IEQ Monitoring and Reporting (Your simple IoT solution to connect and monitor your building)

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Introduction

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Scan the QR
code for more
details

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Agenda

	Topics
1	What is IAQ and IEQ ?
2	Symptoms of Unhealthy Air Quality
3	Various Options for IAQ and IEQ within Siemens BP
4	Connect Box & Cost Comparison with various IAQ and IEQ options
5	Connect Box and Who are your Target customers, our Action items
6	IAQ Setup & its live Demo
7	Q&A

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In continuation to my previous topics on Human Centric Lighting & HVAC controls

Human Centric Lighting Control

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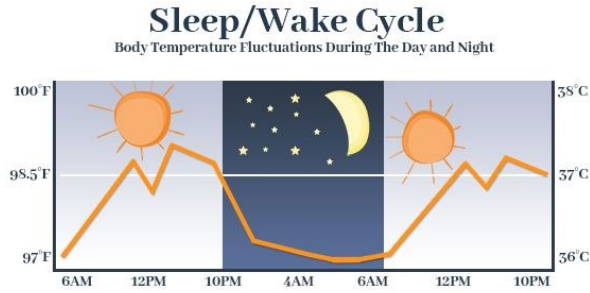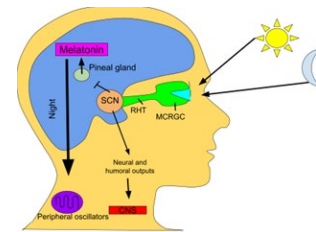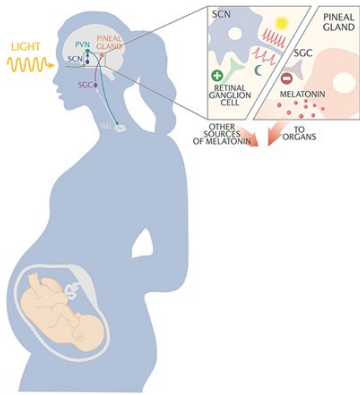
What is IAQ

We Spend 90% of Our Time Indoors.

INDOOR AIR QUALITY (IAQ) : MONITOR, MEASURE AND ANALYZE THE AIR WE BREATHE DAILY

Indoor air is up to **5X** **MORE POLLUTED** than outdoor air

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What is IAQ

POOR **INDOOR AIR QUALITY** IS A SERIOUS THREAT

Indoor Generation is at Health risk

Tired of feeling tired all the time?

Perception versus reality

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What is IAQ

Humidity control

Limit colds and flu
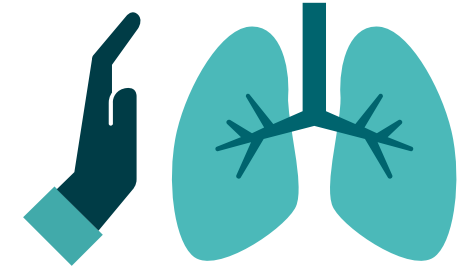
Fine dust control

Reduce risk of lung diseases

CO_2 control

Perform up to 10 times better

VOC control

Detect hazardous gas emissions

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Level of CO$_2$ in Air we Breathe-in

