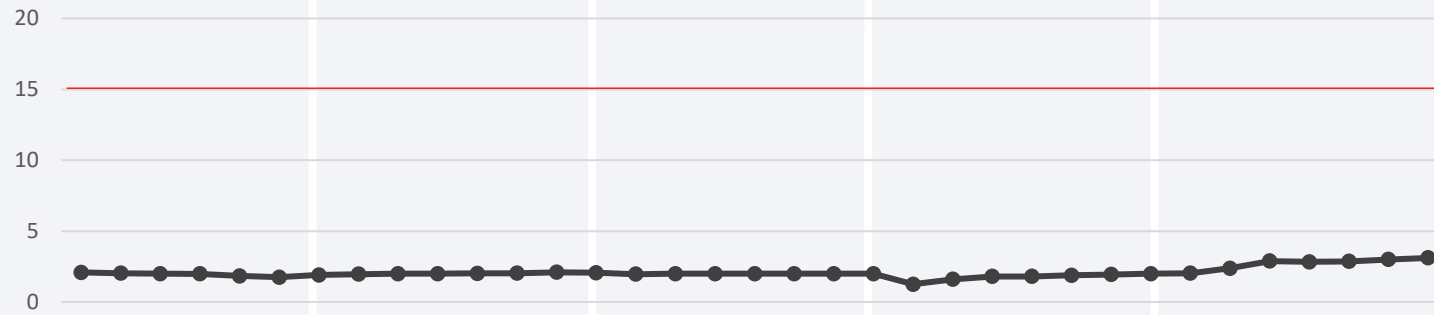
10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

