

# VENTILATION FOR RETROFIT







AB/IS

As Built/In  
Service



AD/T

As Designed/Theoretical



# Acceptable

AIR QUALITY

80 Years  
70 Indoors  
55 At home  
25 sleeping





# Acceptable

AIR QUALITY

The  
cost.



Air pollution is the largest single environmental risk.

Air pollution is the WHO European Region's most significant environmental health risk. For 2019, 569,000 premature deaths can be attributed to ambient air pollution and 154,000 deaths to household air pollution.

The cost of air pollution in Ireland was estimated at approximately €2.3 billion per year in 2015.



# Acceptable

## AIR QUALITY

The

cost.

According to the Asthma + Lung UK 5.4 Million people currently live with asthma, a disease we know is significantly exacerbated by poor indoor environments.



Asthma costs the US economy more than \$80 billion annually

It is estimated to affect 30–50 million people in Europe, approximately 10% of all Europeans. The direct costs of asthma care in Europe is estimated at EUR 17.7 billion per year.



# Acceptable

AIR QUALITY

The

cost.

**Poor housing and ventilation**

Studies consistently show a link between poor respiratory health and housing conditions

Damp & Mould  
Overcrowding  
Poor Ventilation  
Cold Homes  
Other pollutants





# Acceptable

## AIR QUALITY

The  
cost.

One of the most striking findings from a recent UK survey is that 71% of homes did not have ventilation provisions that met the current building standards

Across Europe the figures are not much better.

- Between 22% and 55% have flow rates below regulations
- Between 55% and 75% of users operate the systems at lower rates than they should
- 50% of balanced systems are out of balance or malfunctioning.

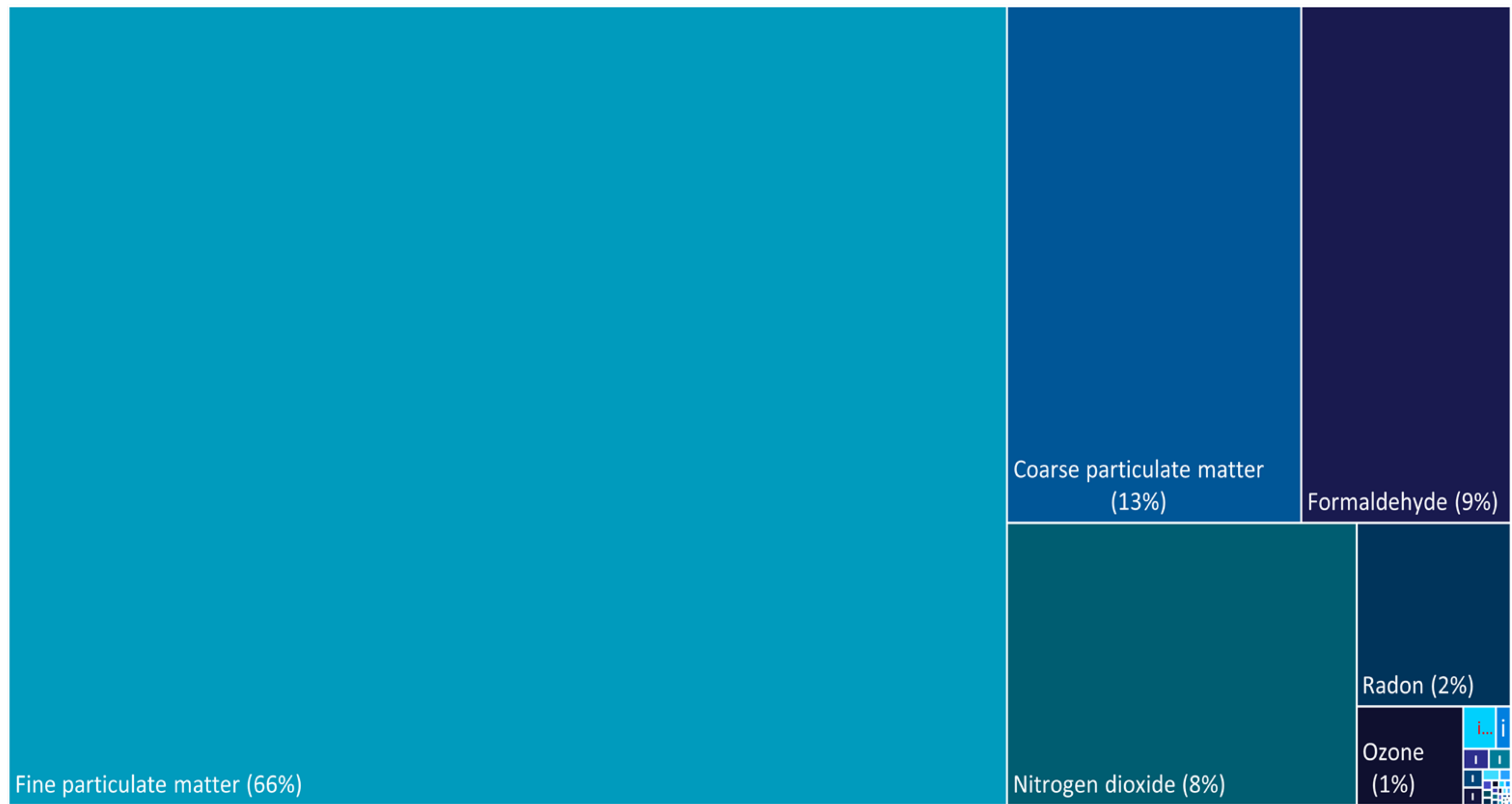




# Acceptable

AIR QUALITY

Total Harm from Residential Indoor Air Contaminants



**Total Harm IAQ**  
**2200 DALY's**

**Harm from Residential Indoor Air Contaminants**  
**Gioberti Morantes, Benjamin Jones, Constanza Molina, and Max H. Sherman**  
**Environmental Science & Technology**  
**2024 58 (1), 242-257**  
**DOI: 10.1021/acs.est.3c07374**