RDG200 THERMOSTATS
Create a perfect **atmosphere**

Serious pollution
Adverse health effects expected ≥1200 ppm

Ordinary air
Complaints of stiffness and odors ≥800 <1200

Fresh
Healthy, normal outside level <800

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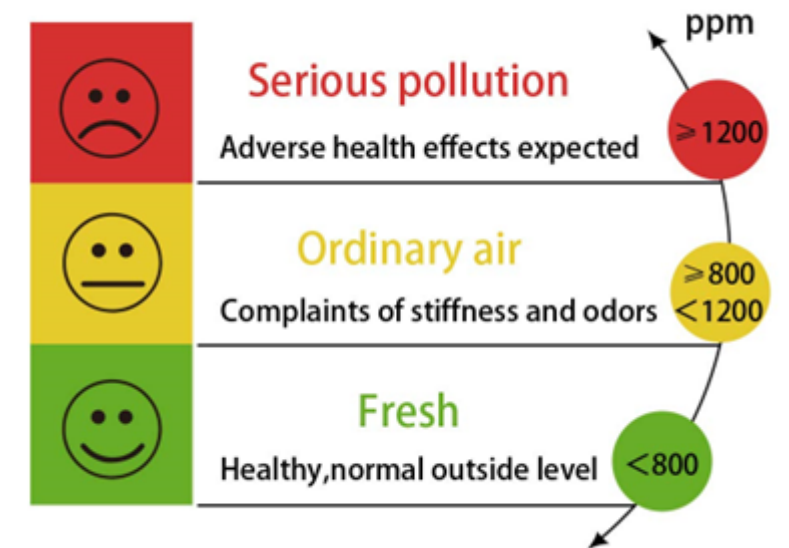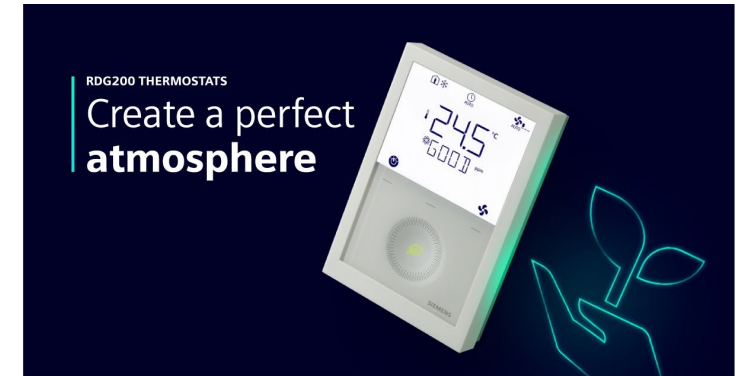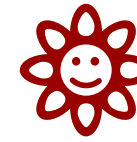
What is IAQ

Recommended and typical levels of CO_2

	CO_2 levels in reality	CO_2 level (ppm)
	EN 13779 (2007) recommendation	400 – 600
	Considered good[1]	<1,000
	Level often found in offices[1]	1,500
	Levels often found in meeting rooms and schools[2]	1,500 – 3,000+
	Regulatory limit for a workplace[1]	5,000
	Unconscious, DEATH	>50,000

References : 1) Re-thinking Organizational Savings through HVAC, REHVA Journal, April 2018 |
2) Airborne particulate matter in schools classrooms in Northern Italy: Int. J. Environ. Res. Public Health, 2014

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What is IAQ

Increase productivity

Effects of CO_2

Score in tests at 1,000 and 2,500 ppm

Basic activity	Use of information	Initiative
35% reduction	**60%** reduction	**91%** reduction