## MEDIA week 36

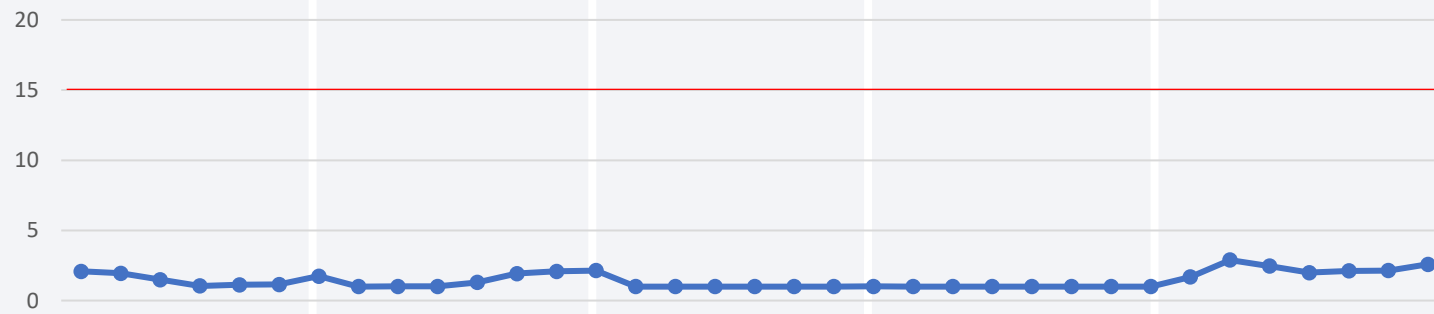


03/07/2023      04/07/2023      05/07/2023      06/07/2023      07/07/2023

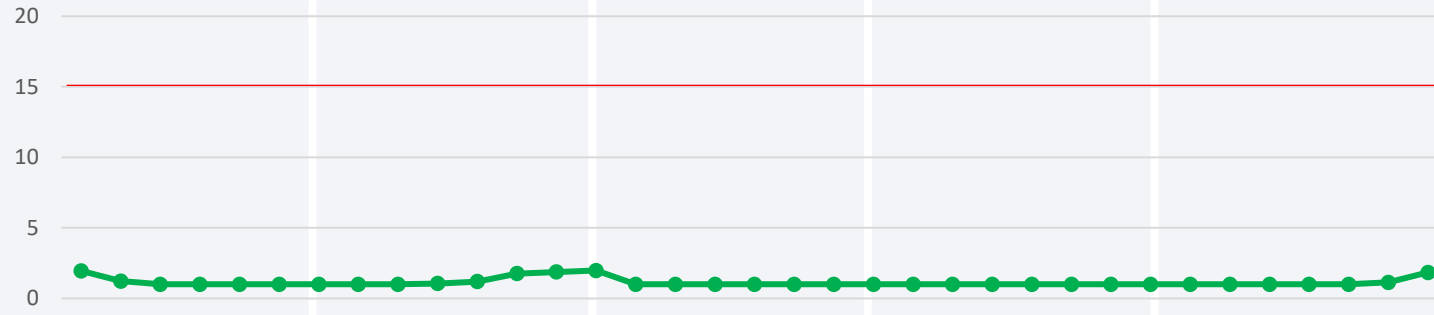
Ufficio grigio



Ufficio centro



Ufficio verde



10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

### MEDIA week 36





03/07/2023

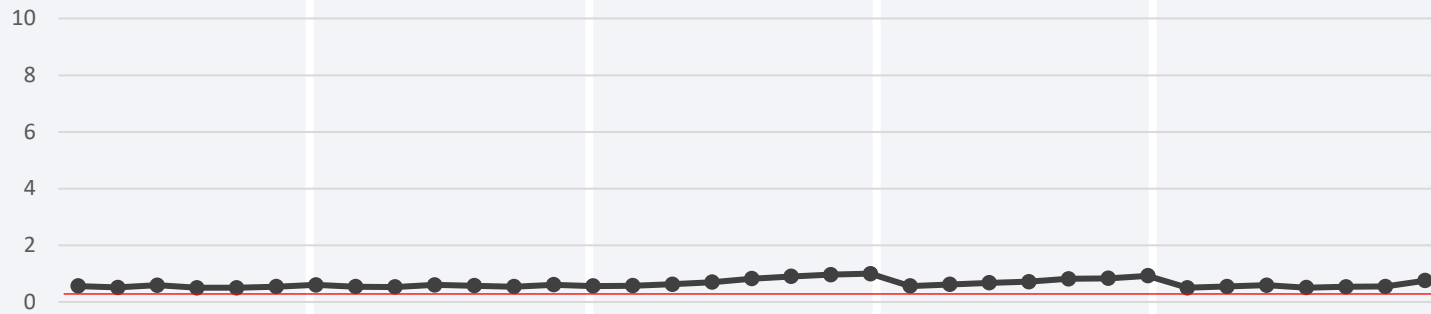
04/07/2023

05/07/2023

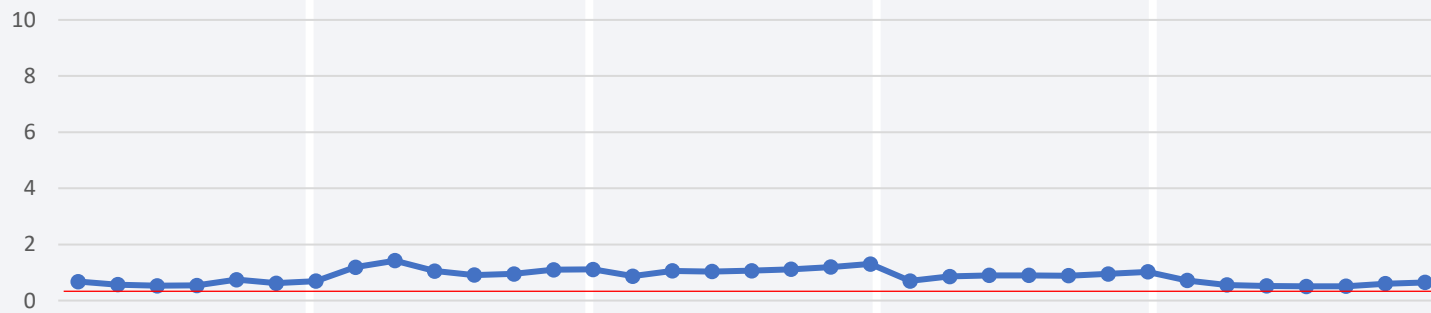
06/07/2023

07/07/2023

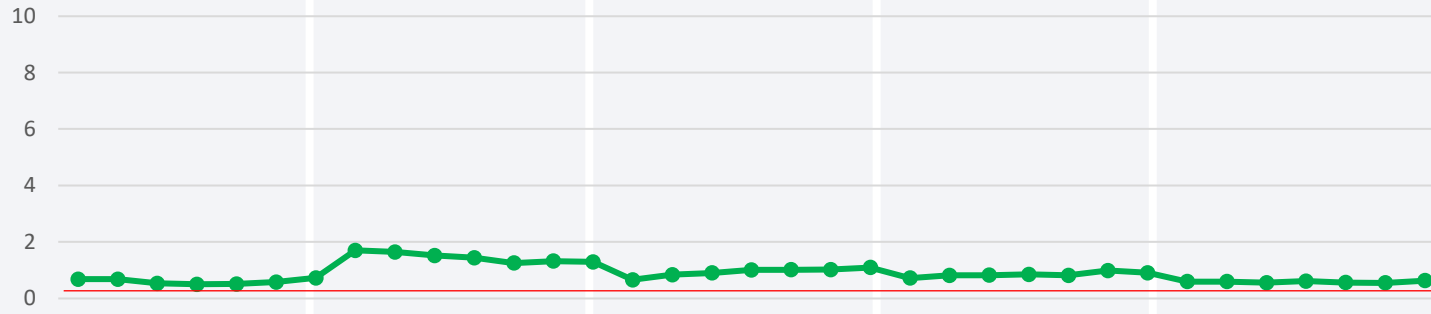
Ufficio  
grigio



Ufficio  
centro

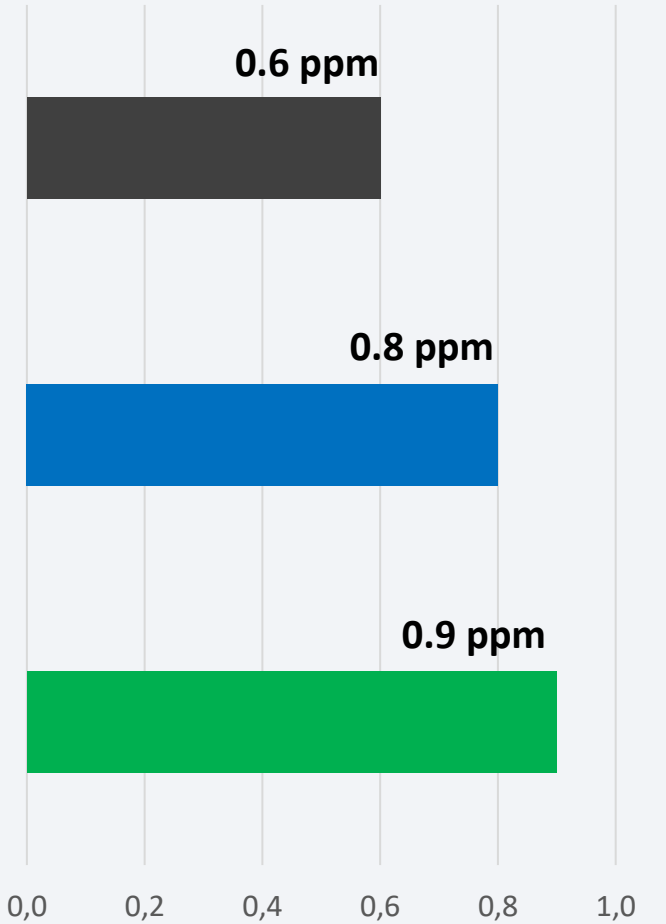


Ufficio  
verde



10:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00

### MEDIA week 36



Week 28

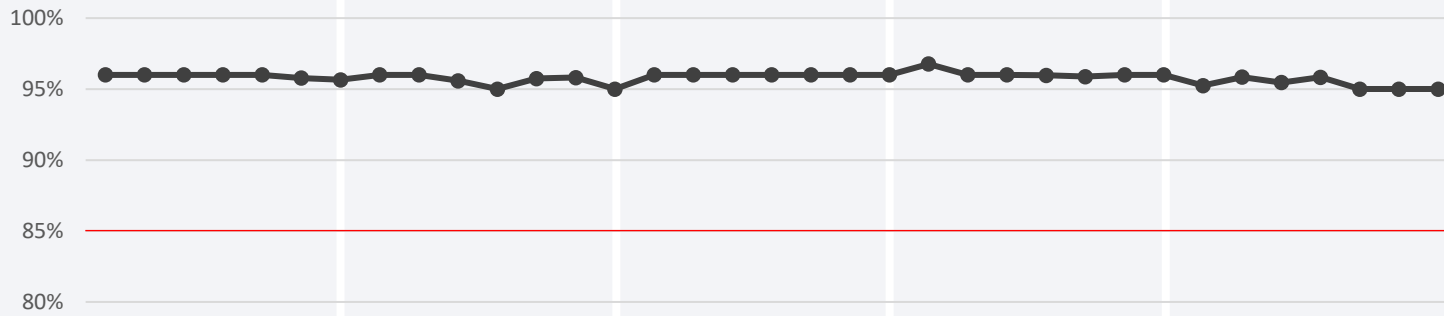
# Fourth week

10/07/2023 - 14/07/2023

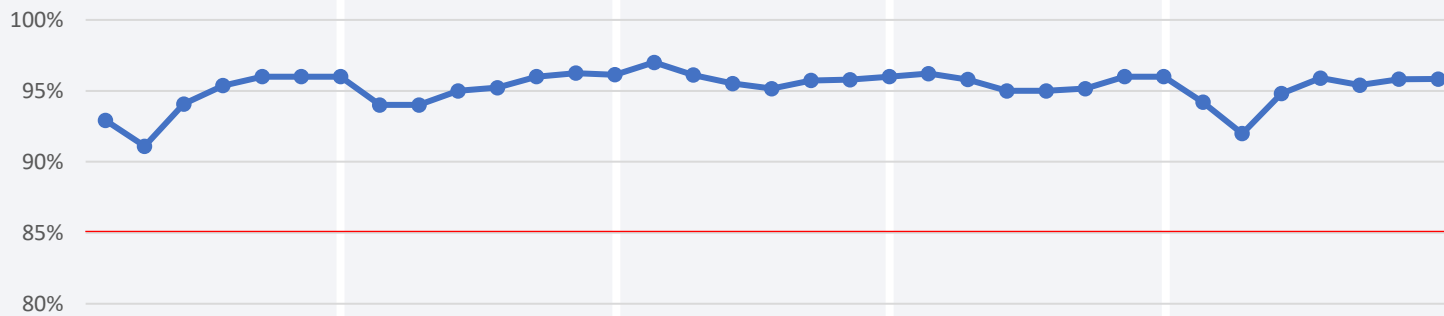
# BRAIN EFFICIENCY INDEX

10/07/2023      11/07/2023      12/07/2023      13/07/2023      14/07/2023

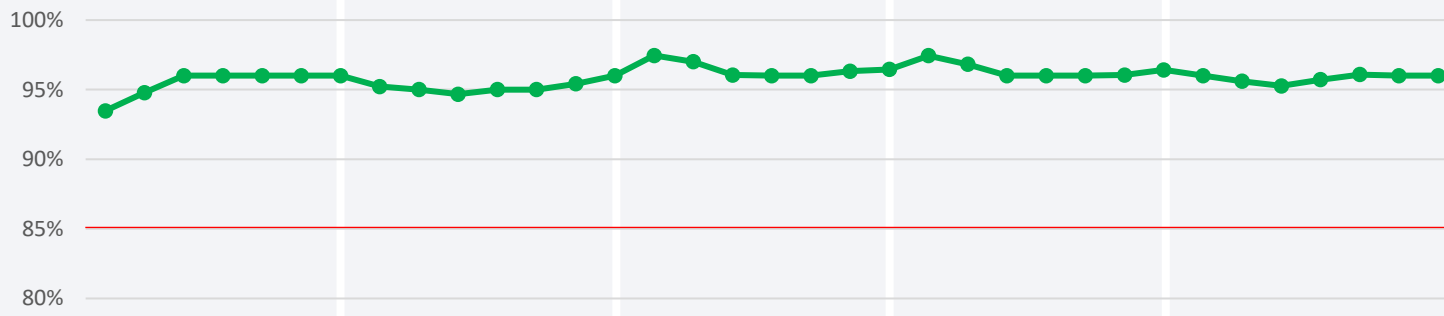
Ufficio grigio



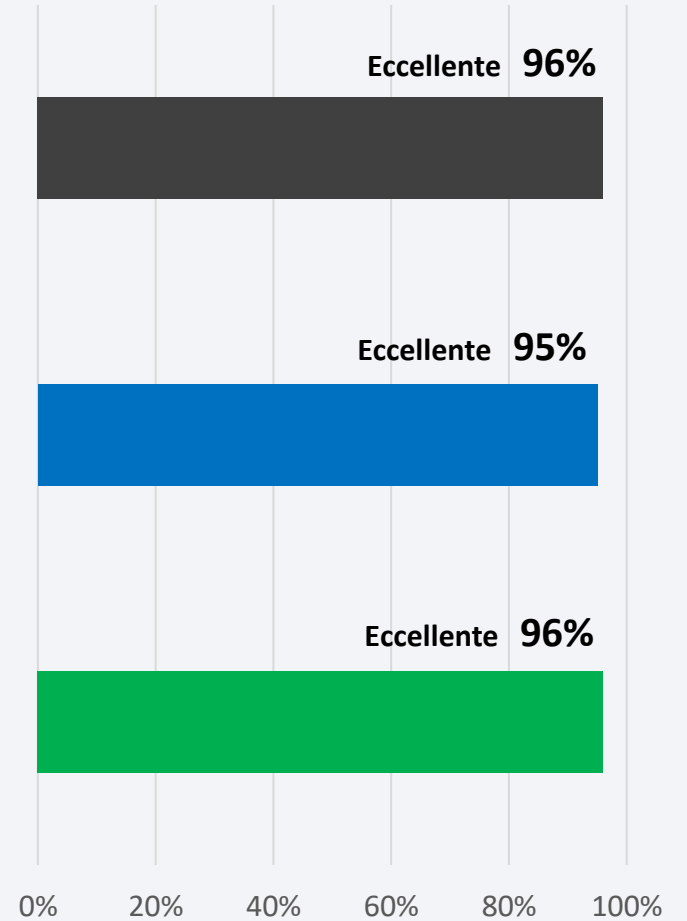
Ufficio centro



Ufficio verde



## MEDIA week 37



10/07/2023

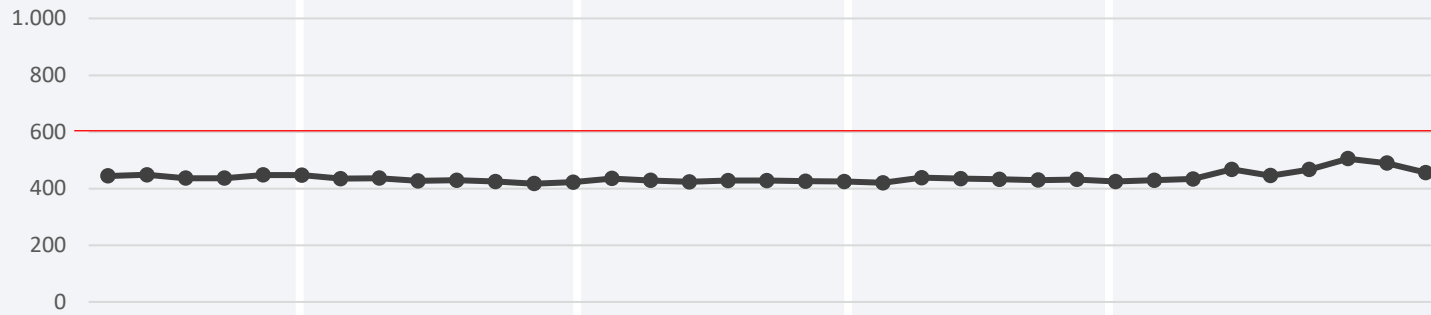
11/07/2023

12/07/2023

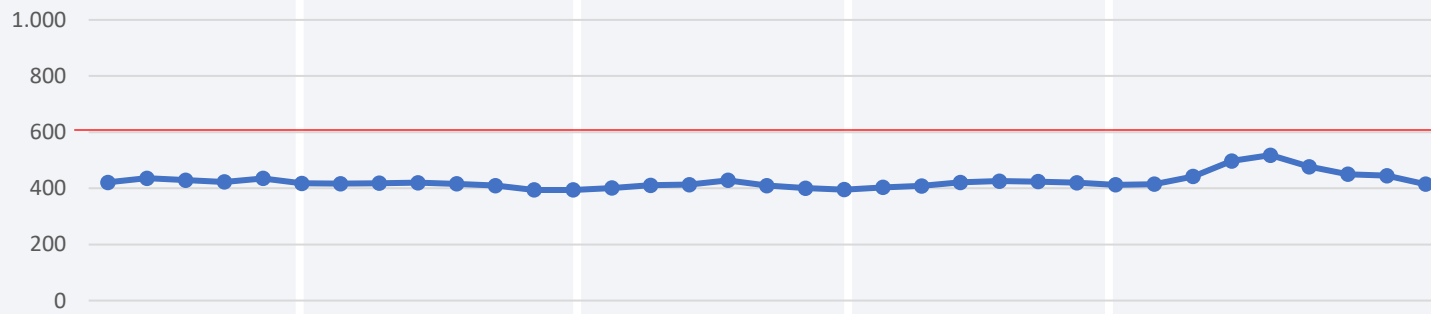
13/07/2023

14/07/2023

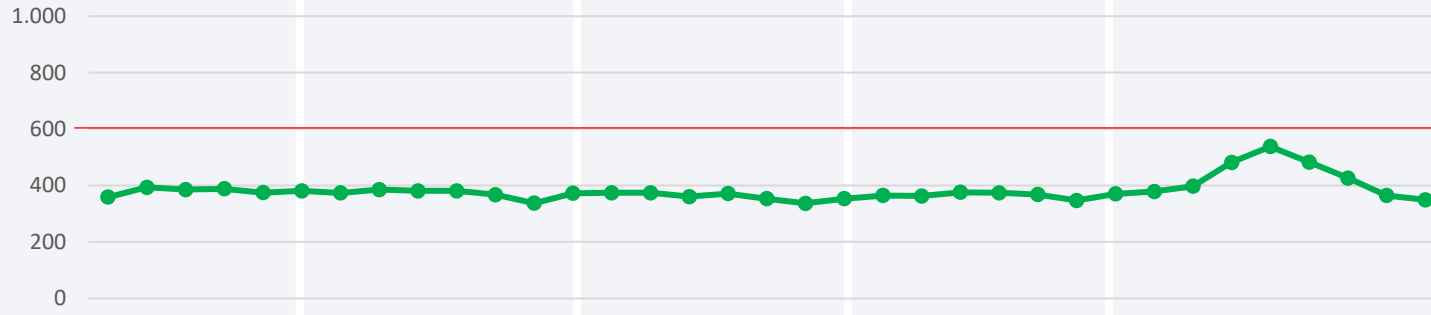
Ufficio grigio



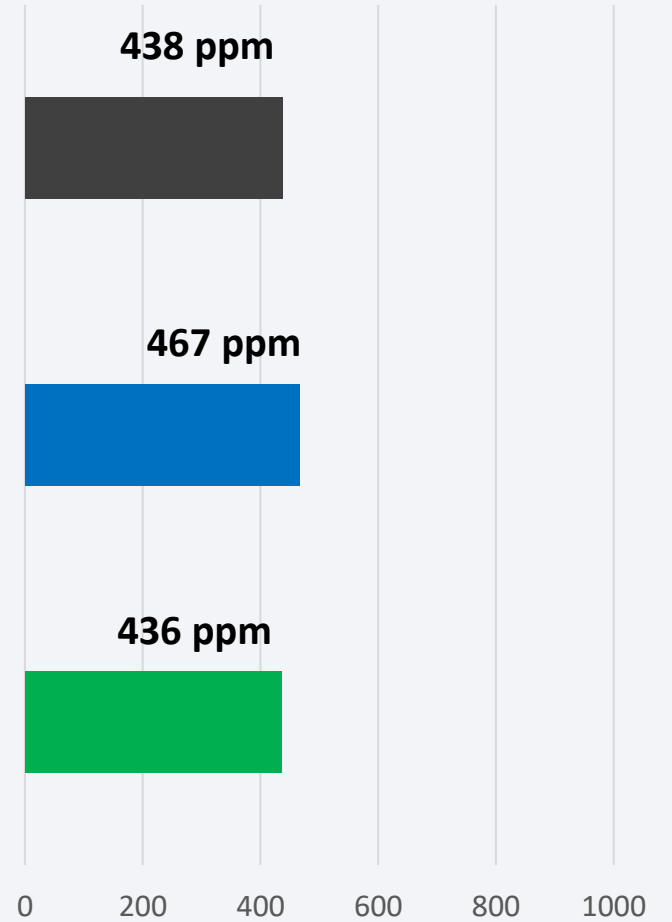
Ufficio centro



Ufficio verde



## MEDIA week 37



# BRAIN EFFICIENCY INDEX

Rumore (dB)