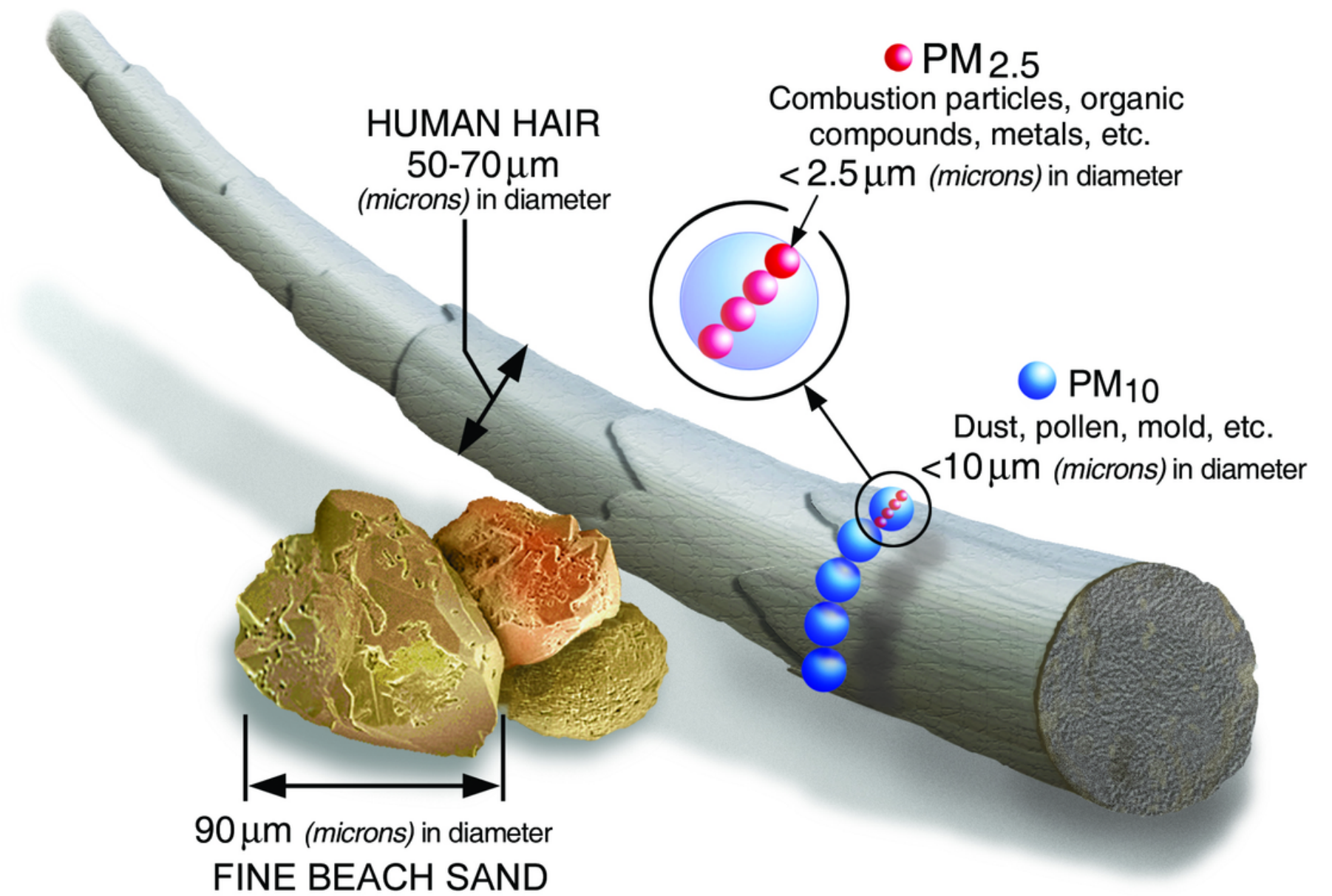
# Acceptable

## AIR QUALITY

### Particulate Matter (PM)

**Explanation:** Particulate matter (PM) consists of tiny particles in the air, such as dust, dirt, soot, and smoke. These particles can come from various indoor activities like cooking, smoking, and burning candles. They can also come from outdoor sources like traffic and industrial emissions and enter the home.

**Health Effects:** When you inhale these tiny particles, they can penetrate deep into your lungs and even enter your bloodstream. This can cause a variety of health issues, including respiratory and cardiovascular diseases, cancers, and even cognitive problems like reduced ability to think clearly. Long-term exposure can also lead to chronic health conditions such as diabetes and low birth weight in infants.





# Acceptable

## AIR QUALITY

### Nitrogen Dioxide (NO<sub>2</sub>)

**Explanation:** Nitrogen dioxide (NO<sub>2</sub>) is a harmful gas that comes from burning fuels like gas and diesel. Inside homes, it mainly comes from gas appliances like cookers. When you breathe in high levels of NO<sub>2</sub>, it can cause inflammation in your lungs, making it harder to breathe. It also makes you more likely to catch respiratory infections and react to allergens.

**Health Effects:** Long-term exposure to NO<sub>2</sub> has been linked to serious health problems like lung cancer, low birth weight in babies, diabetes, and possibly even dementia. Short-term exposure can make your airways inflamed, increasing the risk of infections and allergies. Therefore, it's important to minimize exposure, especially for people with respiratory issues.





# Acceptable

## AIR QUALITY

### Formaldehyde

**Explanation:** Formaldehyde is a strong-smelling gas used in building materials and products. It is found in products like pressed wood furniture, glues, and coatings. Burning fuels and certain cooking methods can also release it.

**Health Effects:** Exposure to formaldehyde can cause irritation of the eyes, nose, and throat, as well as skin rashes.

It has been classified as a probable human carcinogen, meaning long-term exposure can increase the risk of cancer. It's important to minimize exposure by using products with low formaldehyde emissions and ensuring proper ventilation.





# Moisture Balance

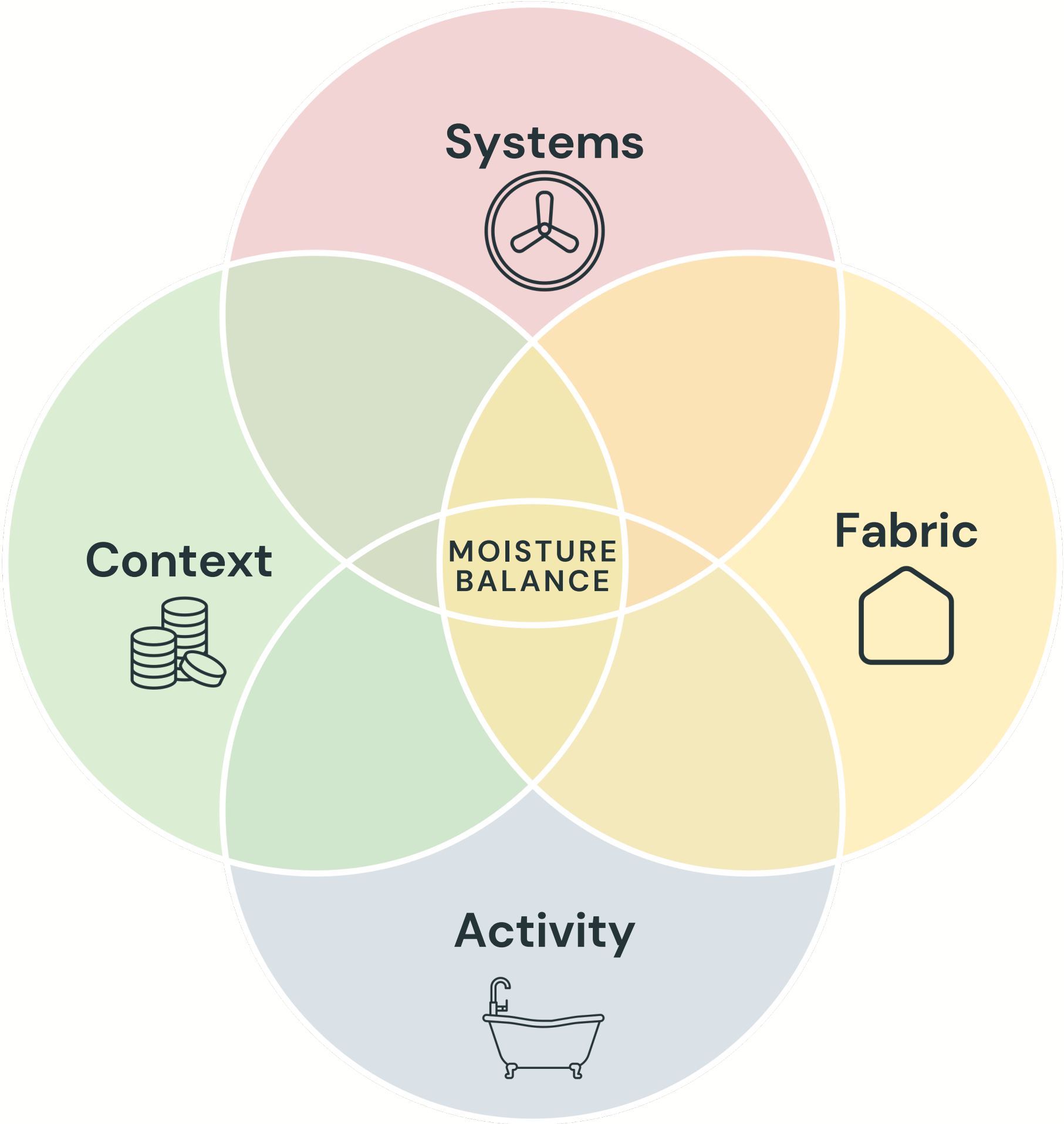
- The concept that a building's healthy balance point is the target.
- Each will have a different balance point based on the building, its use and systems within it.
- There are multiple factors that can upset this balance and consequences to changing elements of it.