Performance 100%

1,000 ppm · 2,500 ppm · 1,000 ppm · 2,500 ppm · 1,000 ppm · 2,500 ppm
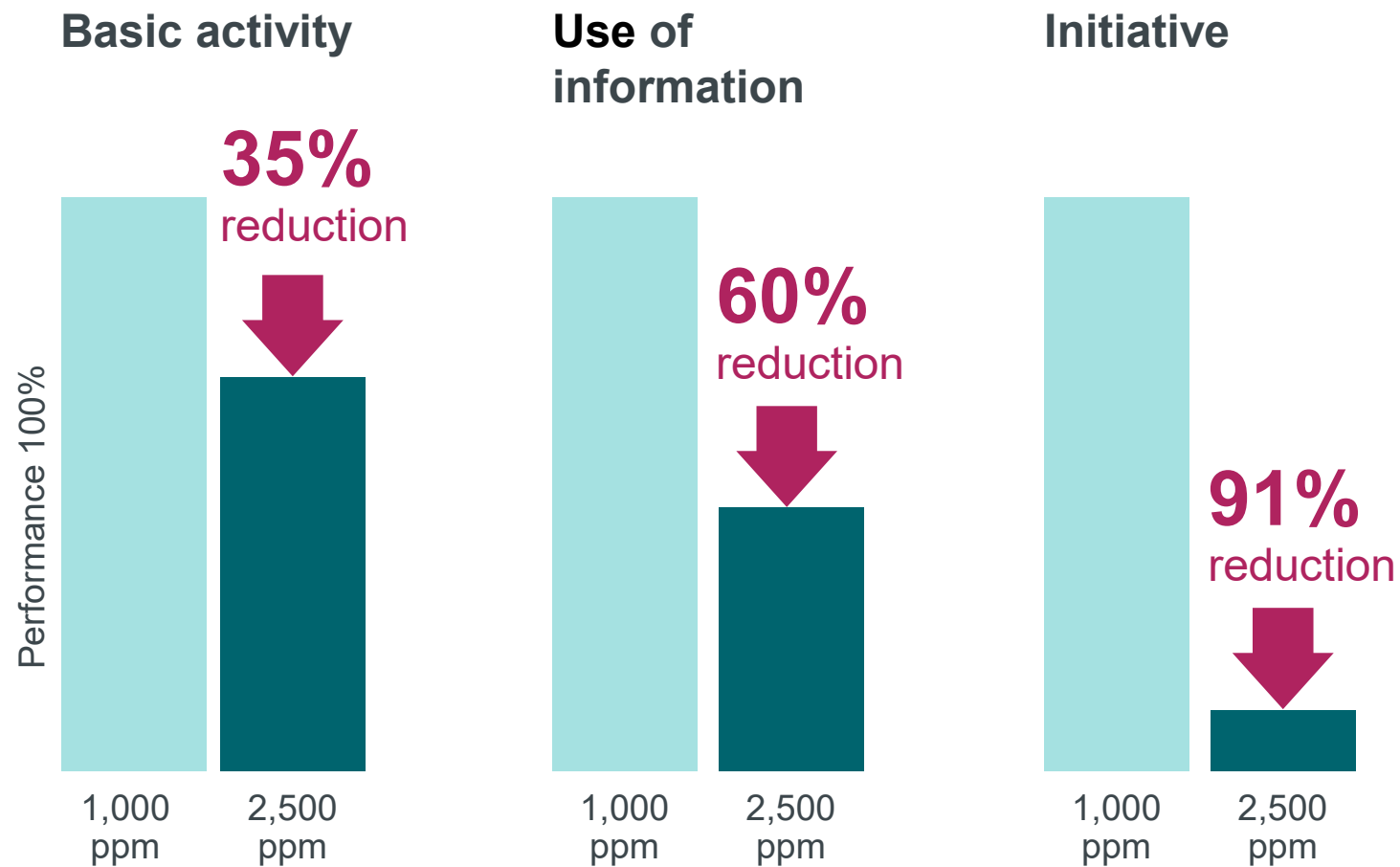
Note: <1'000 ppm is considered good

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Effective ways to reduce CO2 levels