10/07/2023

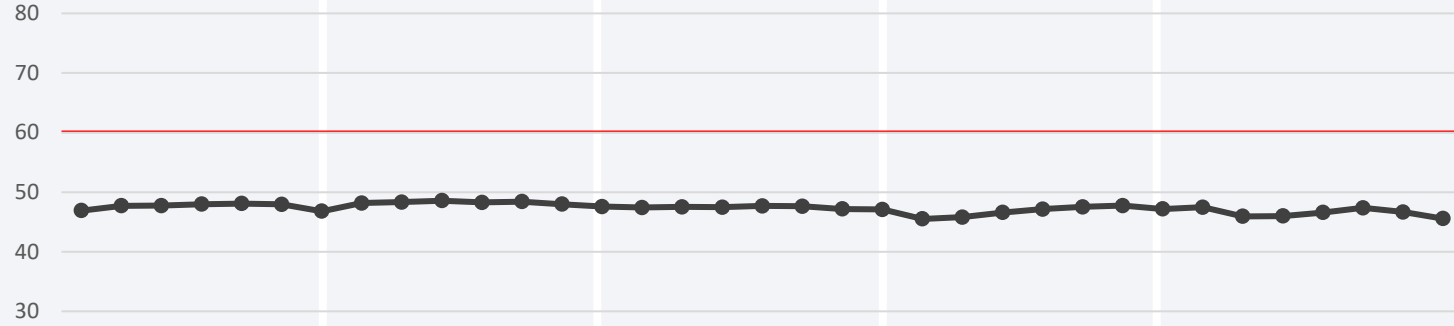
11/07/2023

12/07/2023

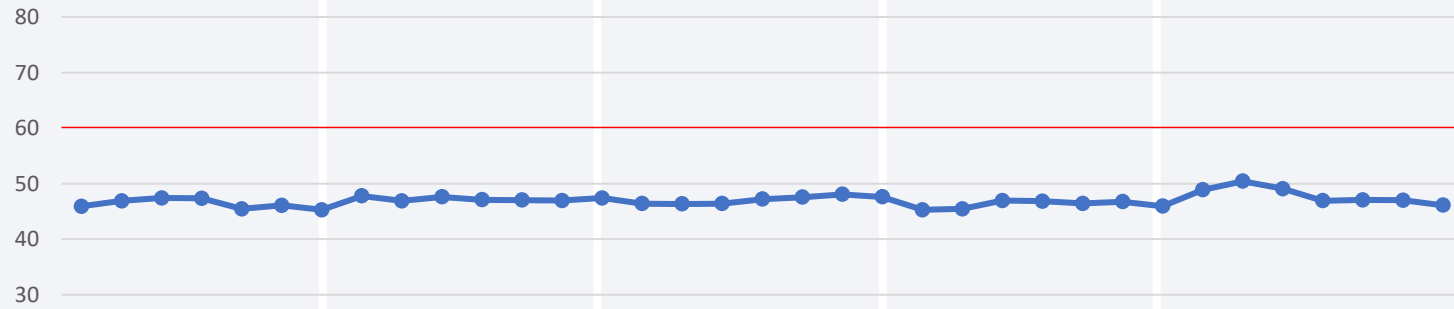
13/07/2023

14/07/2023

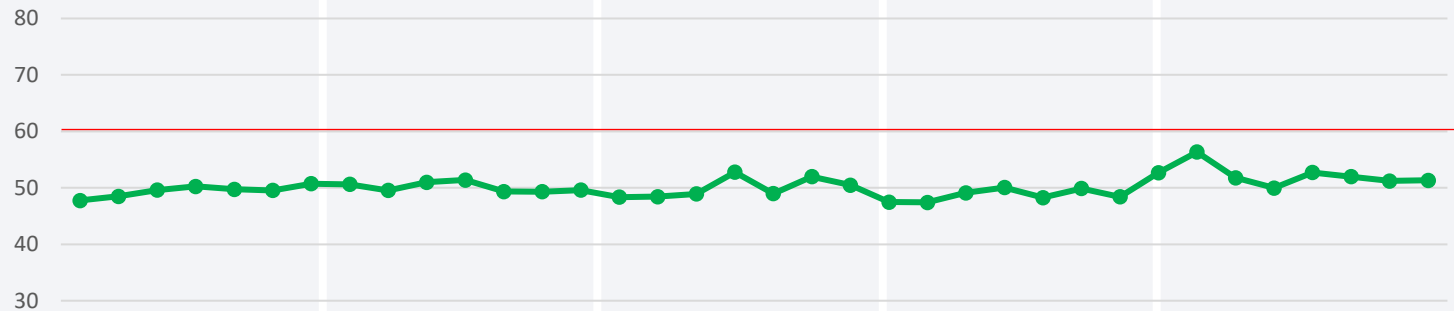
Ufficio grigio



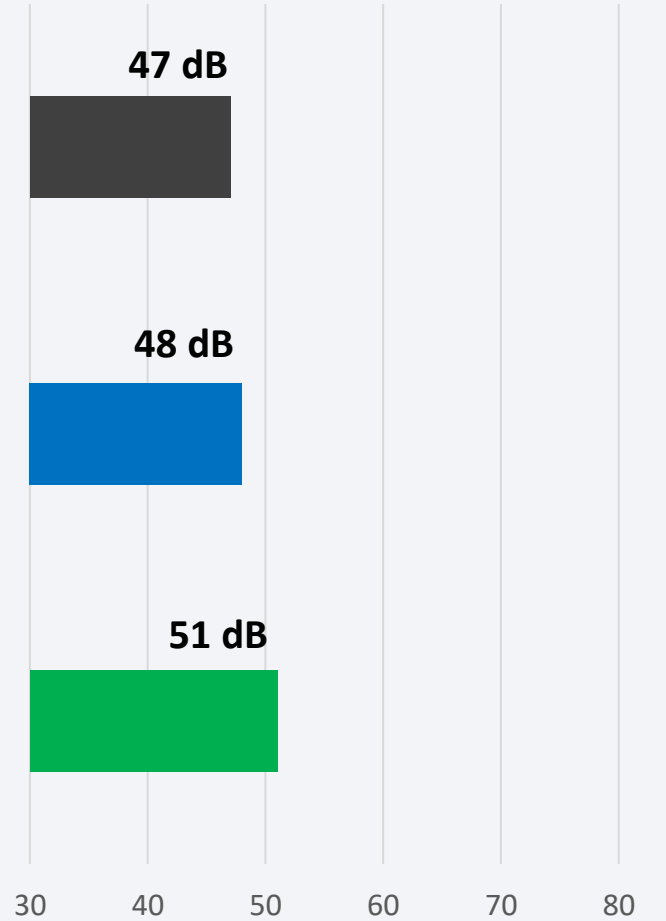
Ufficio centro



Ufficio verde



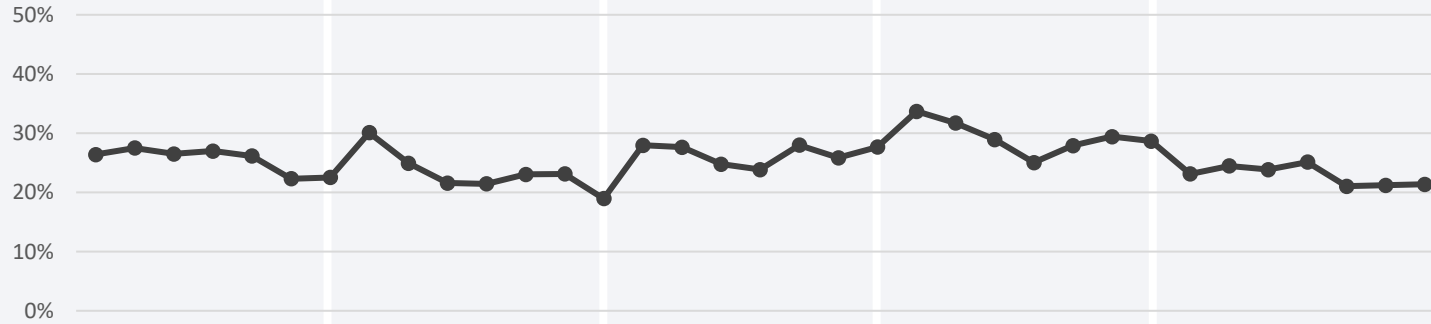
**MEDIA** week 37



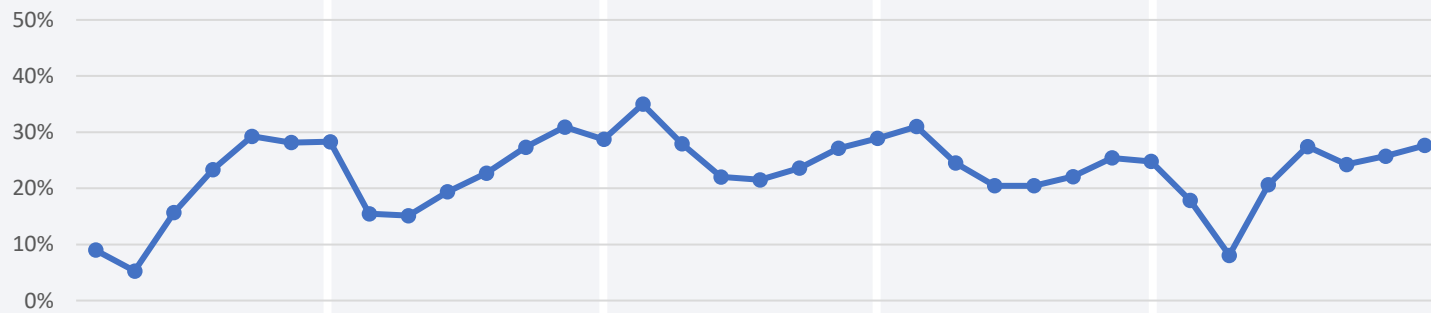
# AMBIENCE COMFORT INDEX

10/07/2023      11/07/2023      12/07/2023      13/07/2023      14/07/2023

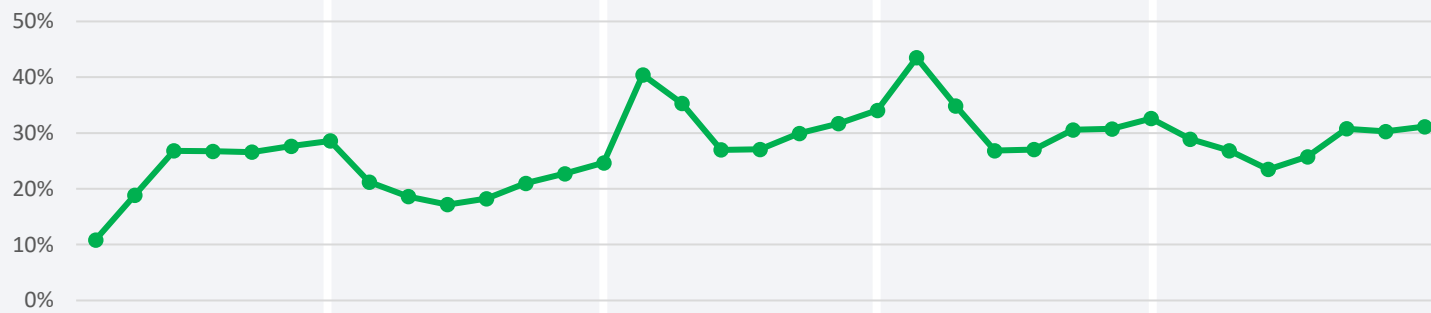
Ufficio grigio



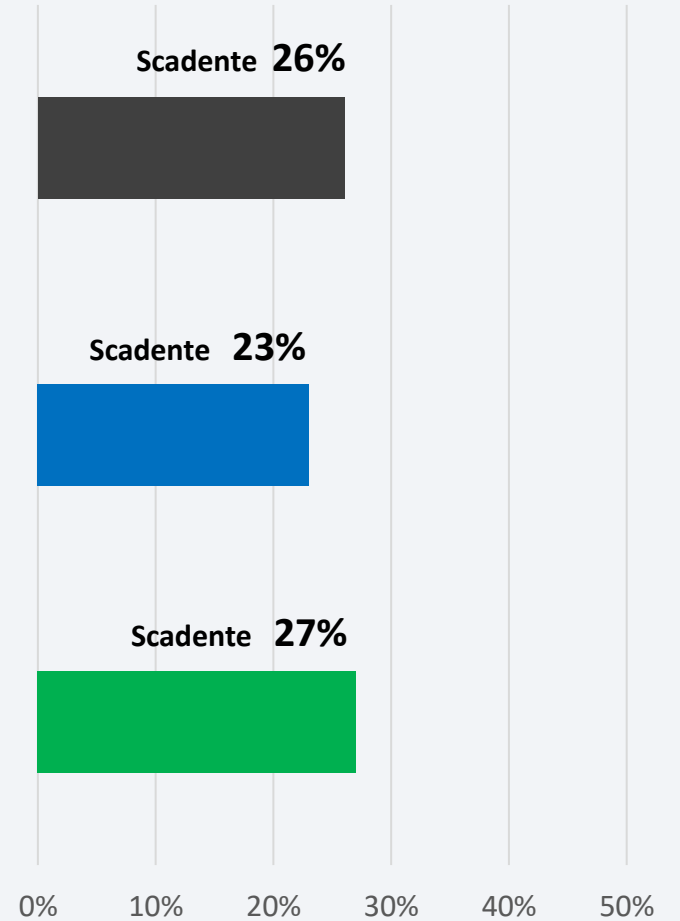
Ufficio centro



Ufficio verde



## MEDIA week 37



# AMBIENCE COMFORT INDEX

Temperatura (°C)