# Moisture Balance

CONDENSATION DAMP  
AND MOULD





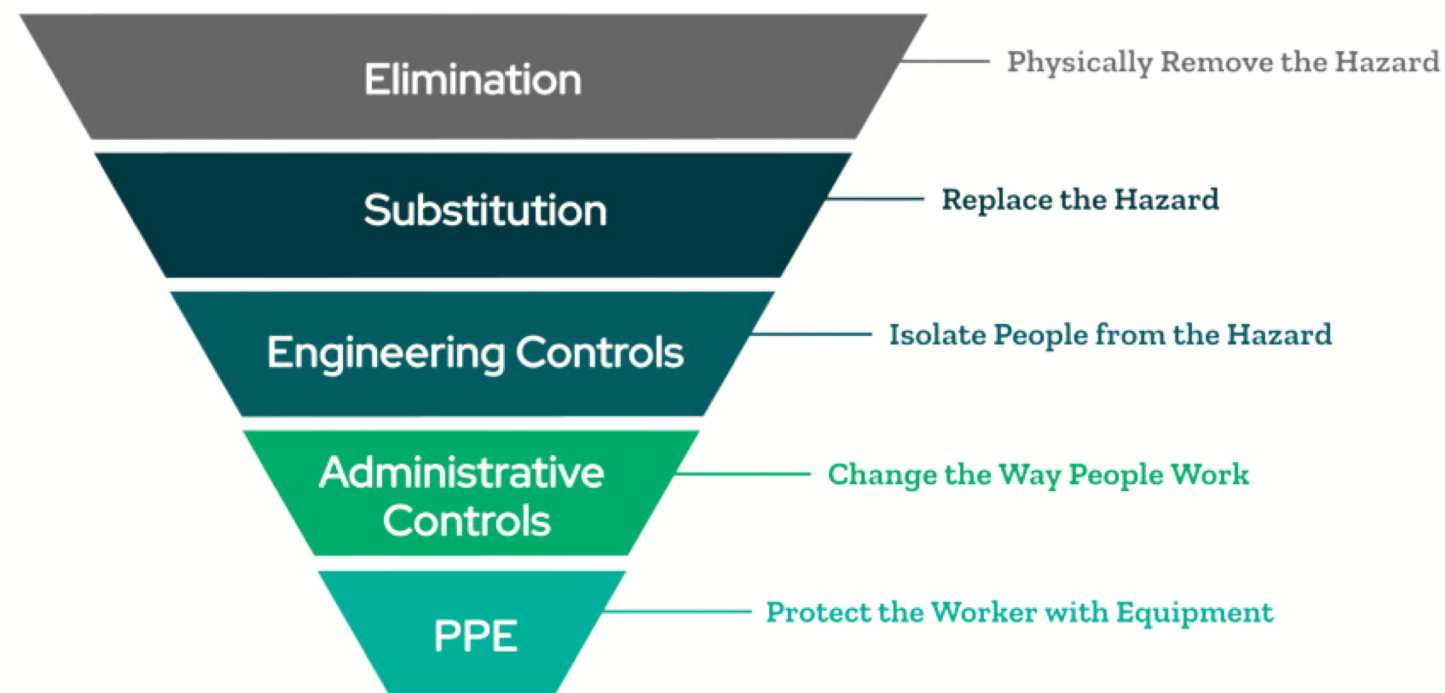




# Acceptable

AIR QUALITY

## Hierarchy of Controls



**Eliminate** - What causes pollutants that I can remove.

**Substitution** - What can I replace that is less harmful

**Engineering** - What can control and protect us once a pollutant is in the air

**Admin** - What can I do or how can I behave that will improve my risk



# Ventilation Basics





# Ventilation Basics

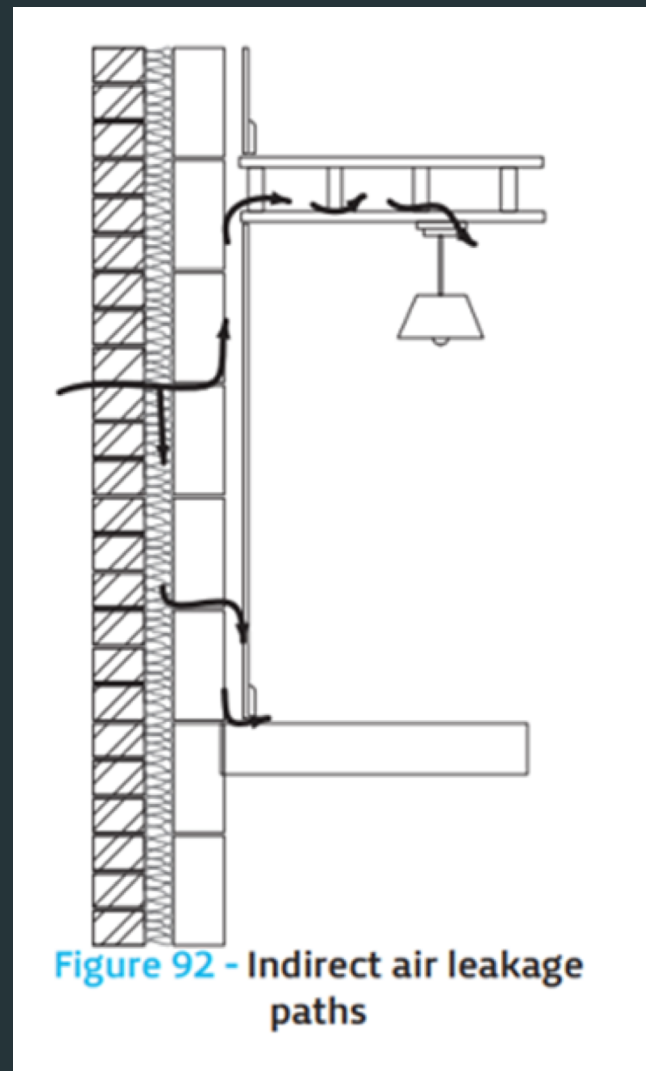
Controlled and uncontrolled ventilation or  
intended and unintended