Enhance your airflow and ventilation

Invest in indoor plants

Maintain your HVAC system well

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What is IAQ

Relative Humidity

RH represents amount of water in air in percentage

Relative Humidity 0%
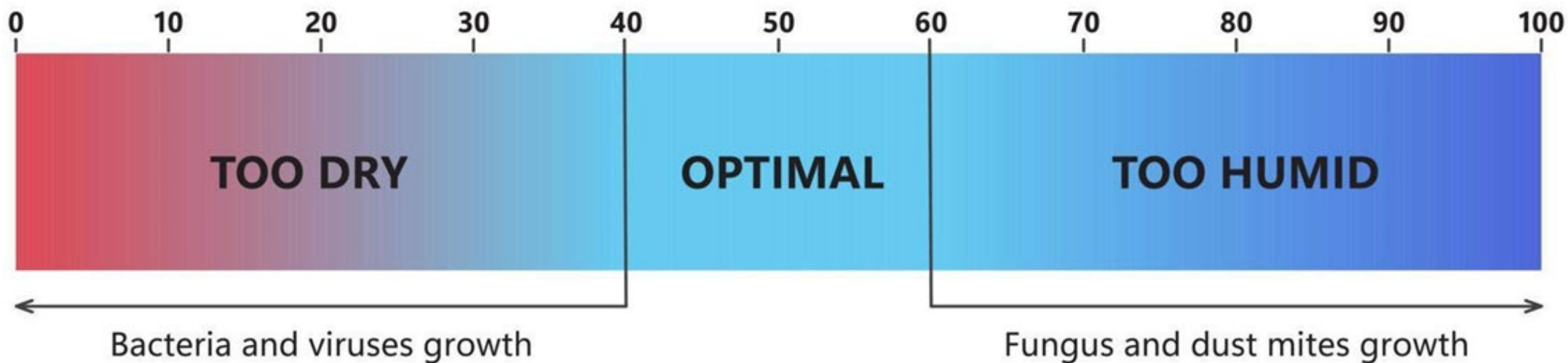Relative Humidity 50%
Relative Humidity 75%
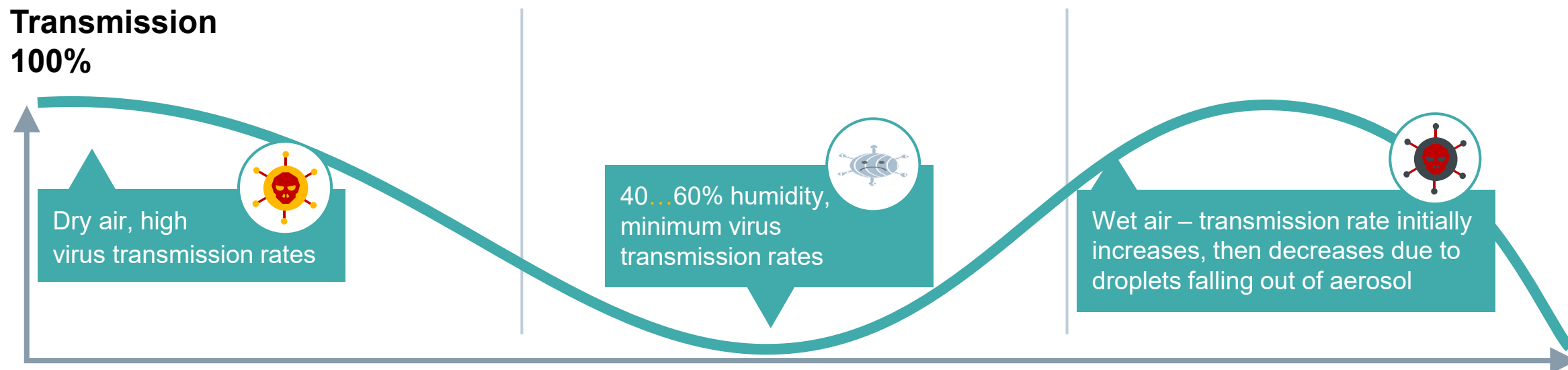Relative Humidity 100%

0 10 20 30 40 50 60 70 80 90 100

TOO DRY   OPTIMAL   TOO HUMID

Bacteria and viruses growth

Fungus and dust mites growth

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What is IAQ

How does humidity affect transmission rates?

Transmission
100%

Dry air, high virus transmission rates

40…60% humidity, minimum virus transmission rates

Wet air – transmission rate initially increases, then decreases due to droplets falling out of aerosol

0% r.h.
Low humidity
Virus transmission rates are high as the viruses remain active and in an aerosol.

40-60% r.h.
Medium humidity
The viruses are deactivated, ensuring minimum virus transmission rates.