10/07/2023

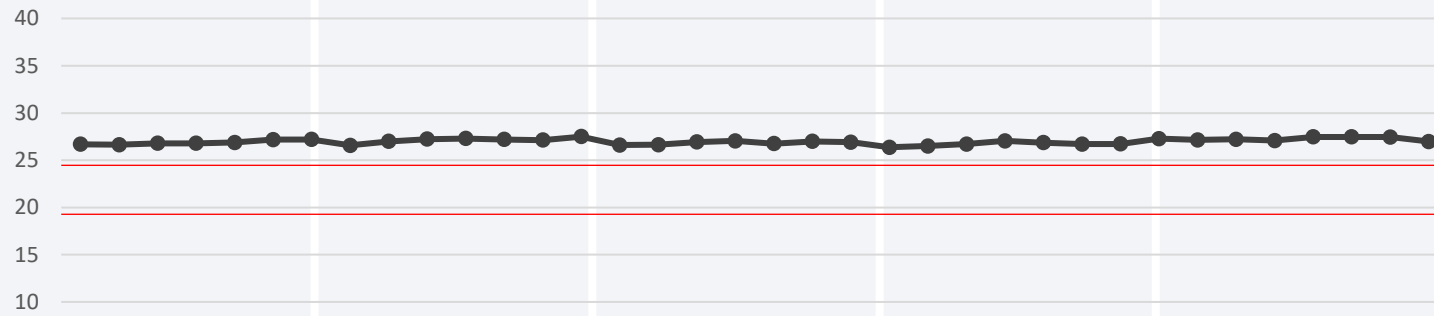
11/07/2023

12/07/2023

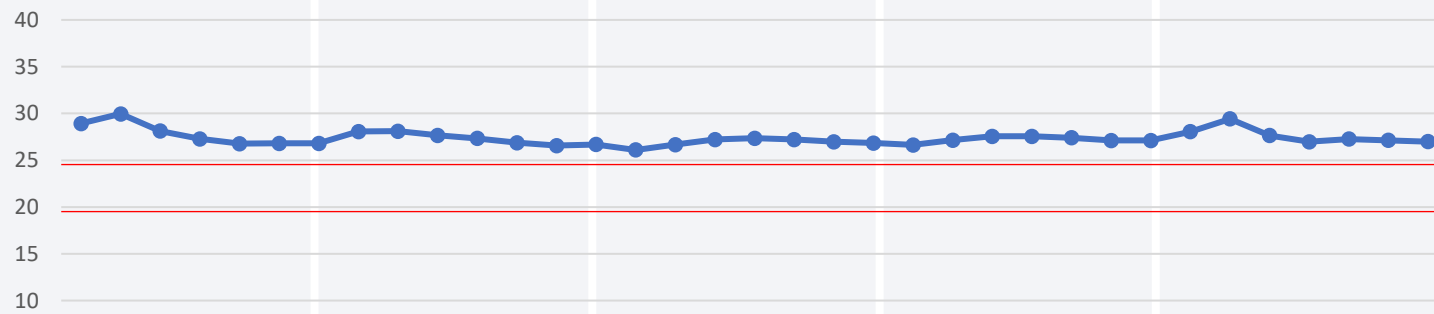
13/07/2023

14/07/2023

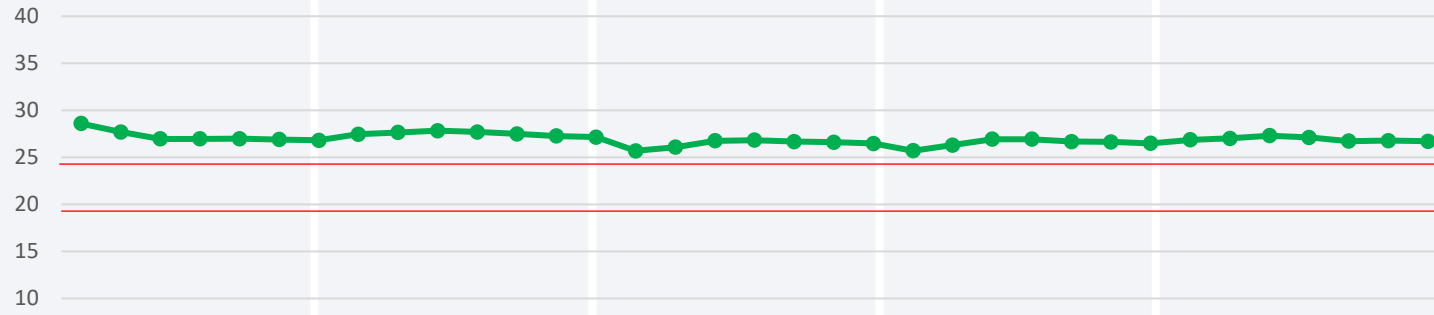
Ufficio grigio



Ufficio centro

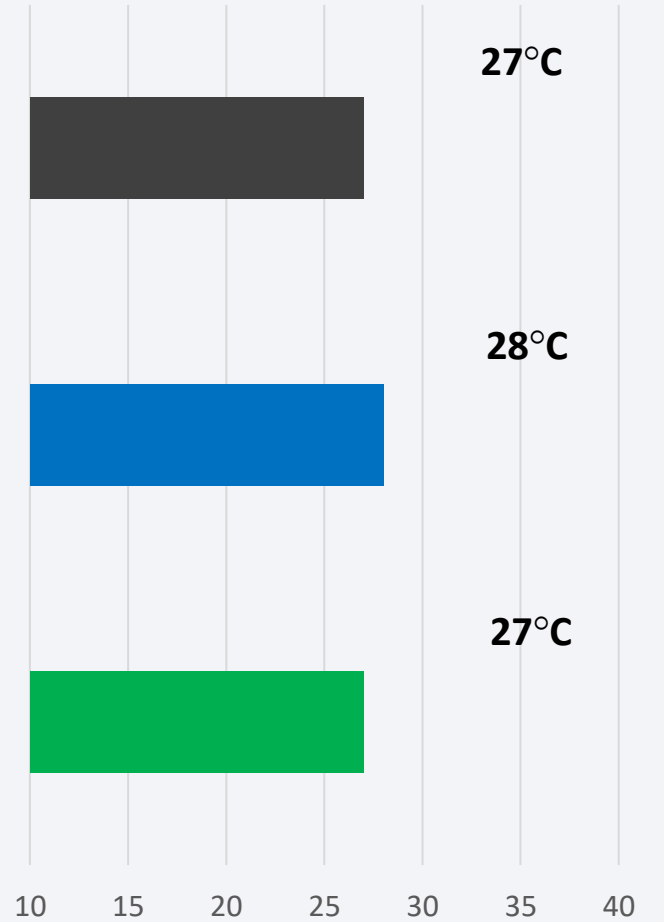


Ufficio verde



10:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00

**MEDIA** week 37



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# AIR QUALITY INDEX

10/07/2023

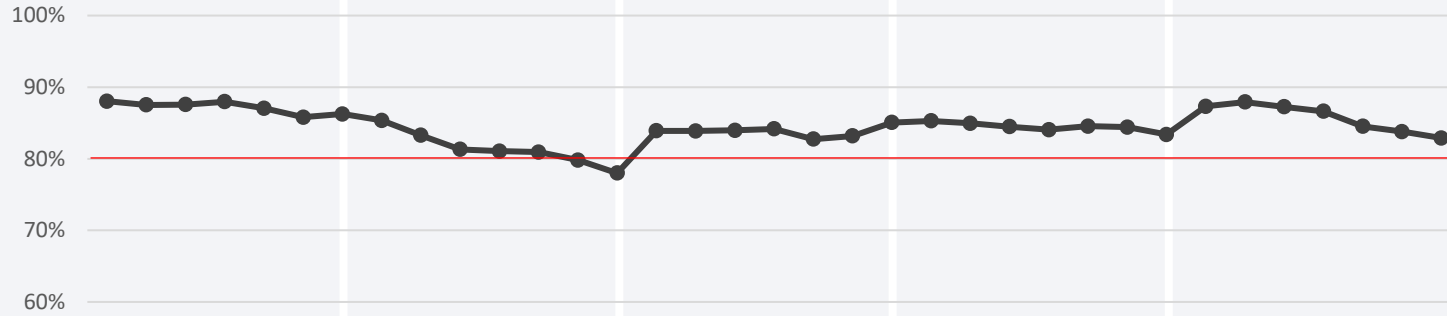
11/07/2023

12/07/2023

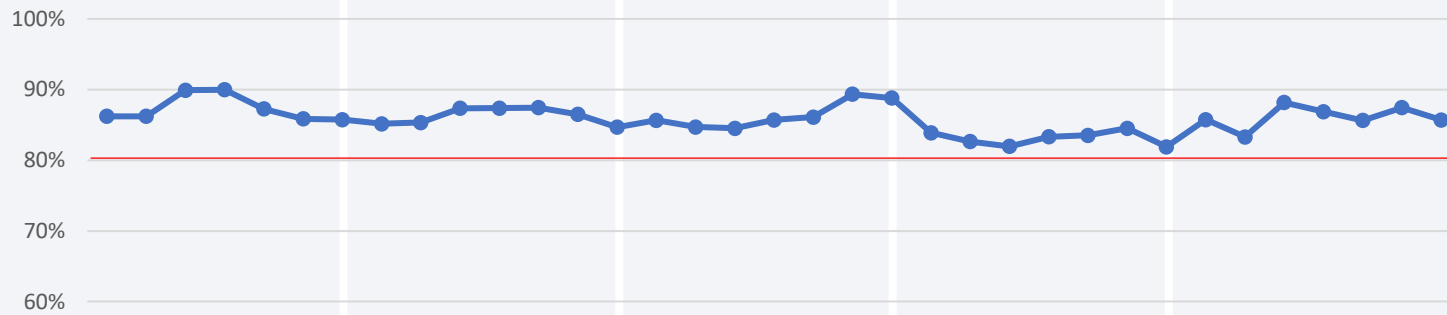
13/07/2023

14/07/2023

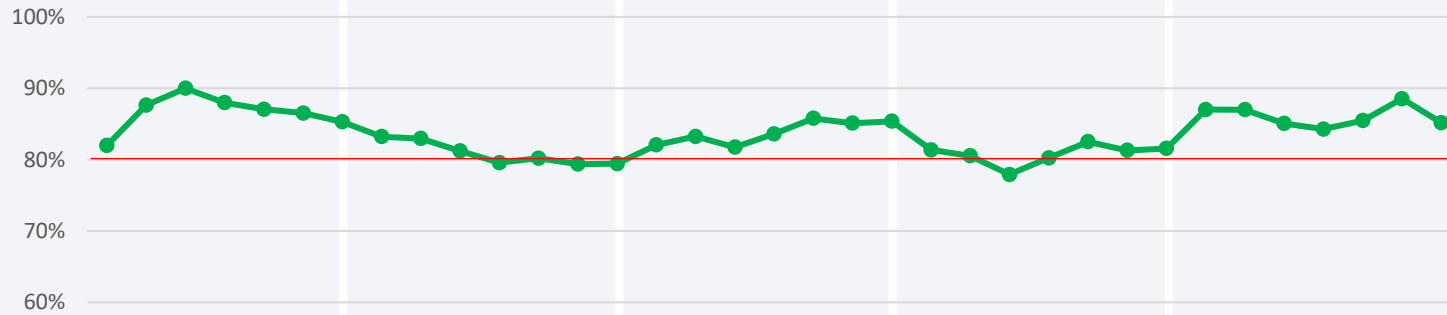
Ufficio  
grigio



Ufficio  
centro



Ufficio  
verde



10:00

12:00

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16:00

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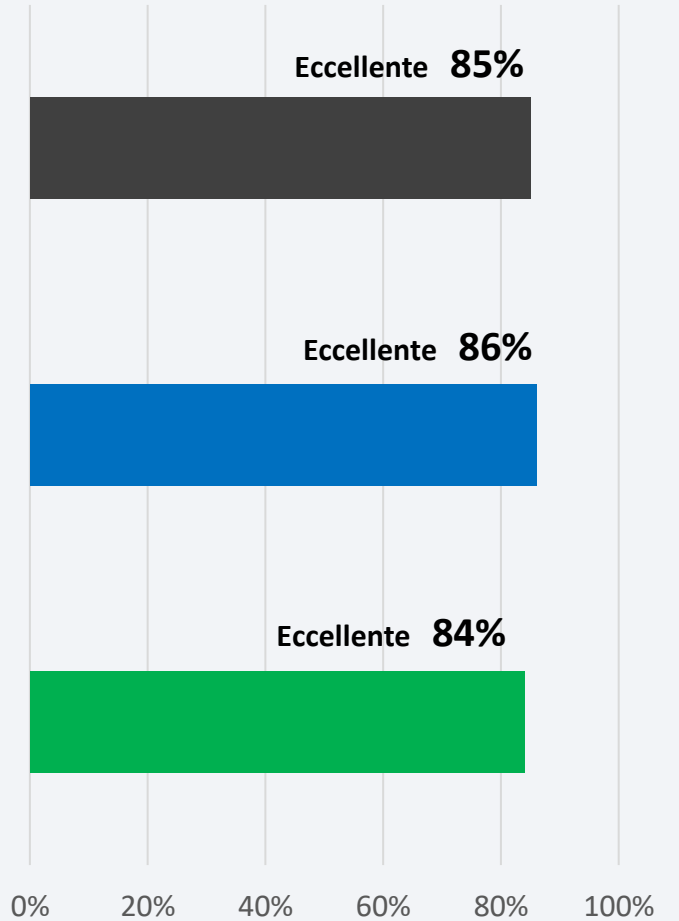
16:00