# Ventilation Basics

Controlled and uncontrolled ventilation or  
intended and unintended





# Ventilation Basics

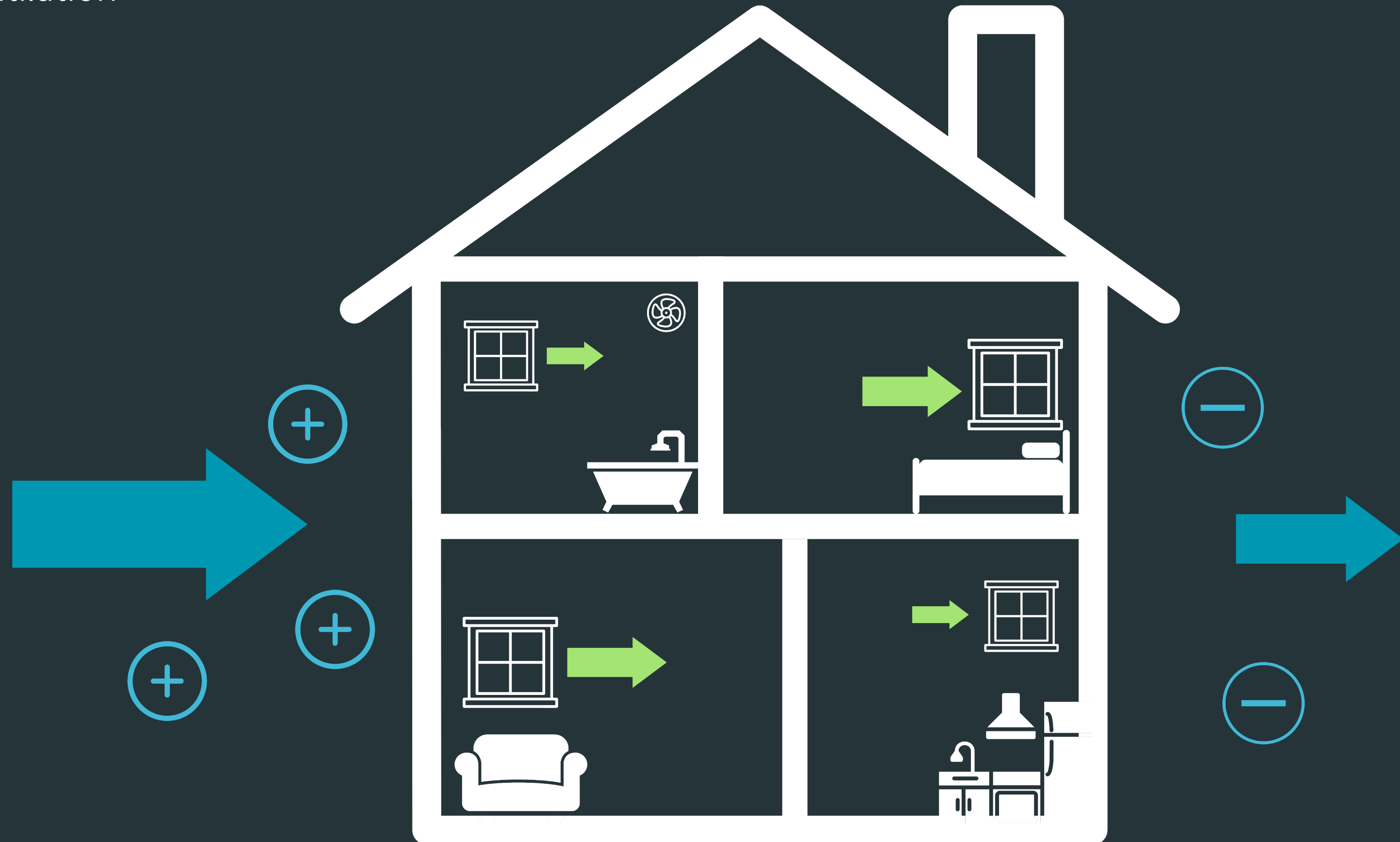
## Natural Ventilation





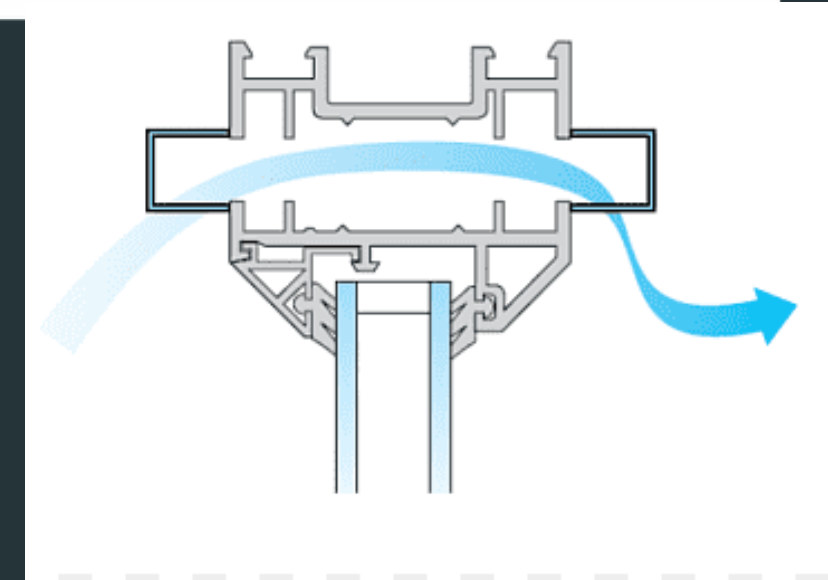
# Ventilation Basics

## Natural Ventilation



# Ventilation Basics

Natural Ventilation





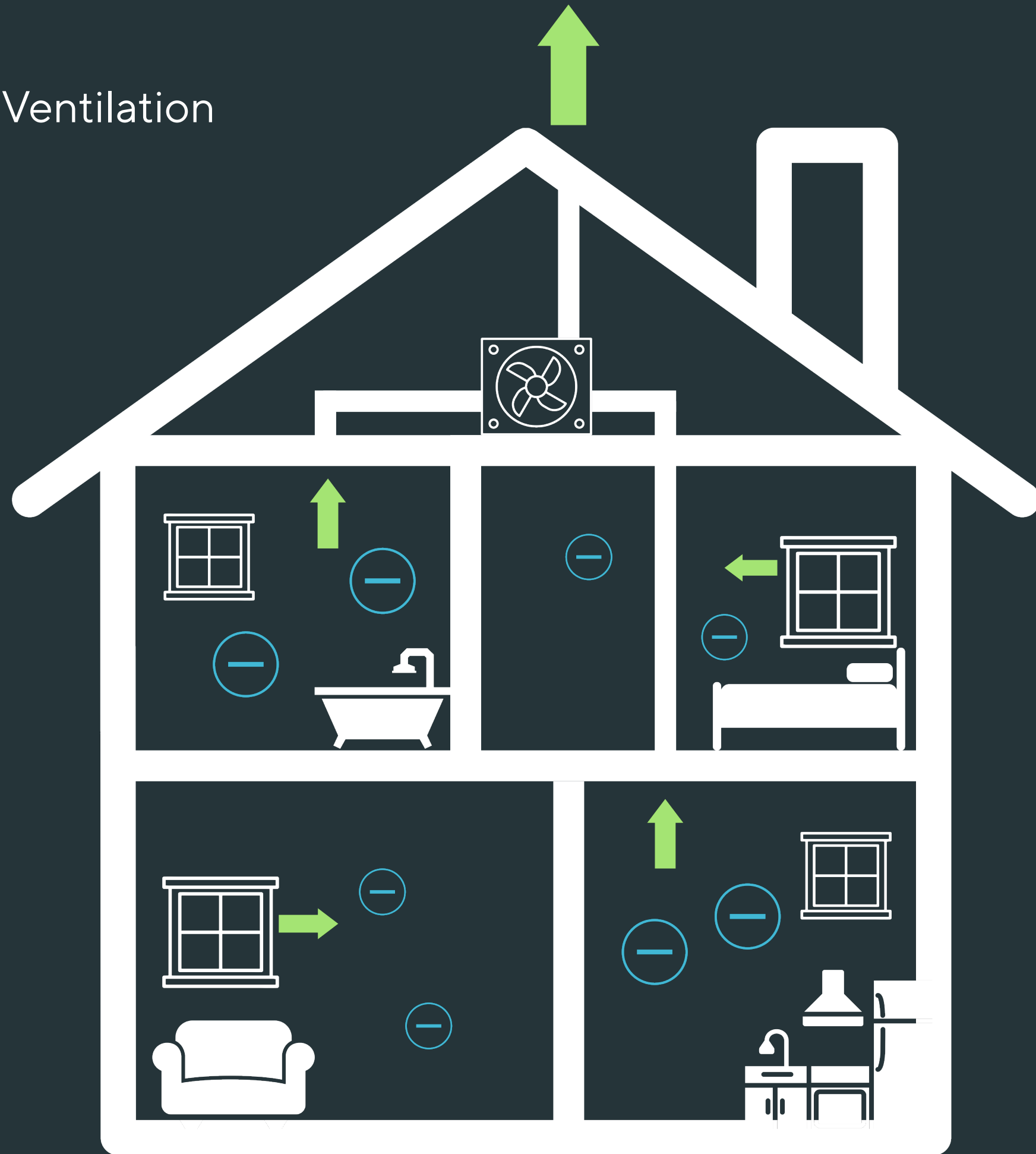
# Ventilation Basics

## Continuous Mechanical Extract Ventilation



# Ventilation Basics

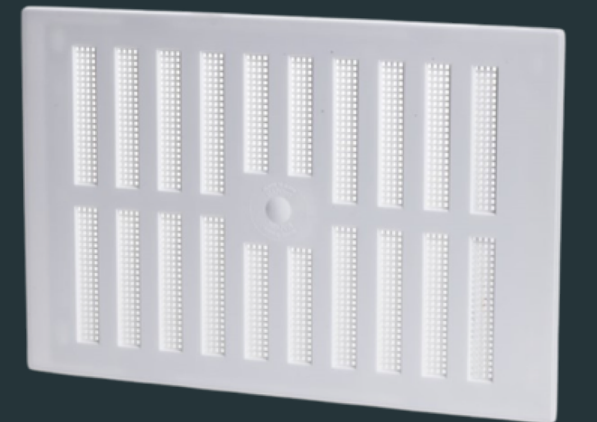