100% r.h.
High humidity
As the air becomes wetter, the transmission rate initially increases, then decreases due to droplets falling out of aerosol.
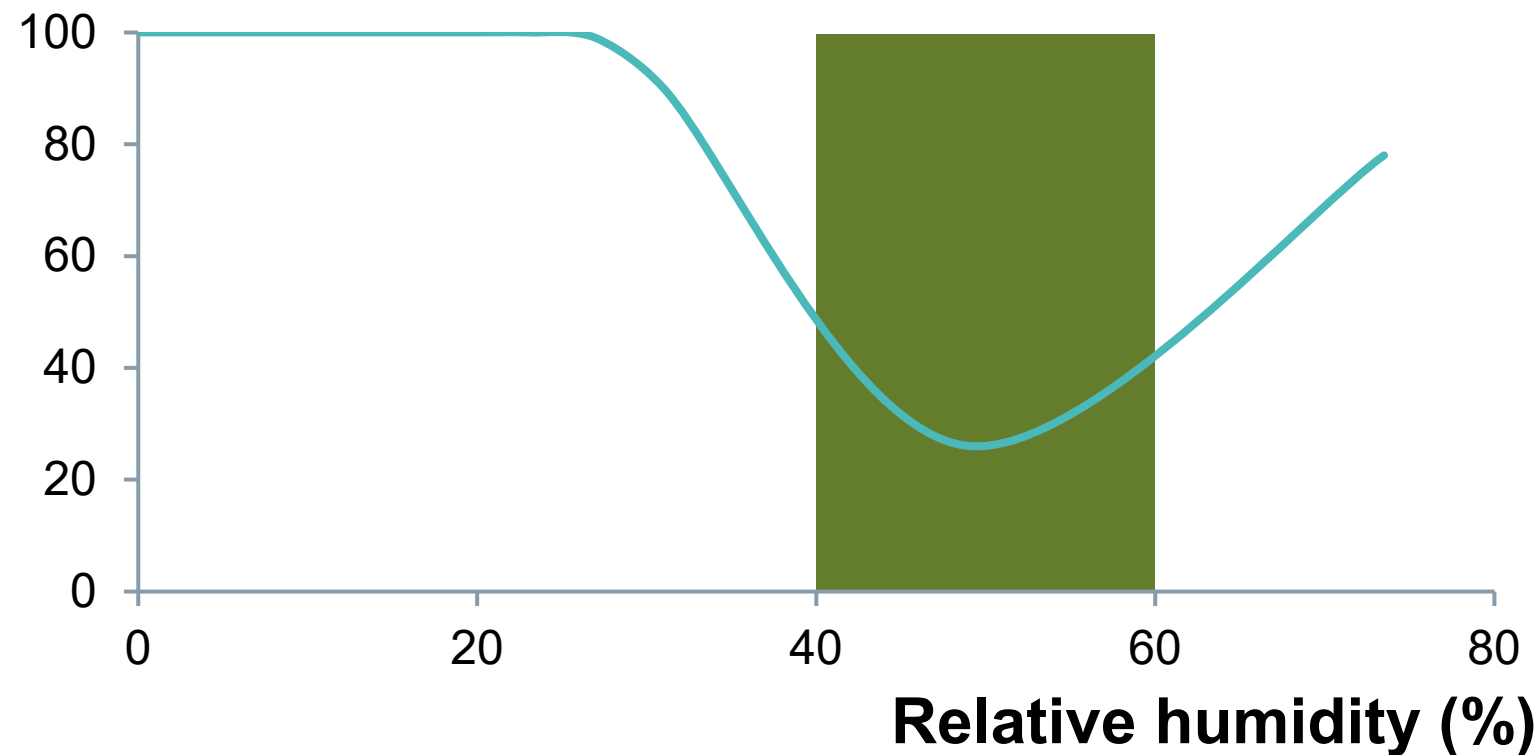
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What is IAQ

Recommendations for humidity control

Control of relative humidity between 40 and 60%:

- Colds and flu reduced to one third

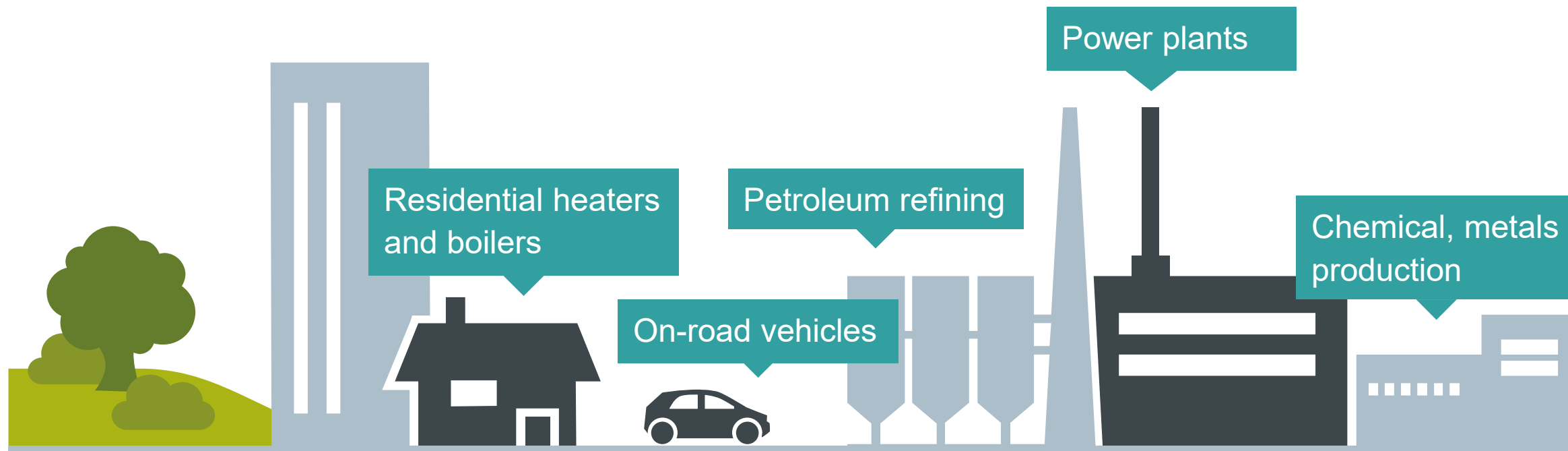- Fewer staff absences

- Higher productivity

Transmission (%)

100

80

60

40

20

0

0   20   40   60   80

Relative humidity (%)

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Humidity Control

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What is IAQ

Hazard Level	VOC μg/m³
Good	100
Moderate	200
Poor	300
Unhealthy	400
Very Unhealthy	500
Hazardous	600
Extreme	700

What is IAQ

Where do VOCs come from?