12:00

14:00

16:00

## MEDIA week 37



10/07/2023

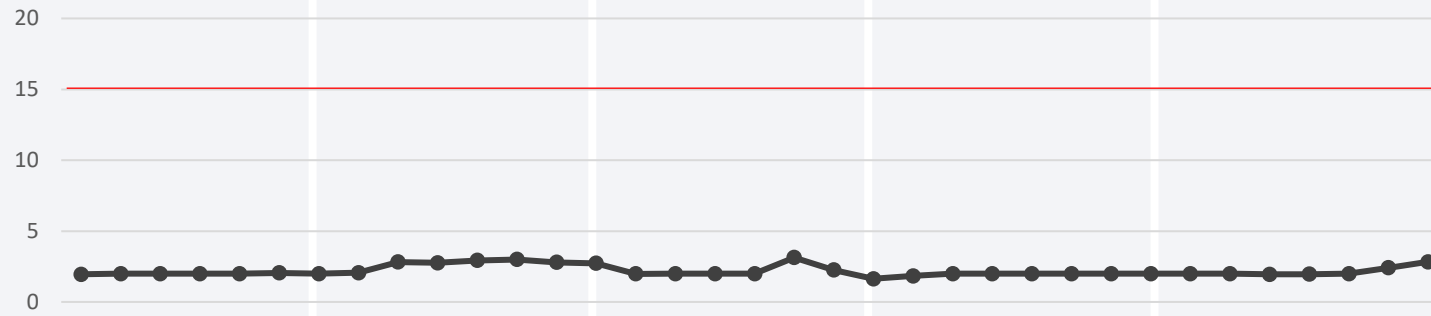
11/07/2023

12/07/2023

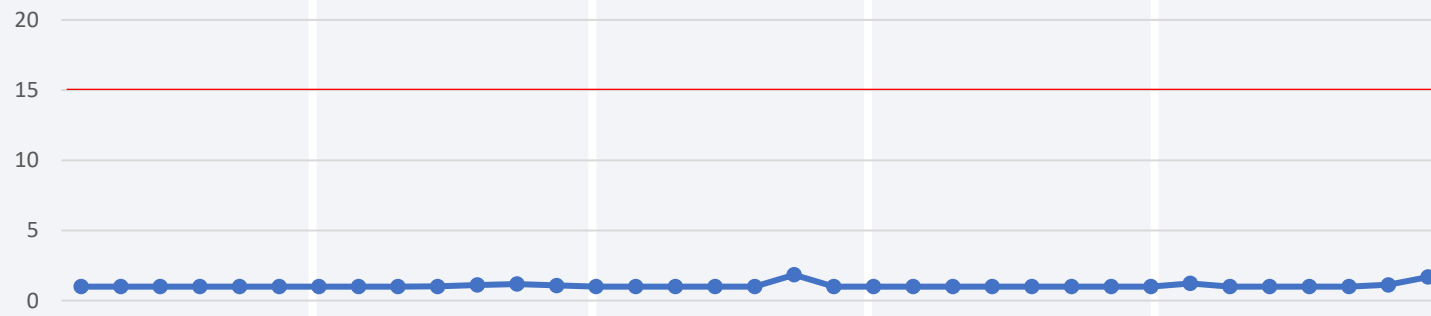
13/07/2023

14/07/2023

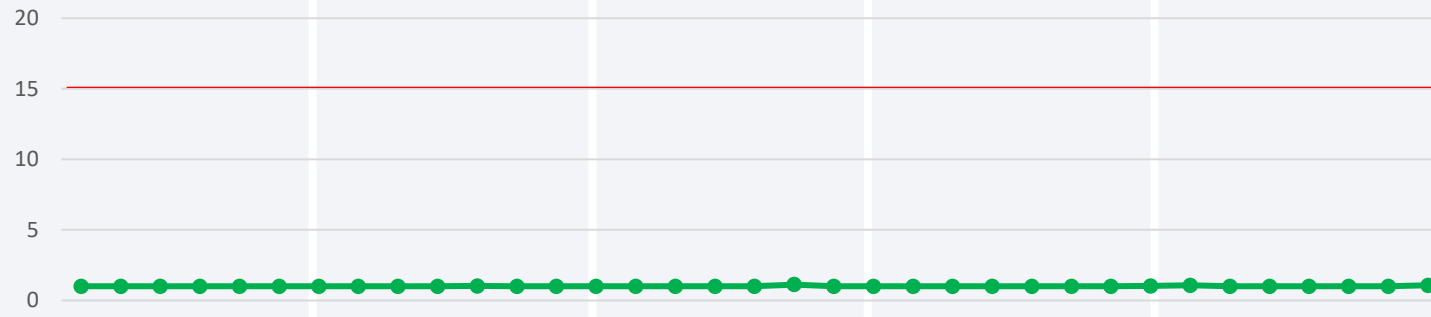
Ufficio grigio



Ufficio centro



Ufficio verde



10:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00

### MEDIA week 37

2.2  $\mu\text{g}/\text{m}^3$



2.2  $\mu\text{g}/\text{m}^3$



1.9  $\mu\text{g}/\text{m}^3$



0 5 10 15 20

10/07/2023

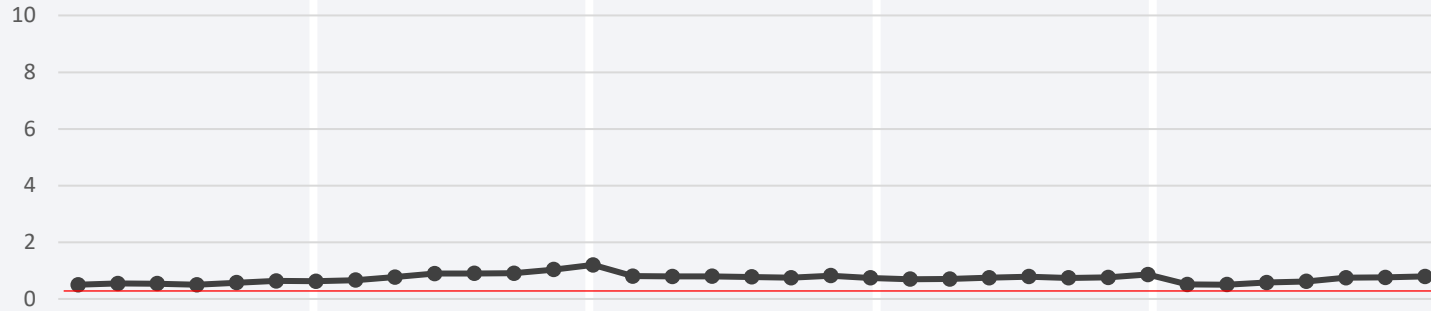
11/07/2023

12/07/2023

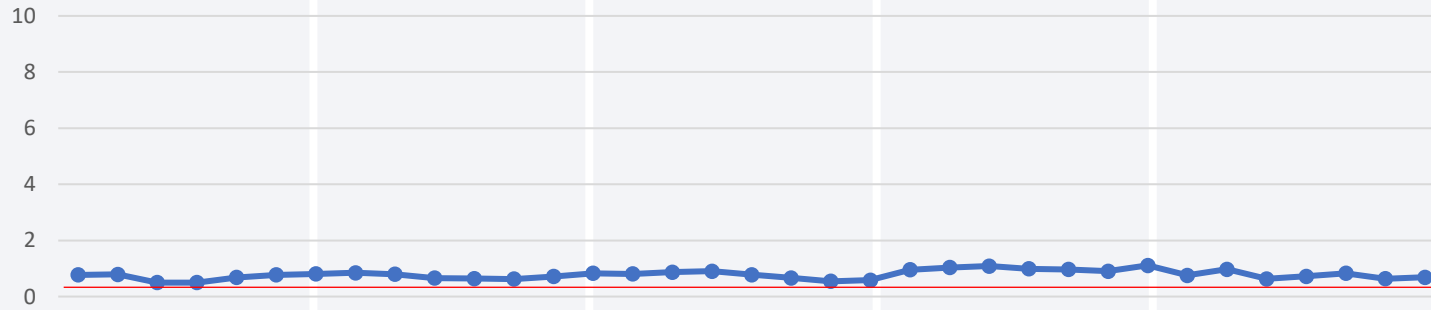
13/07/2023

14/07/2023

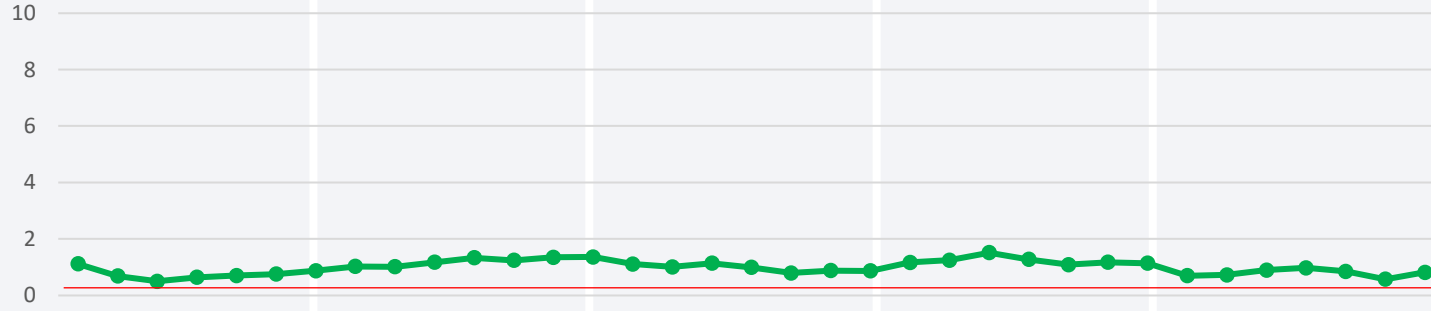
Ufficio grigio



Ufficio centro



Ufficio verde



### MEDIA week 37

0.7 ppm

0.8 ppm

0.9 ppm

0 2 4 6 8 10

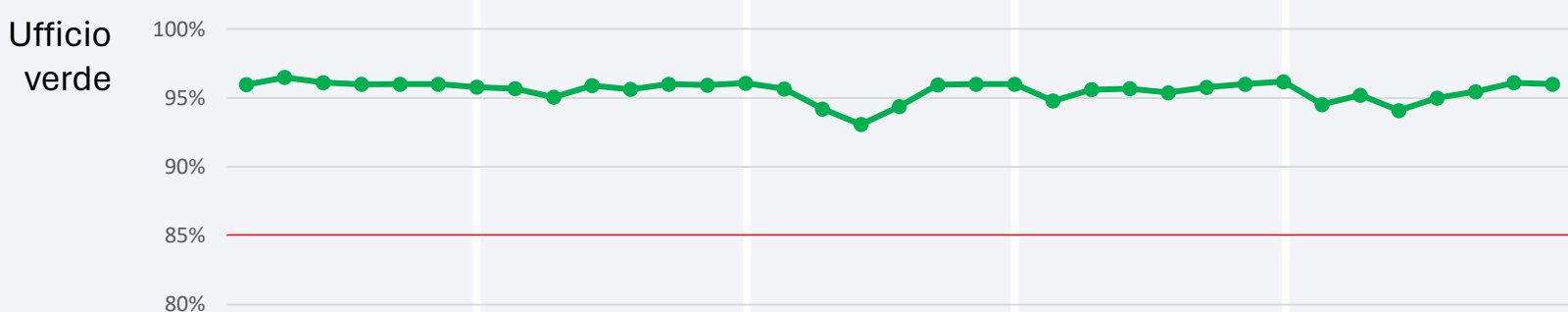
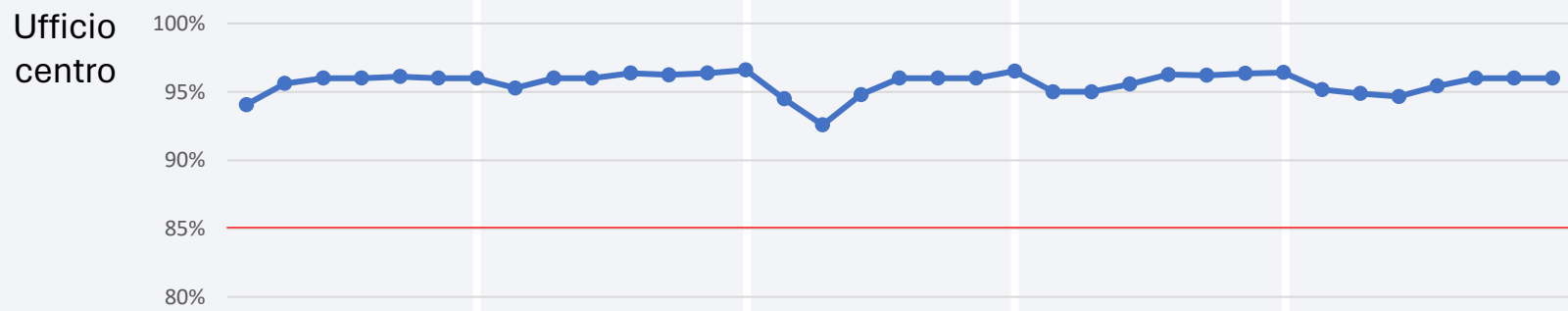
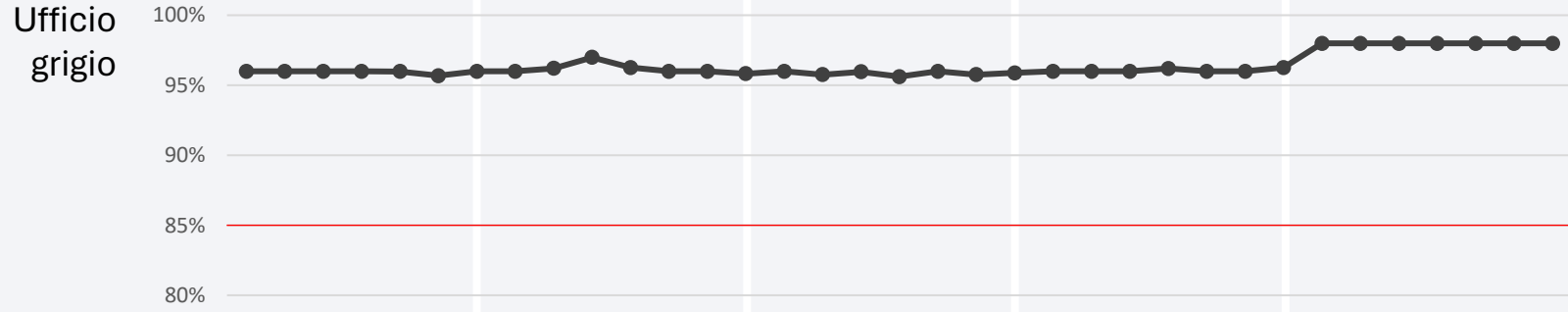
Week 29

# **Fifth week**

17/06/2023 - 21/06/2023

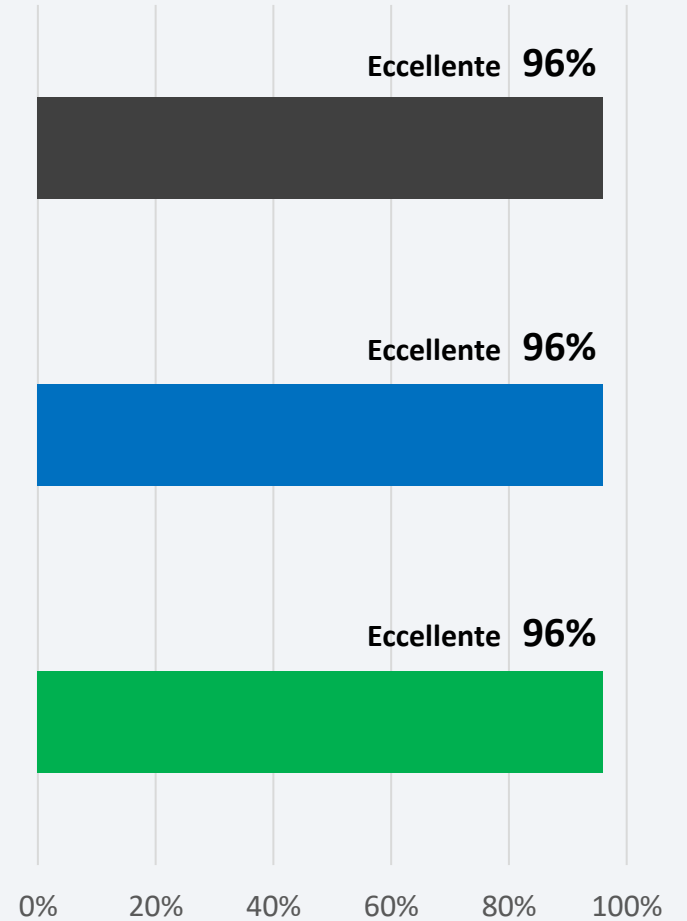
# BRAIN EFFICIENCY INDEX

17/07/2023      18/07/2023      19/07/2023      20/07/2023      21/07/2023



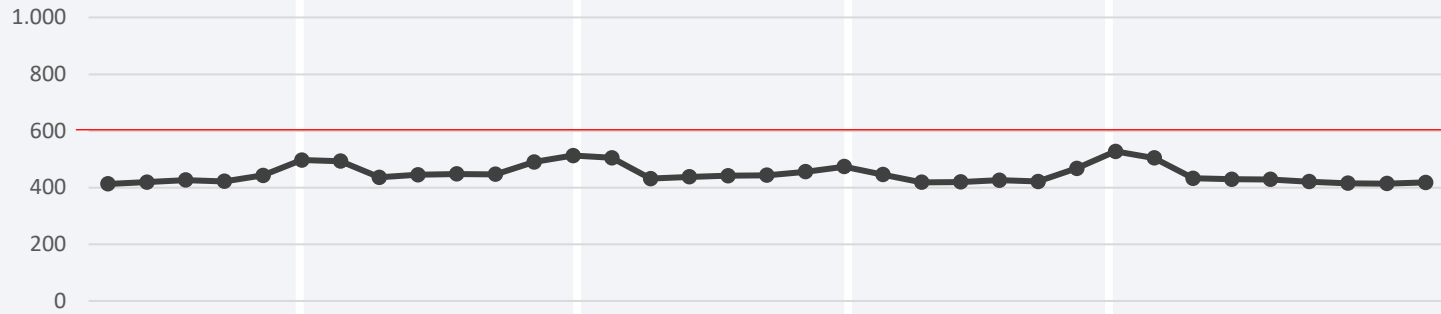
10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

## MEDIA week 38

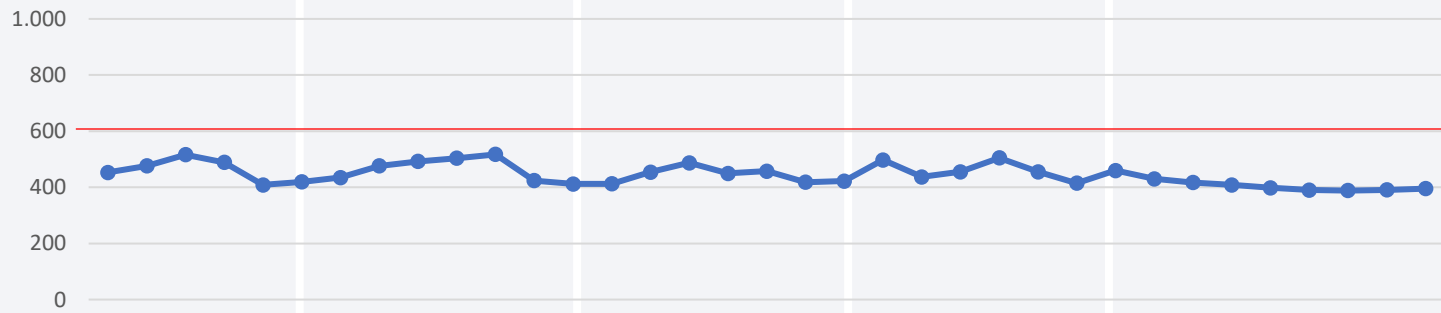


17/07/2023      18/07/2023      19/07/2023      20/07/2023      21/07/2023

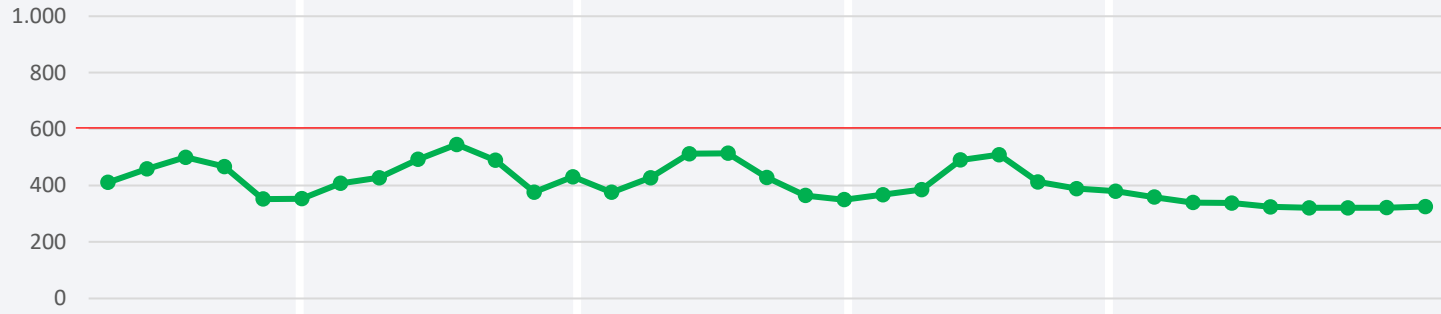
Ufficio grigio



Ufficio centro

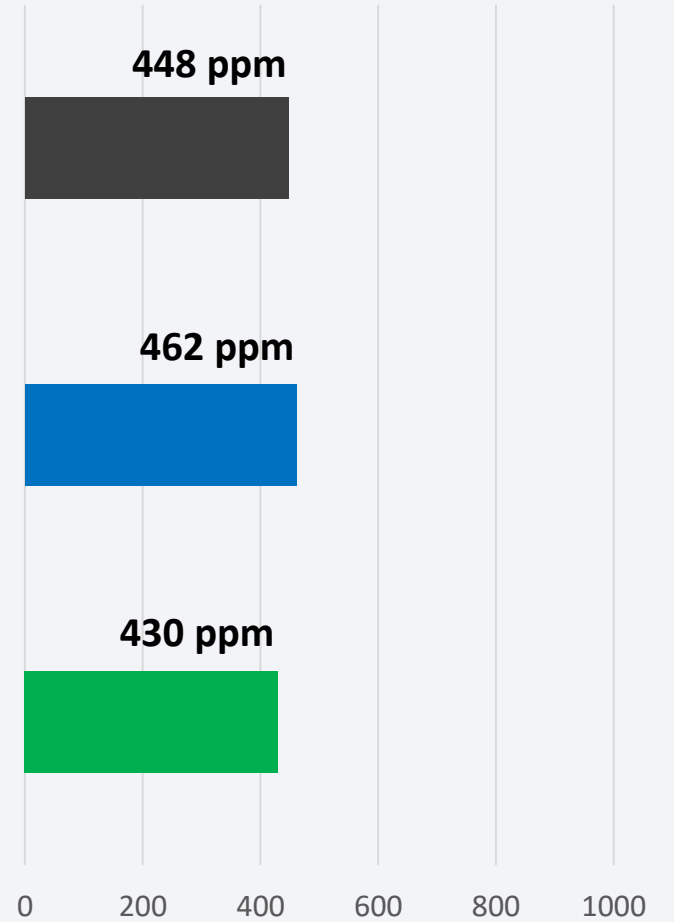


Ufficio verde



10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

### MEDIA week 38



# BRAIN EFFICIENCY INDEX

Rumore (dB)