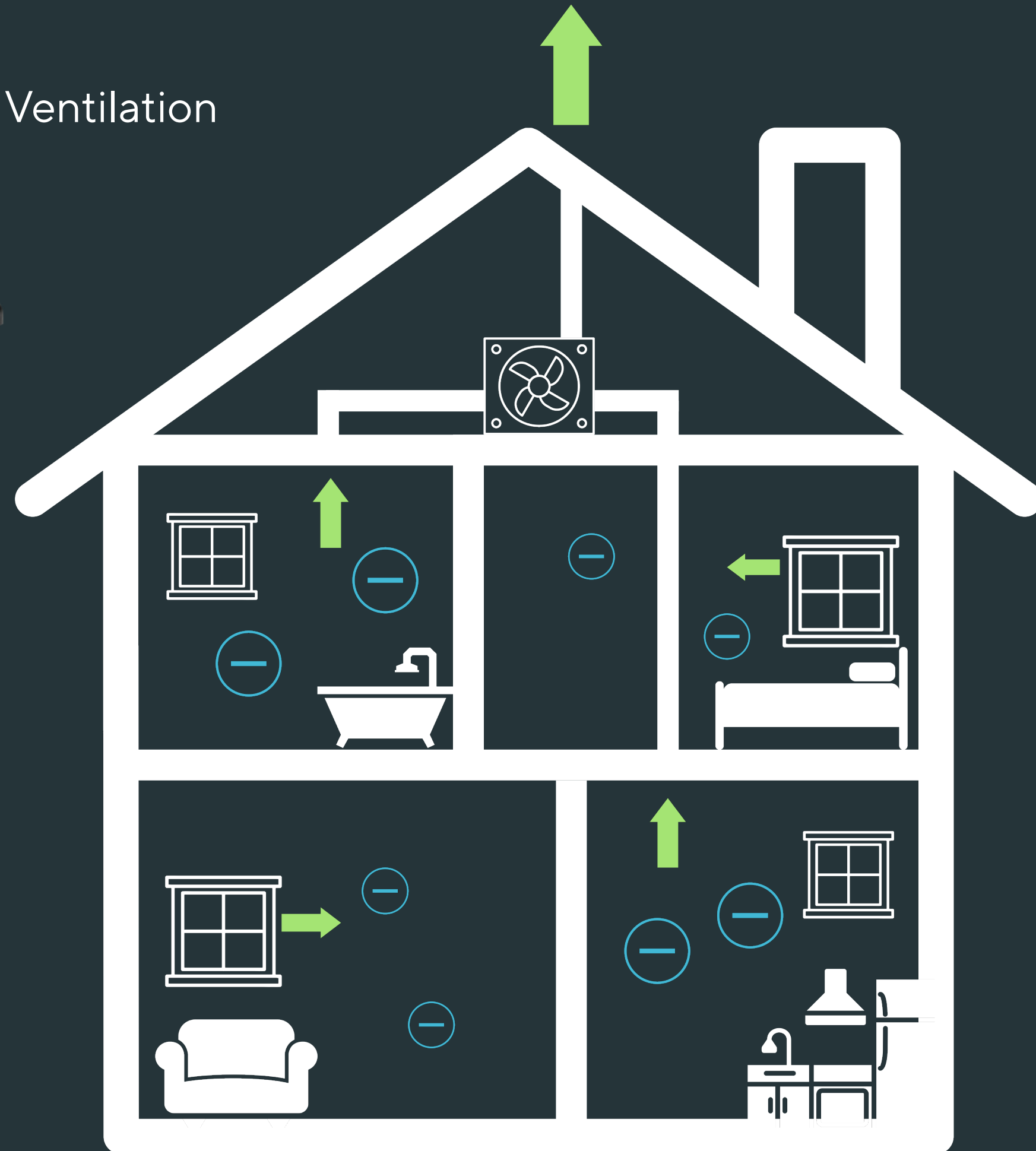
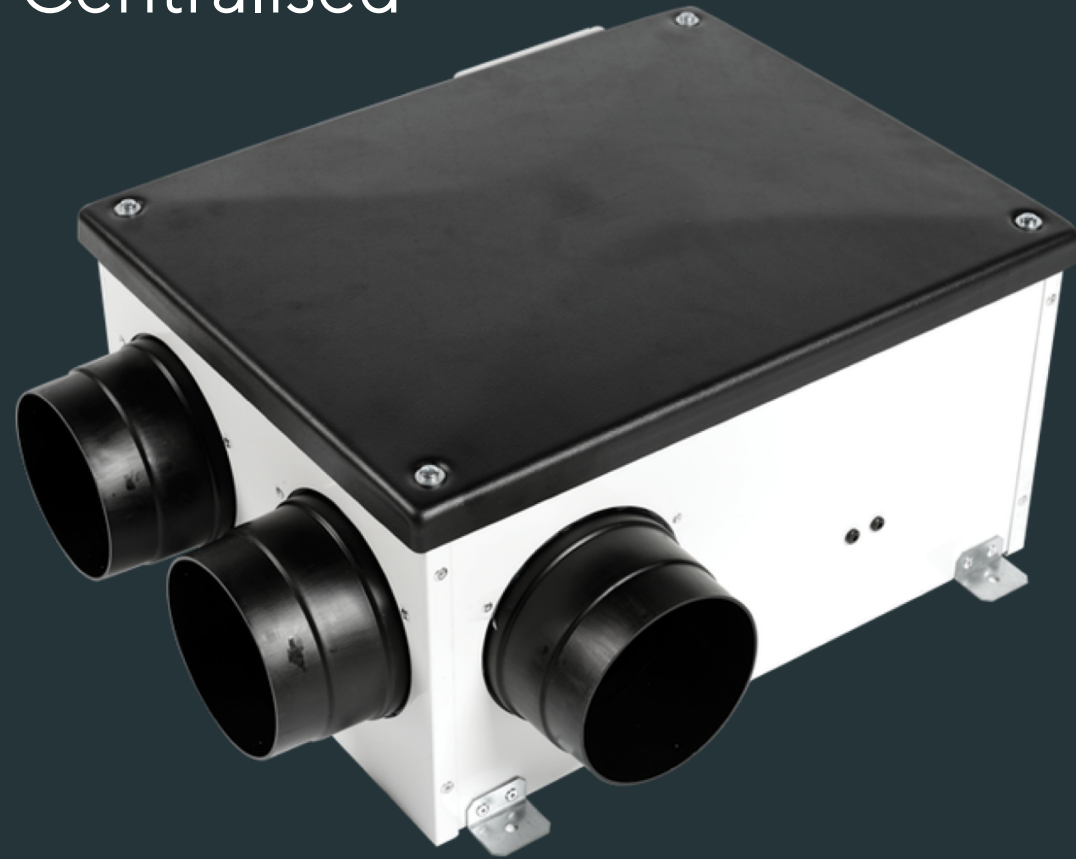
Continuous Mechanical Extract Ventilation





# Ventilation Basics

Continuous Mechanical Extract Ventilation  
Centralised



# Ventilation Basics

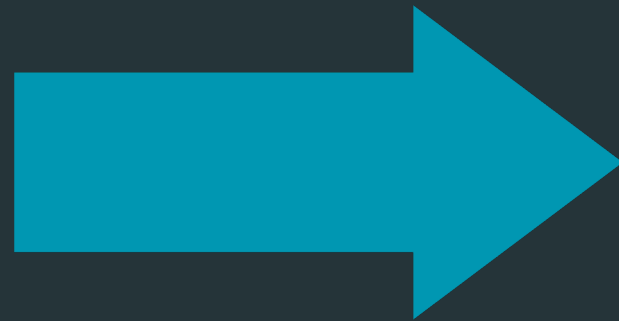
Continuous Mechanical Extract Ventilation  
De Centralised





# Ventilation Basics

Continuous Mechanical Extract Ventilation  
De Centralised



# Ventilation Basics

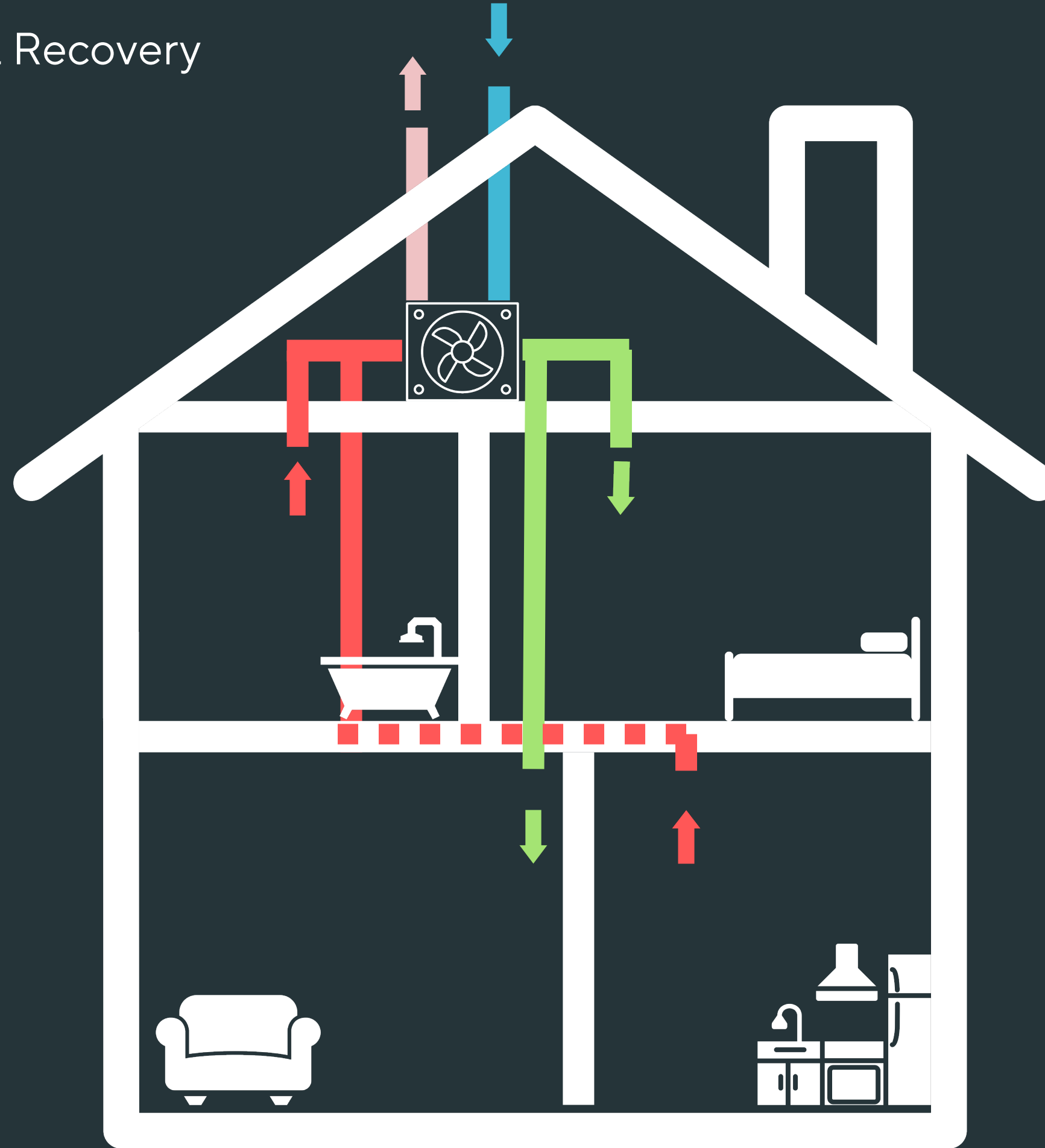
Mechanical Ventilation with Heat Recovery