Outdoors

Power plants

Residential heaters and boilers

Petroleum refining
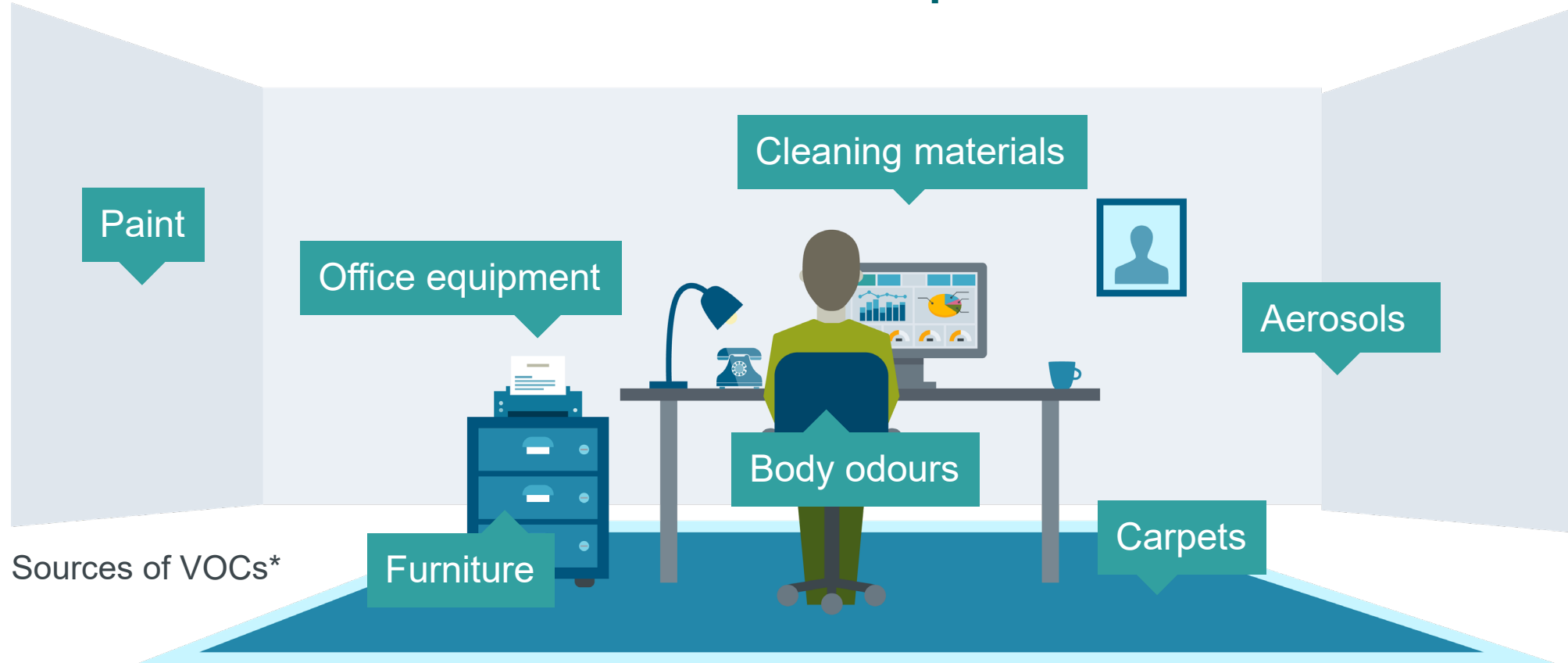
On-road vehicles

Chemical, metals production

All outdoor VOCs contribute to global warming, ozone layer depletion and tropospheric ozone formation

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What is IAQ

VOC build-up

Paint

Office equipment

Cleaning materials

Aerosols

Body odours

Sources of VOCs*

Furniture

Carpets

Help avoid headaches and respiratory problems by limiting VOCs

* VOC = Volatile Organic Compounds

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What is IAQ

Effects on human body

Short-term effects
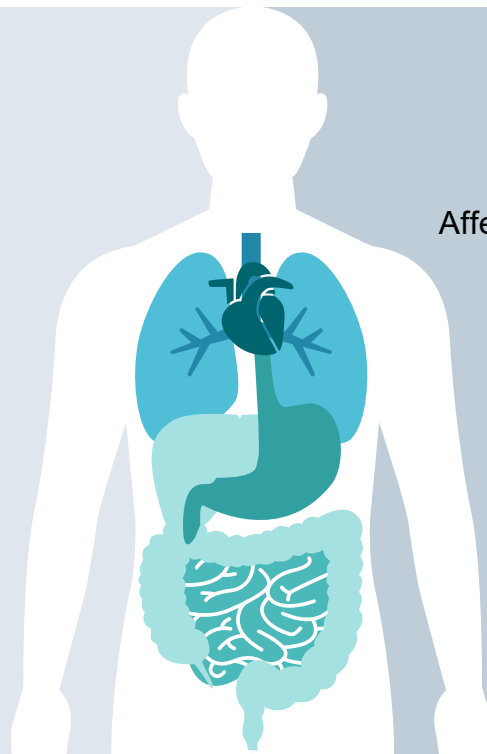
- Headache
- Nose, throat, eye inflammation
- Coughing, painful breathing
- Pneumonia, bronchitis
- Skin irritation

Long-term effects

- Affects central nervous system (headache, anxiety)
- Cardiovascular diseases
- Respiratory diseases (asthma, cancer)
- Impacts liver, spleen, blood
- Impacts reproductive system