17/07/2023

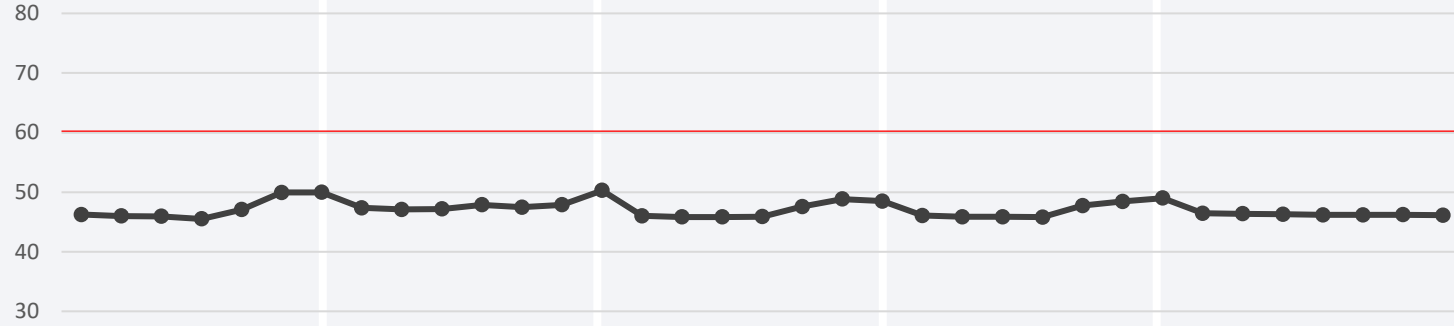
18/07/2023

19/07/2023

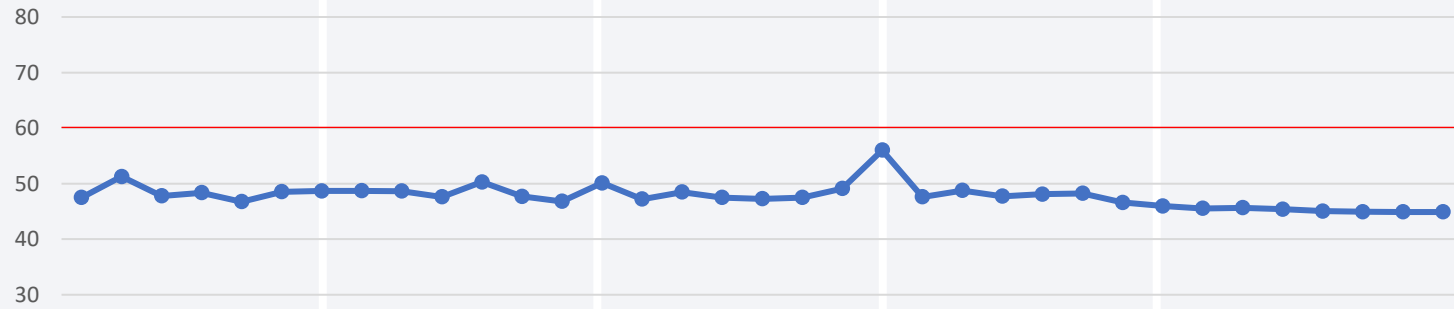
20/07/2023

21/07/2023

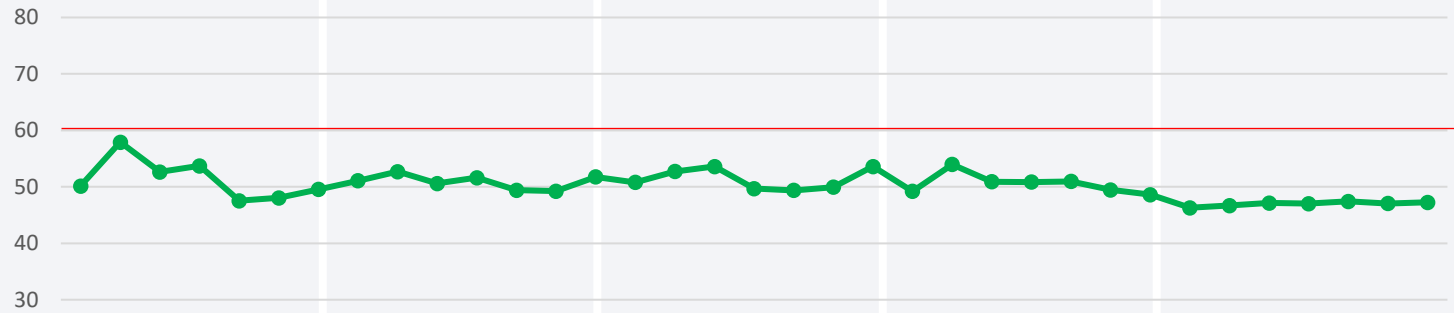
Ufficio grigio



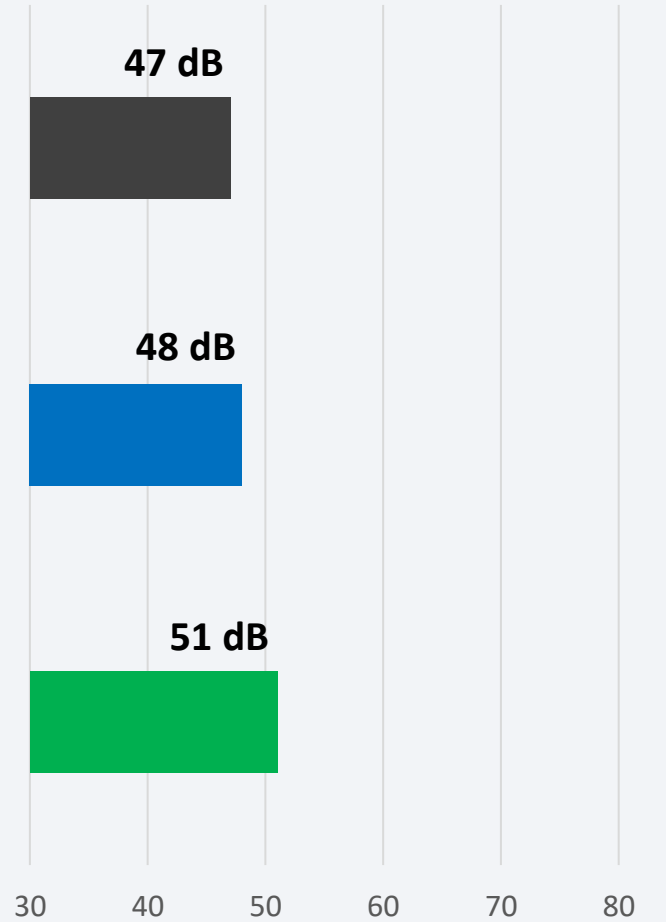
Ufficio centro



Ufficio verde



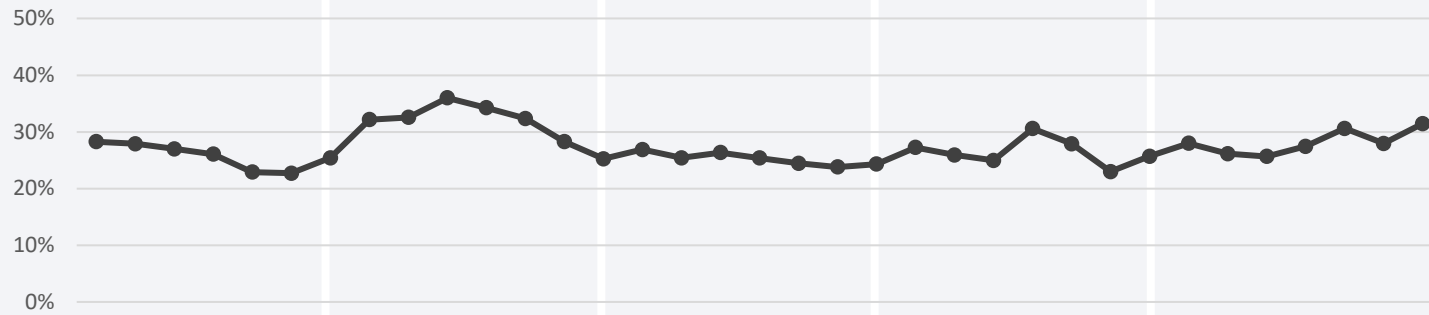
**MEDIA** week 38



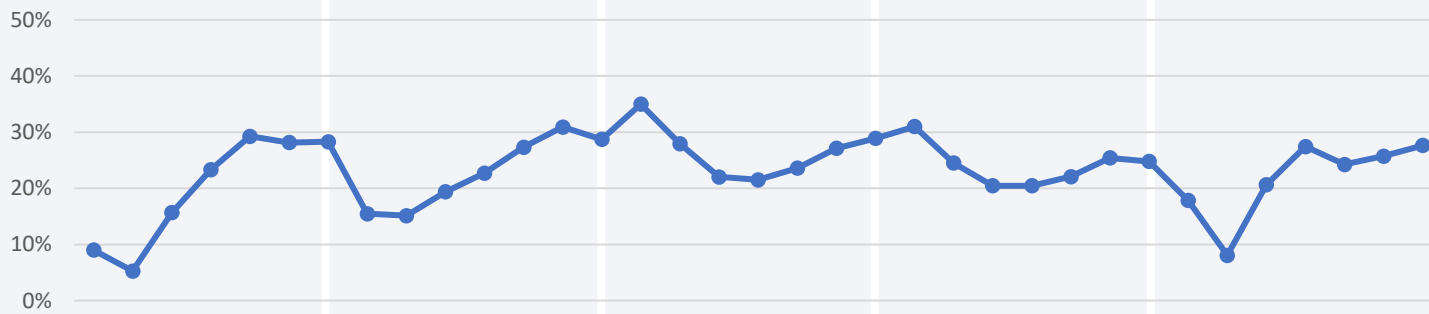
# AMBIENCE COMFORT INDEX

17/07/2023      18/07/2023      19/07/2023      20/07/2023      21/07/2023

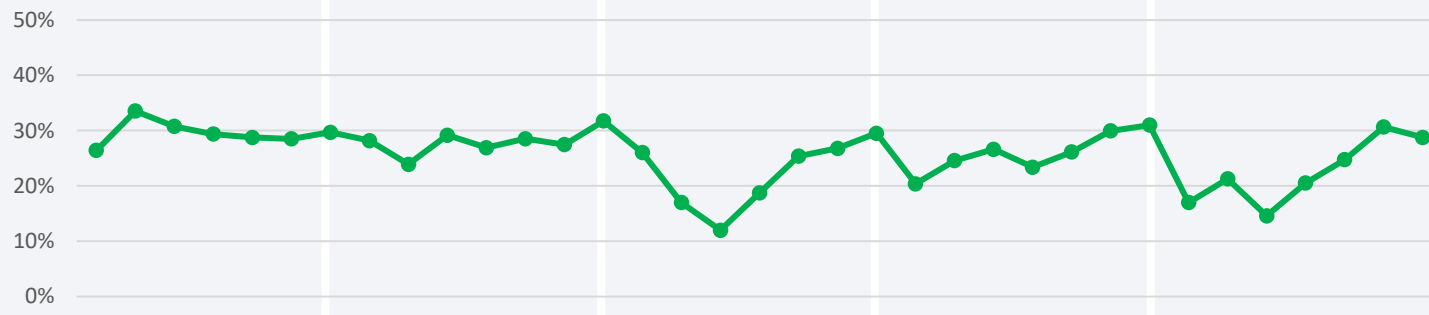
Ufficio grigio



Ufficio centro

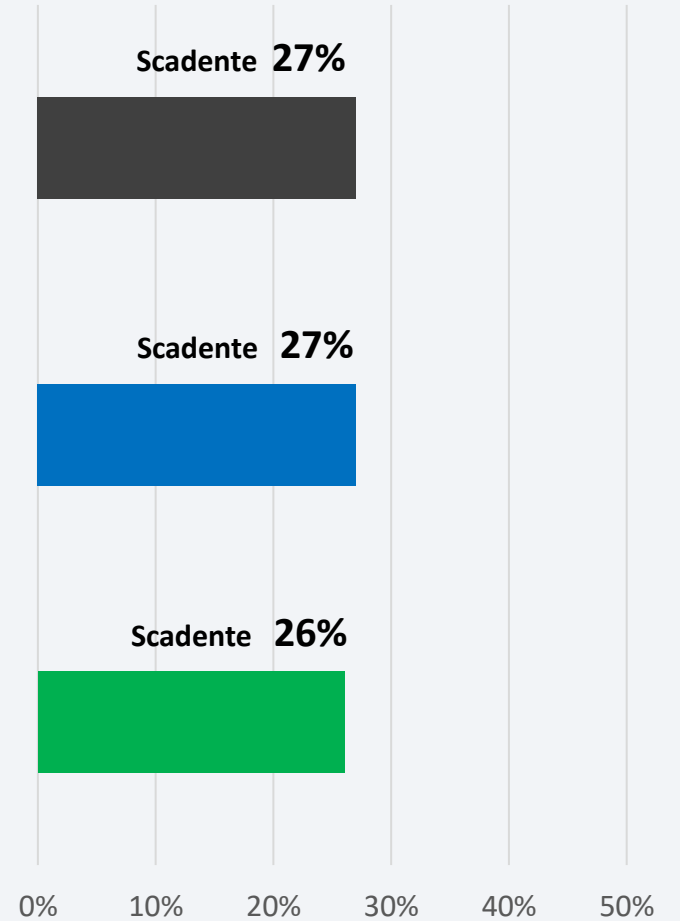


Ufficio verde



10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

## MEDIA week 38





# AMBIENCE COMFORT INDEX

Temperatura (°C)