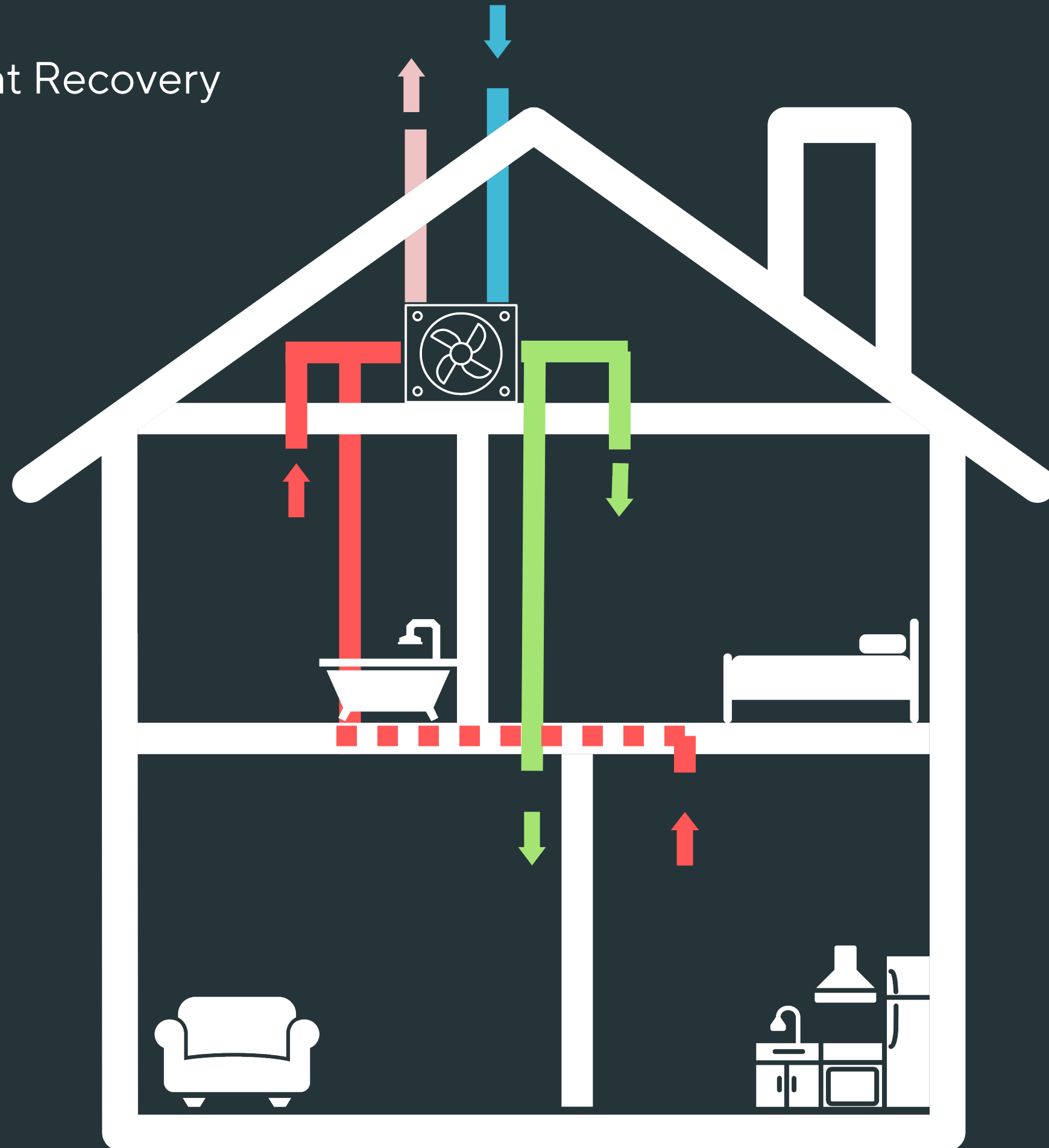
# Ventilation Basics

Mechanical Ventilation with Heat Recovery



# Ventilation Basics

Mechanical Ventilation with Heat Recovery





# Ventilation Basics

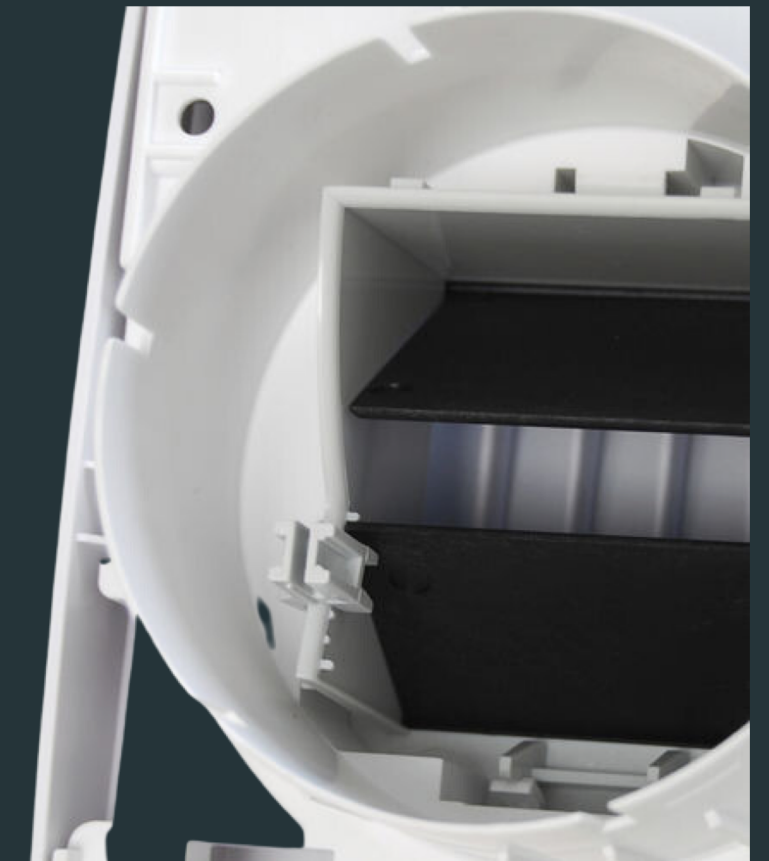
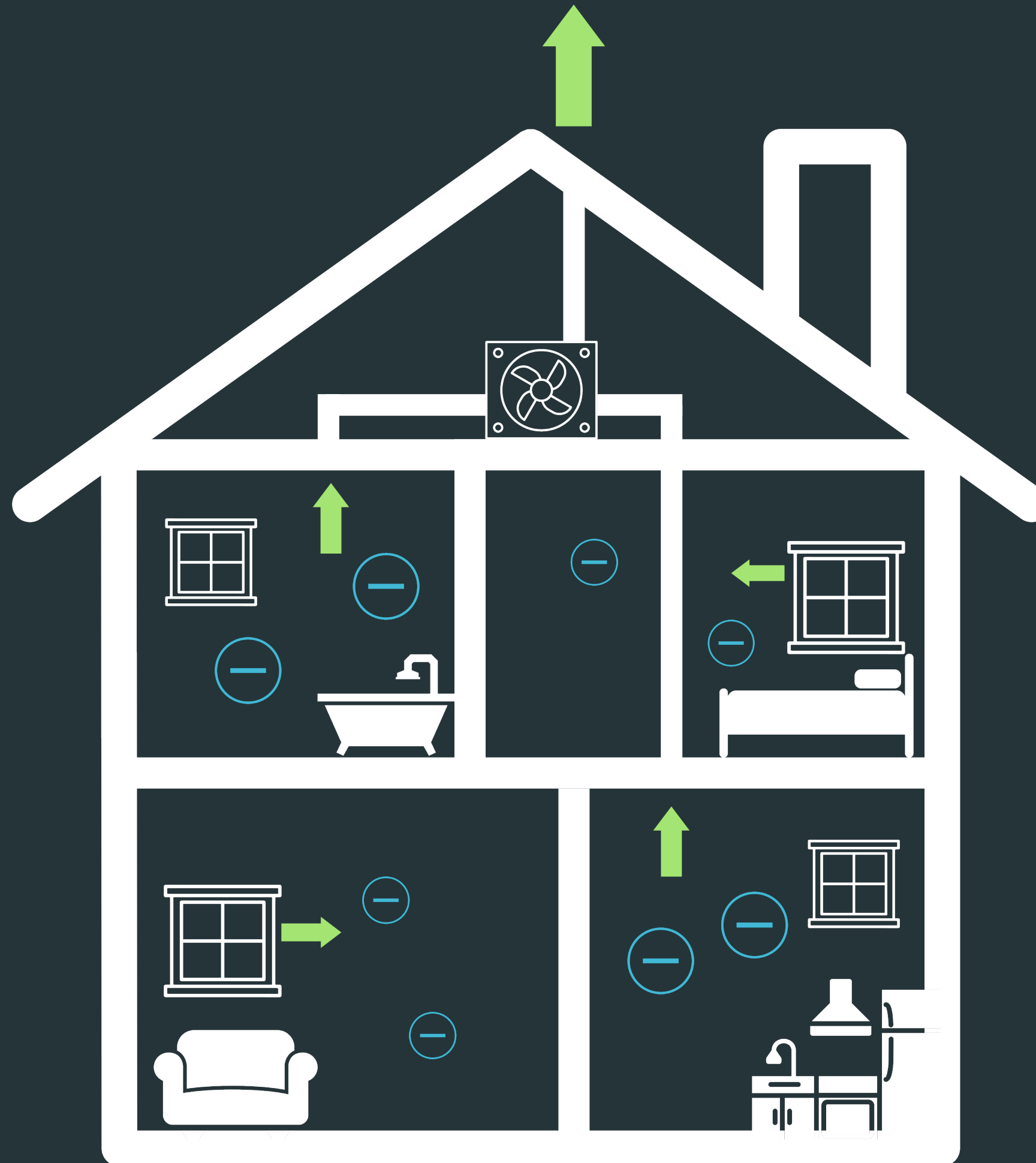
Mechanical Ventilation with Heat Recovery