17/07/2023

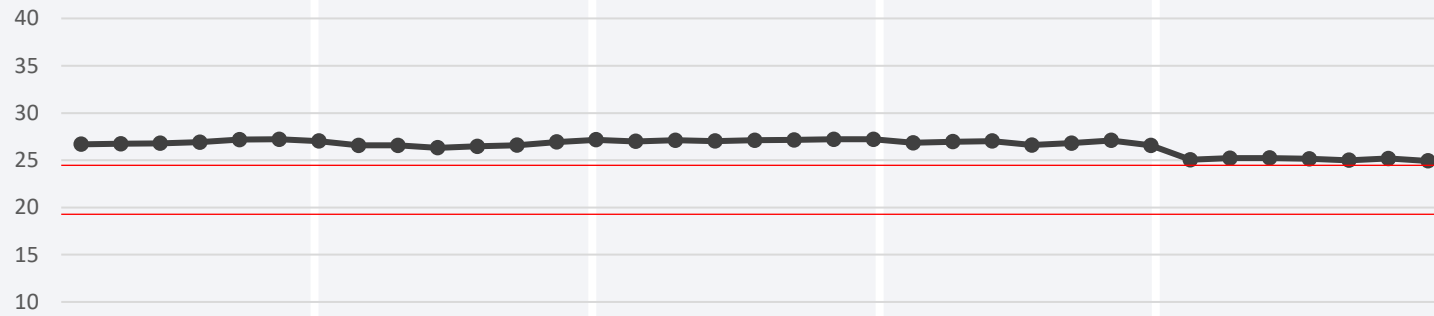
18/07/2023

19/07/2023

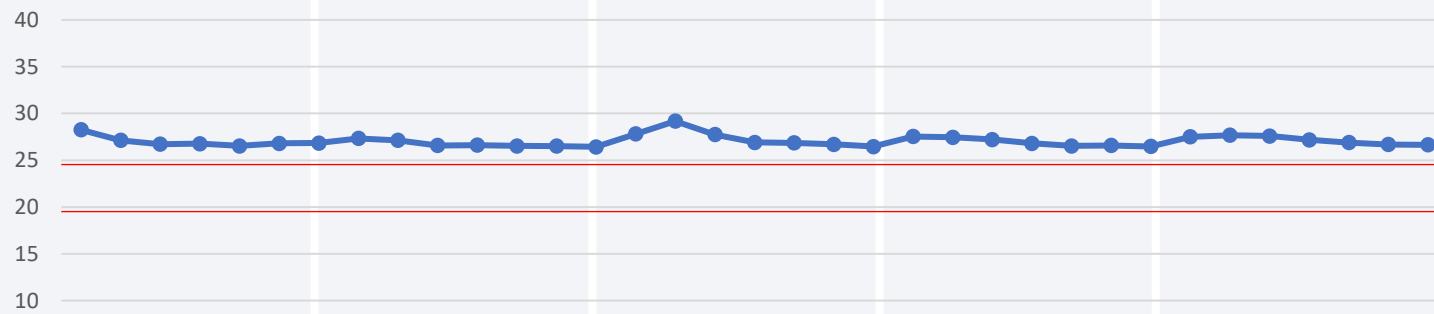
20/07/2023

21/07/2023

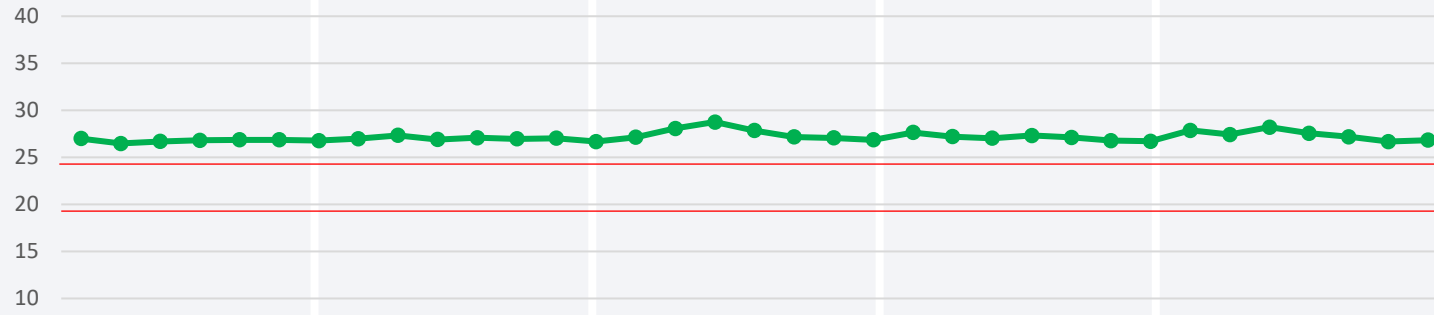
Ufficio grigio



Ufficio centro

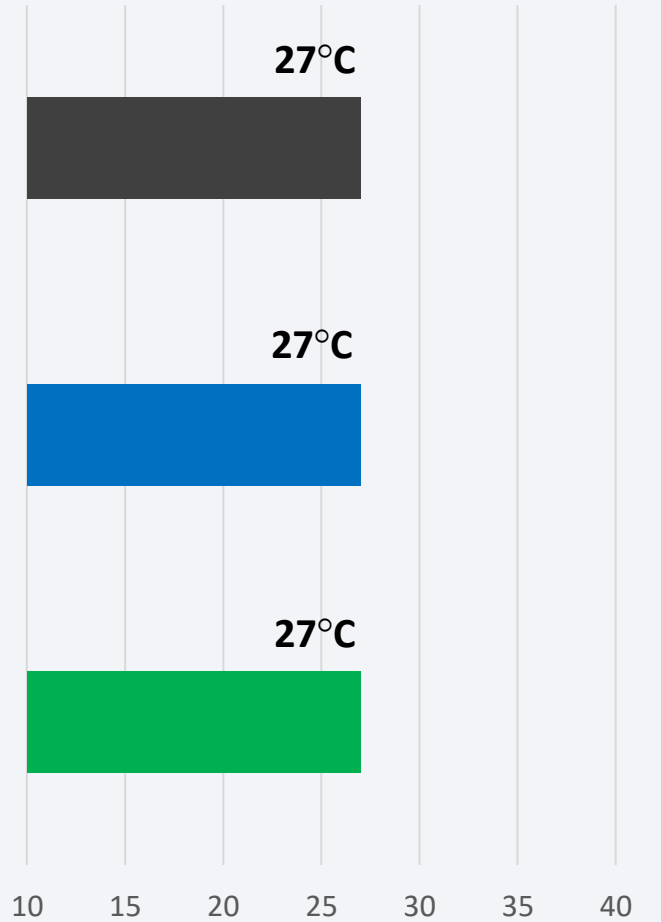


Ufficio verde



10:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00

**MEDIA** week 38



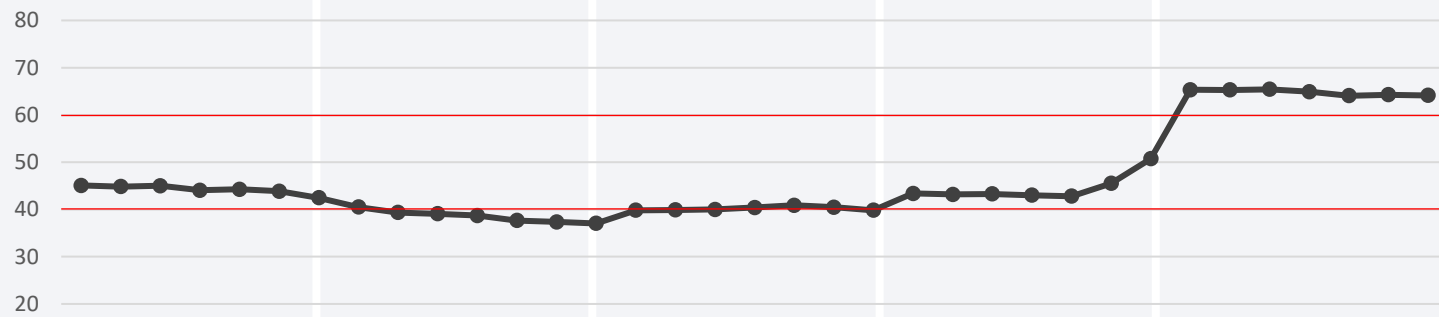
# AMBIENCE COMFORT INDEX

Umidità (%)

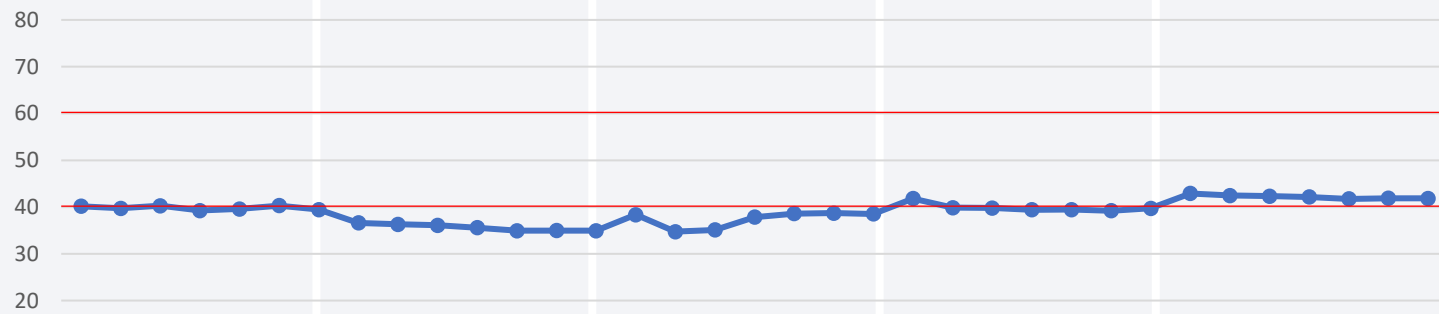


17/07/2023      18/07/2023      19/07/2023      20/07/2023      21/07/2023

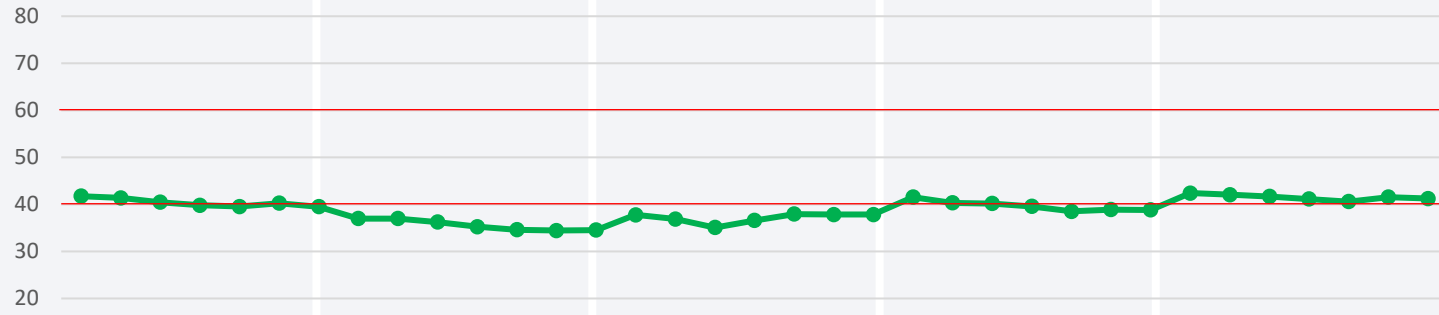
Ufficio grigio



Ufficio centro

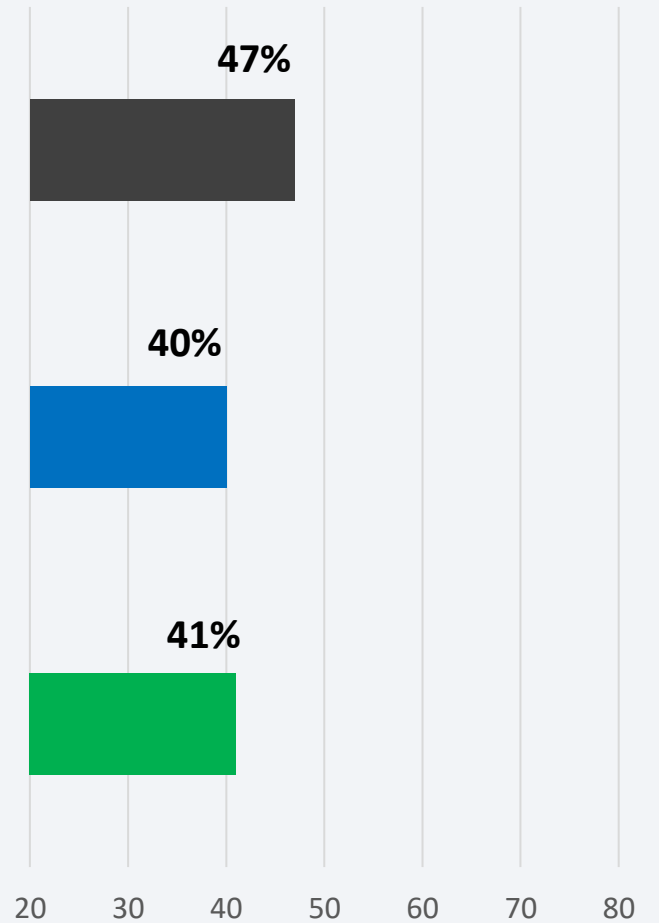


Ufficio verde



10:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00    12:00    14:00    16:00