Single room or decentralised



# Ventilation Basics

## Demand Controlled Ventilation





# Performance

## THREE PILLARS

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There are three pillars of adequate ventilation in homes.

Background Ventilation  
Local Exhaust Ventilation  
Purge Ventilation

And perhaps a 4th.....





# Measuring Performance



# Measuring Performance

MEASURING PERFORMANCE IS NOT

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# Measuring Performance

MEASURING PERFORMANCE IS....

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# Manage what you measure

MEASURING AIR QUALITY





# See The Air

## MONITORING

It is a fast-moving world, and we can see the air like never before.

There are effectively 3 levels of environmental monitoring.

1. Research Level
2. Practitioner Level
3. Low cost





# Monitoring

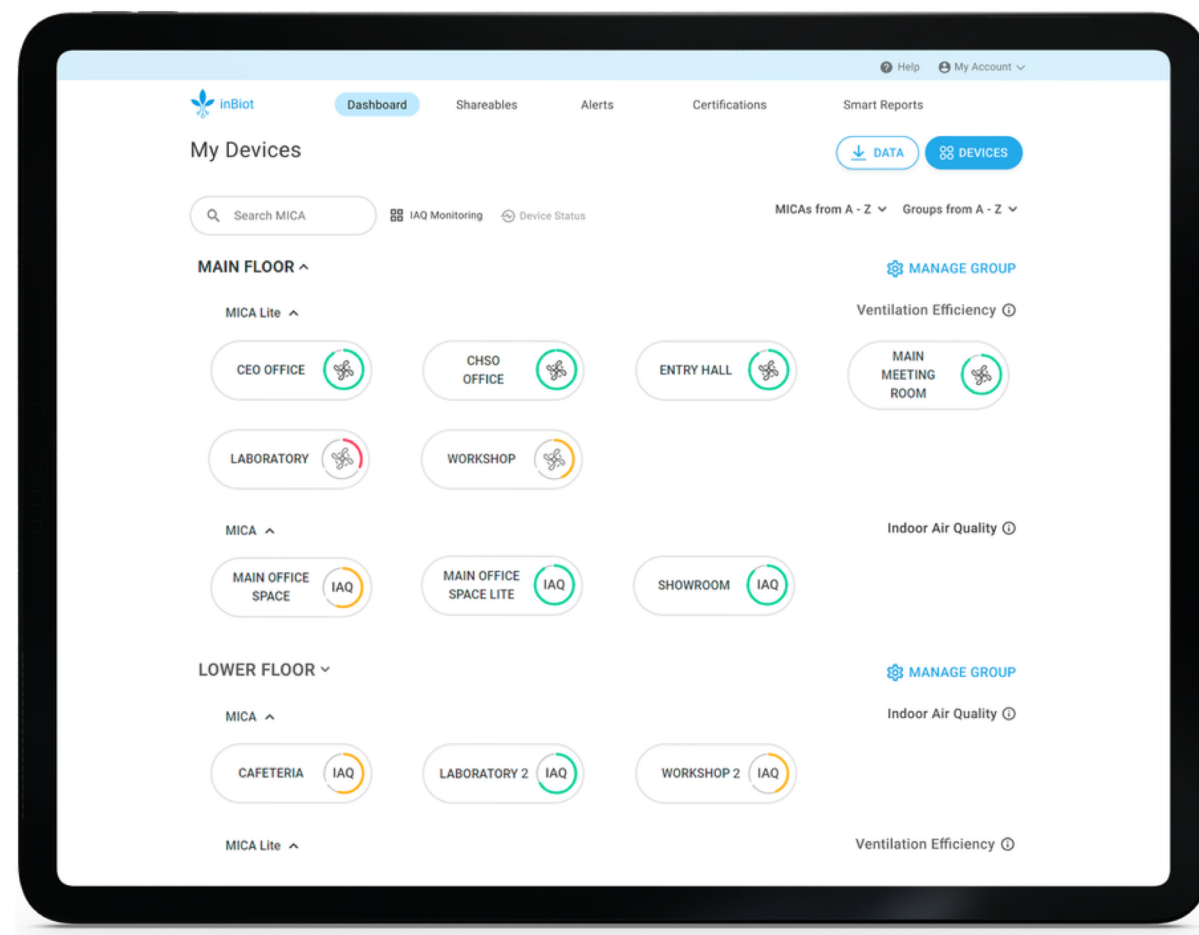


Some may be battery-powered, others plugged in.

There is a range of connectivity options from none to gsm, wifi, LoRaWAN,...

Some will have screens that display numbers, and others will have traffic light systems.

Most good ones will come with a connected dashboard, integration and reporting proposition.



# See The Air

## MONITORING

In housing, service providers can use these devices to improve communication with tenants, provide better service, and monitor risks.