## MEDIA week 38



# AIR QUALITY INDEX

17/07/2023

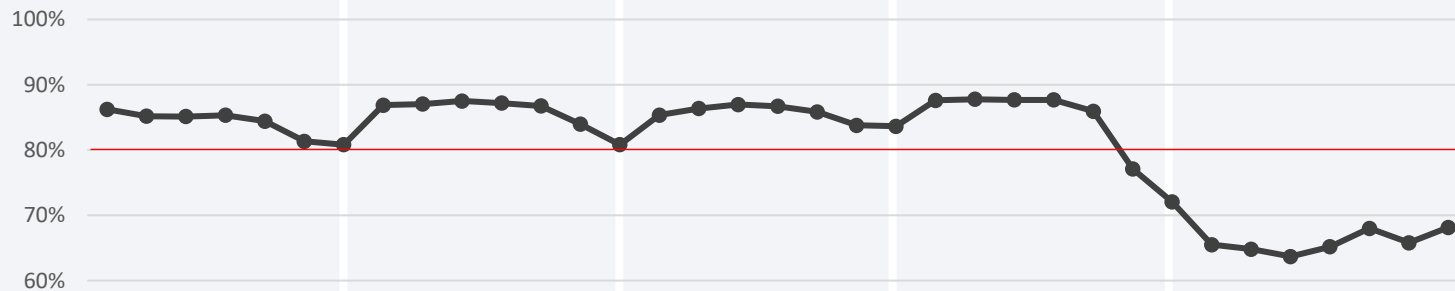
18/07/2023

19/07/2023

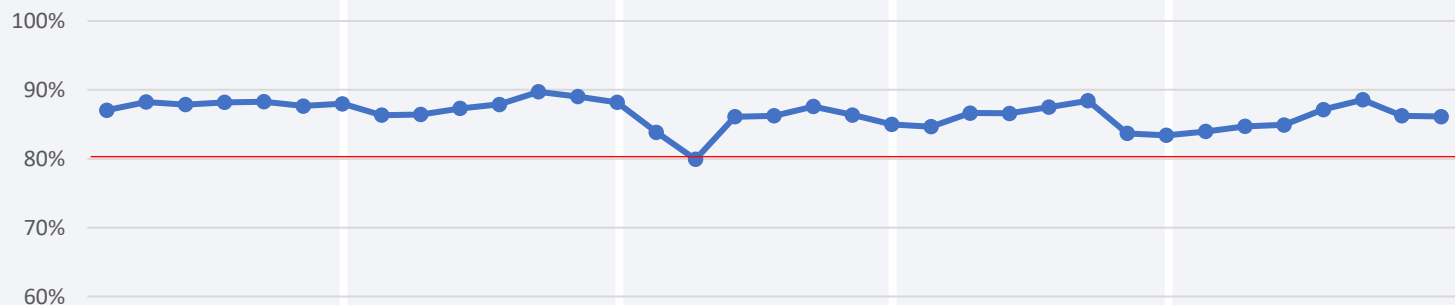
20/07/2023

21/07/2023

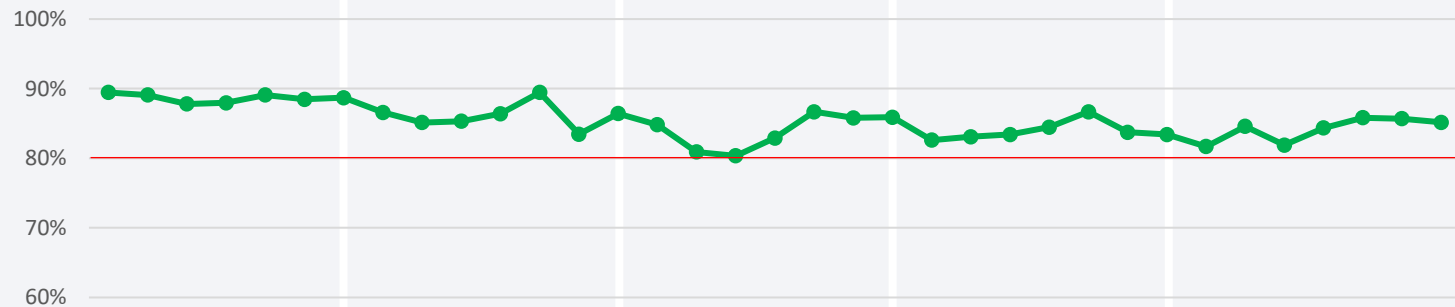
Ufficio  
grigio



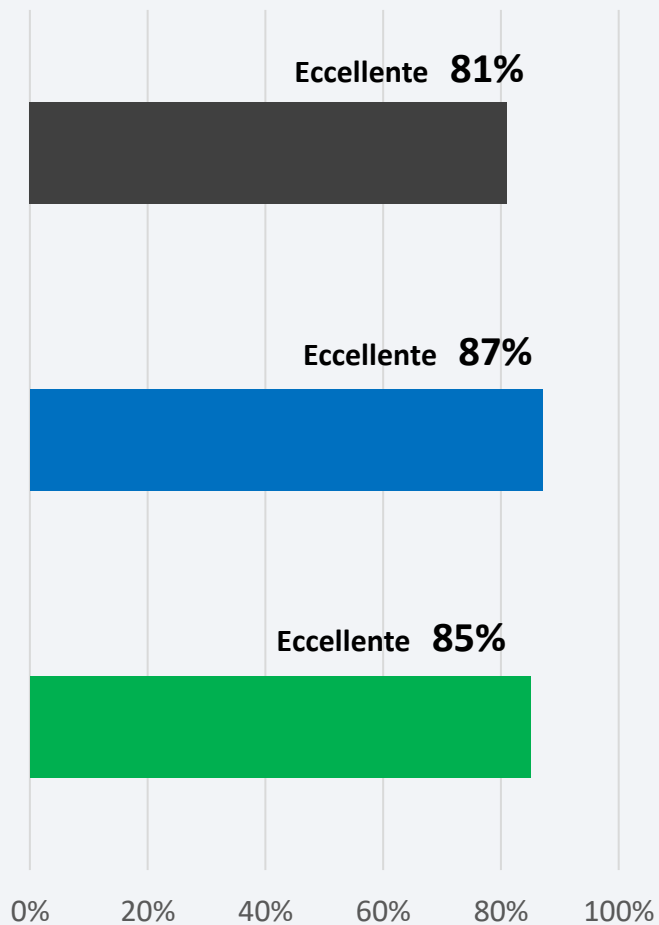
Ufficio  
centro



Ufficio  
verde



## MEDIA week 38



17/07/2023

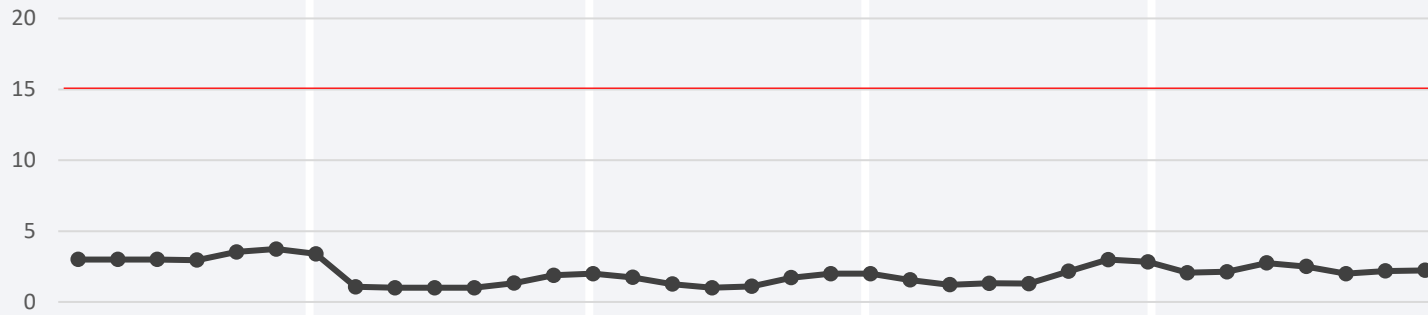
18/07/2023

19/07/2023

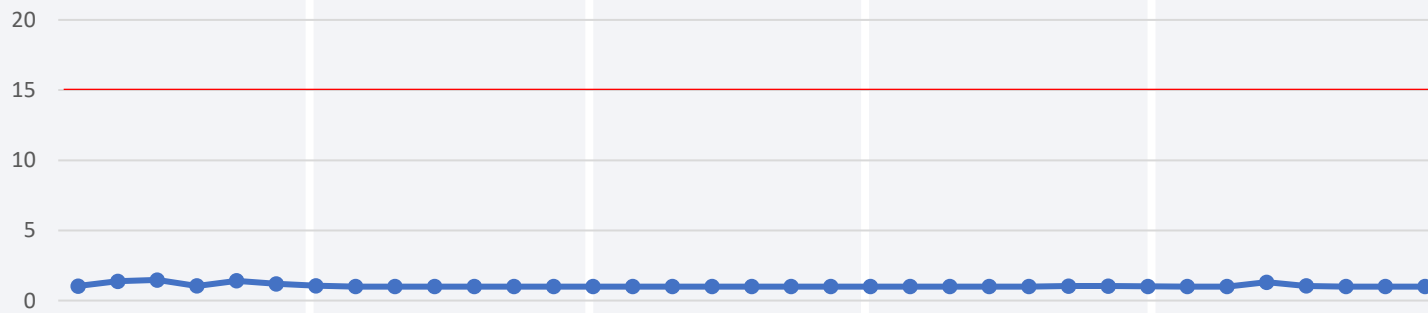
20/07/2023

21/07/2023

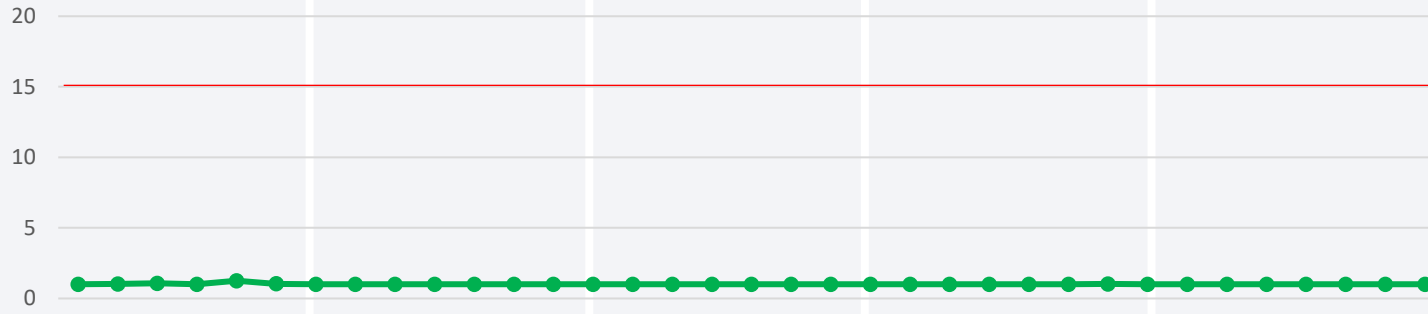
Ufficio grigio



Ufficio centro



Ufficio verde



10:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00 12:00 14:00 16:00

### MEDIA week 38



17/07/2023

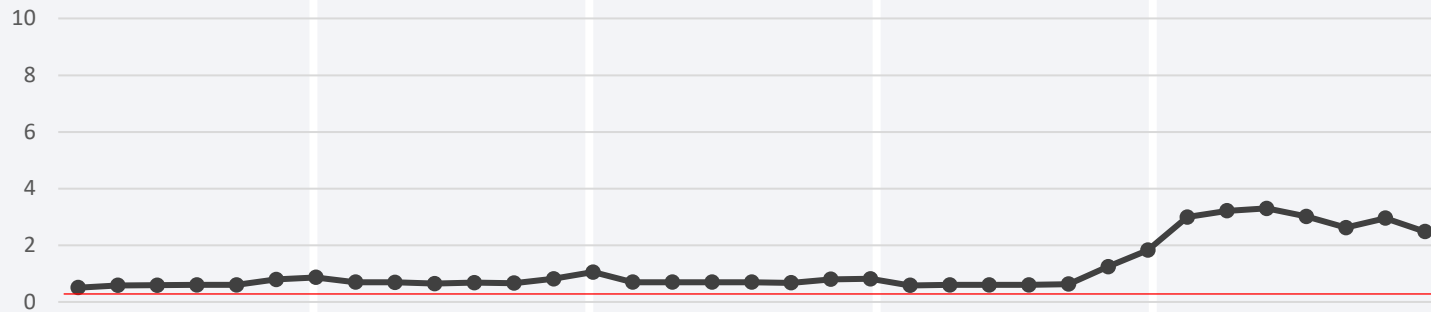
18/07/2023

19/07/2023

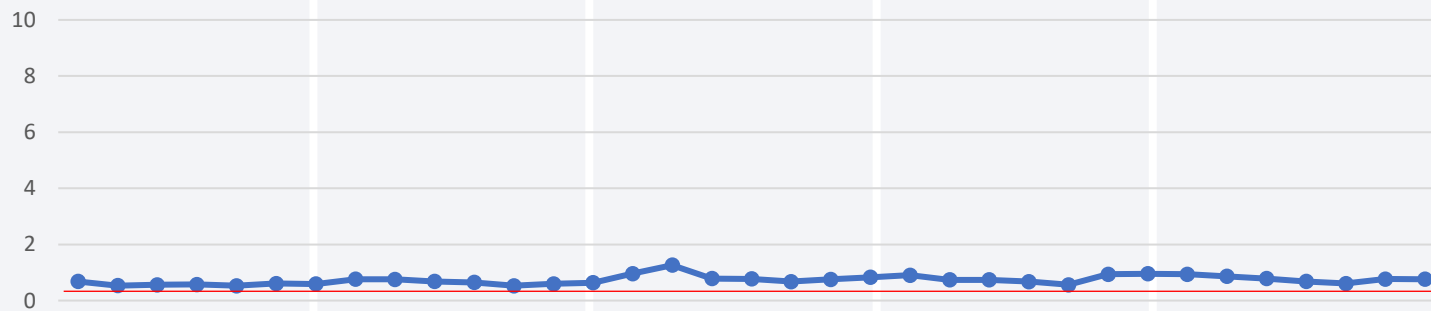
20/07/2023

21/07/2023

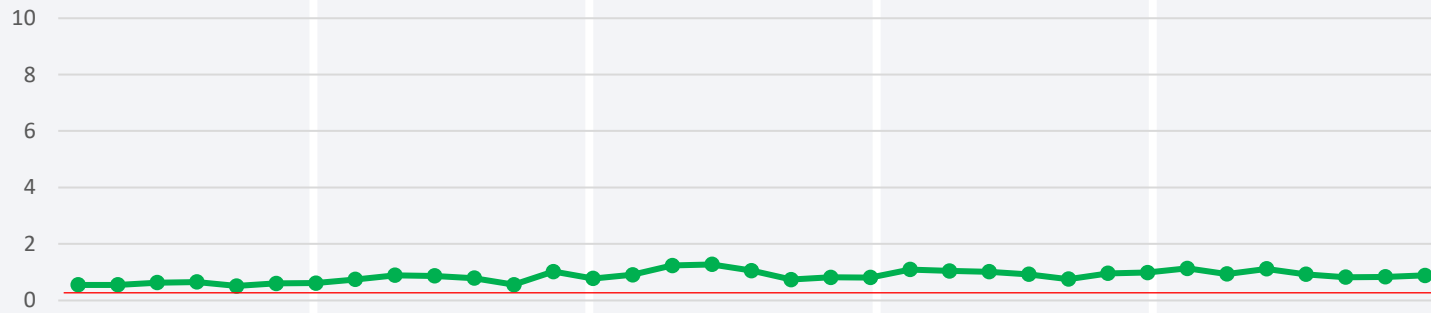
Ufficio grigio



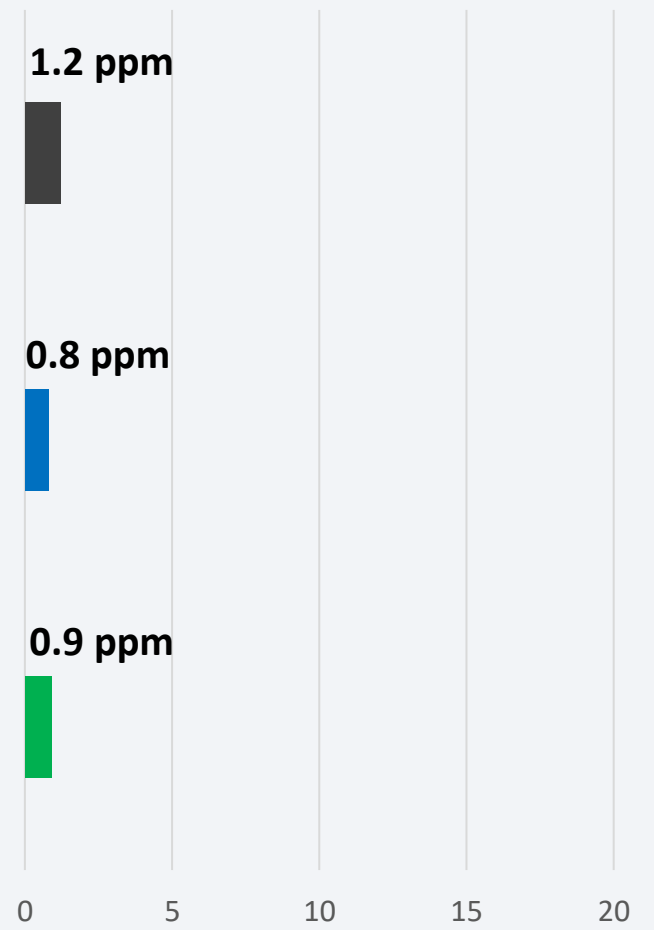
Ufficio centro



Ufficio verde



### MEDIA week 38



# DATA SUMMARY

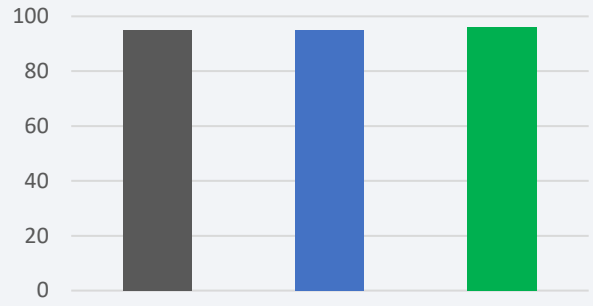
Ufficio grigio

Ufficio centro

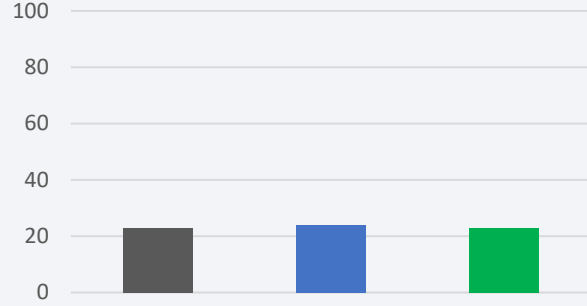
Ufficio verde



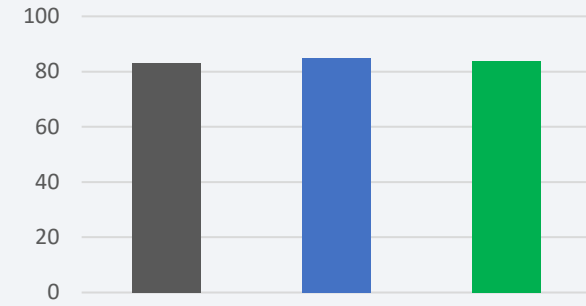
Brain efficiency index



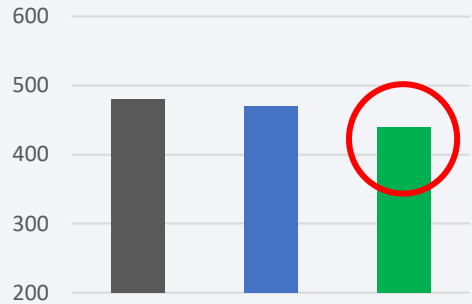
Ambience comfort index



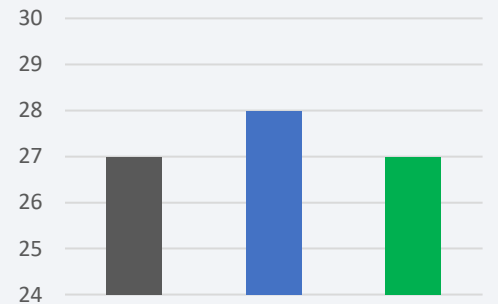
Air quality index



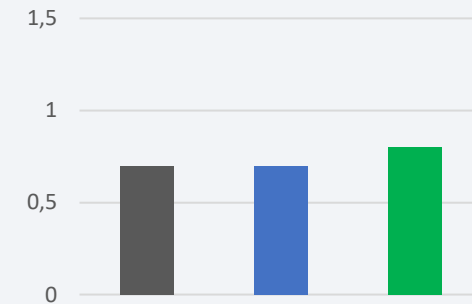
CO2 (ppm)



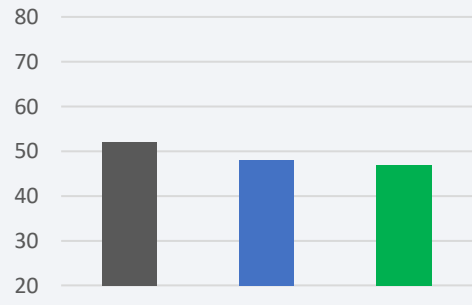
Temperatura (°C)



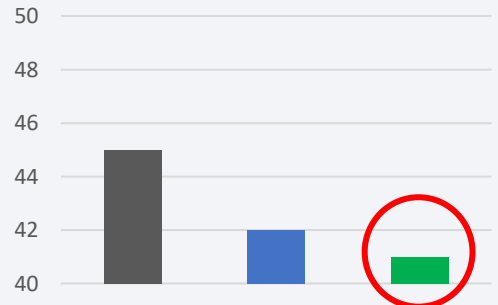
VOC (ppm)



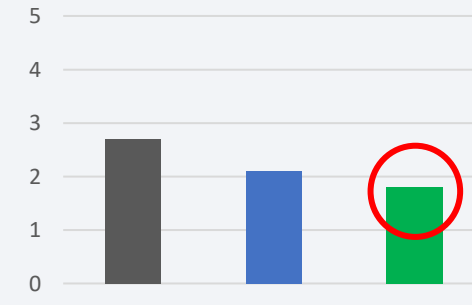
Rumore (dB)



Umidità (%)



PM (µg/m³)



- There are differences in **all three indicators** and always in favour of the **green office**.
  1. For the Brain Efficiency Index, the **CO2 concentration** is significantly **lower** in the green office.
  2. For the Ambience Comfort Index, it is the **humidity** level being **lowest** in the green office.
  3. For Air Quality Index, the presence of **particulate matter** is **reduced** in the green office.
- Environmental variables can be drastically modulated by the presence of plants, which are able to absorb CO2 and regulate the level of humidity. Regarding the impact on PM, the dynamics need to be further investigated.