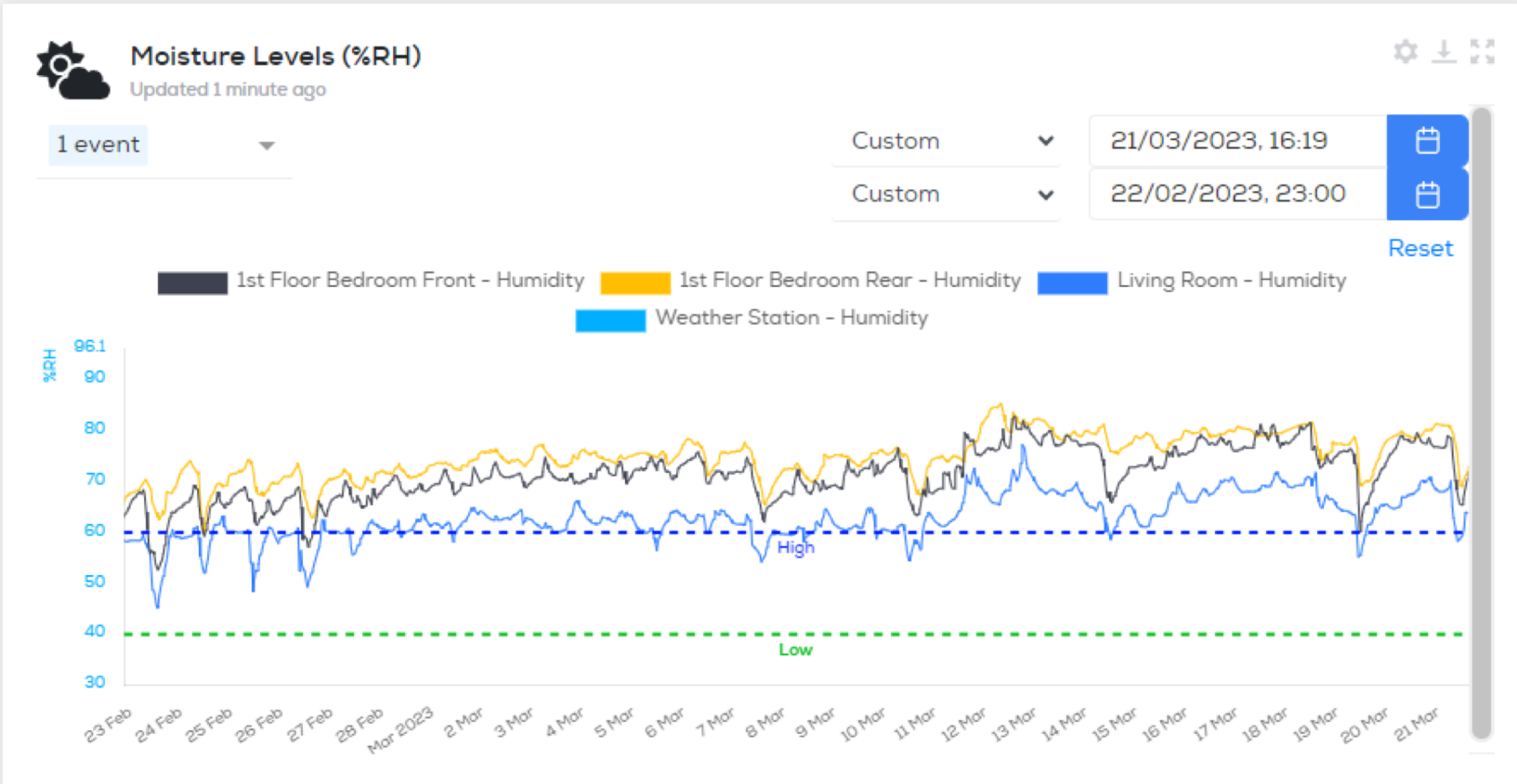
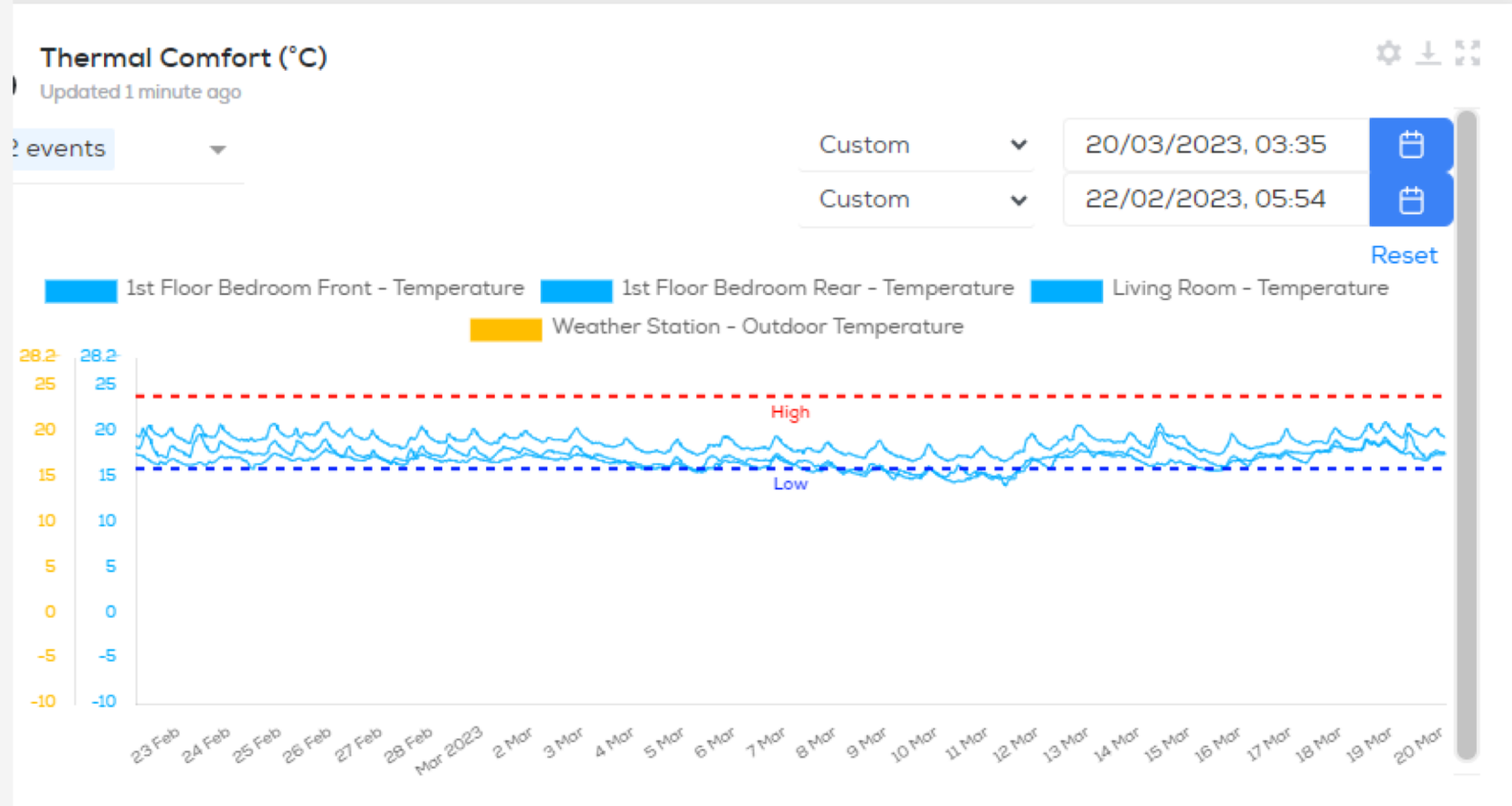
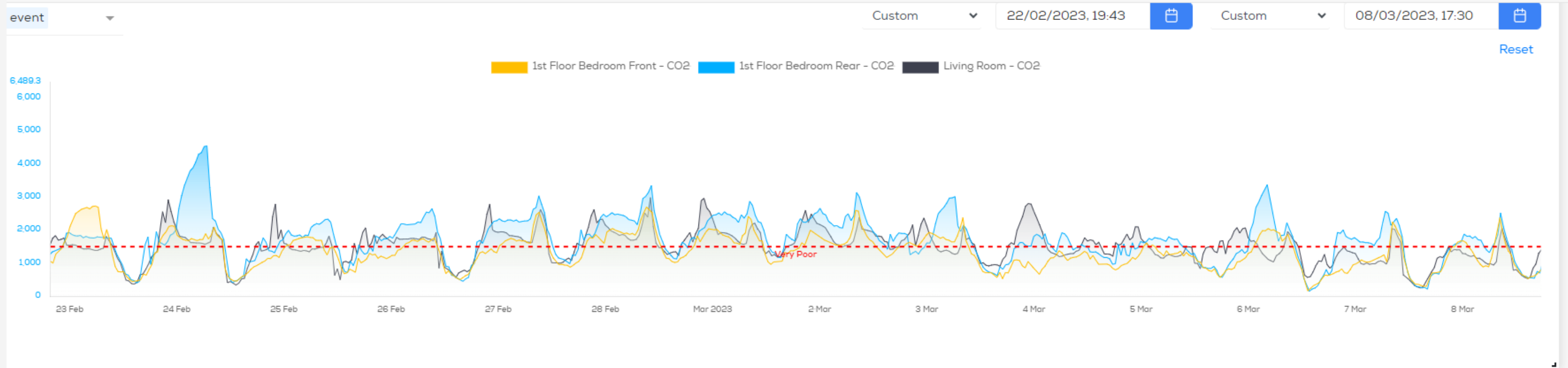
For example, Fuel Poverty, Condensation Damp and Mould, Empty Properties, and the effectiveness of interventions like replacing ventilation or insulation





# Environmental Monitoring

Lets look at some data







Radon



# Thank you