The level of impact depends on …

- concentration of VOCs,
- exposure time,
- exposure frequency

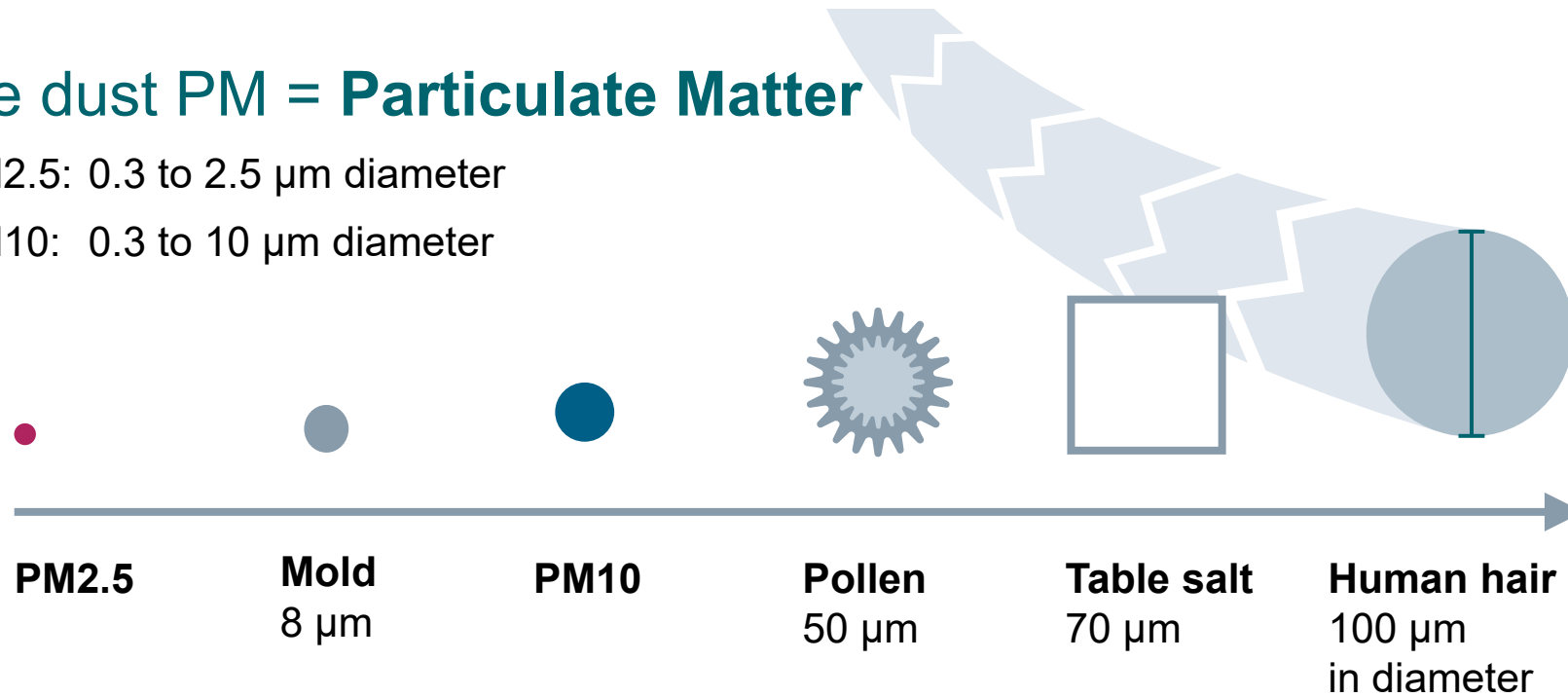Some organic substances cause cancer in animals, some are suspected to cause cancer in humans*

* United States Environmental Protection Agency

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What is IAQ

Fine dust pollution matters to everyone

Fine dust PM = **Particulate Matter**

- PM2.5: 0.3 to 2.5 µm diameter
- PM10: 0.3 to 10 µm diameter

PM2.5

Mold
8 µm

PM10

Pollen
50 µm

Table salt
70 µm

Human hair
100 µm
in diameter

Sources

Vehicle exhaust

Industry

Power stations

Fuel burning

Natural sources

Fine dust pollution is a worldwide issue

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What is IAQ

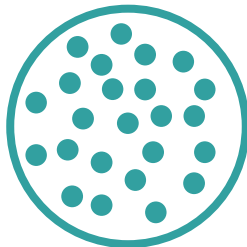## The danger of fine dust and smog

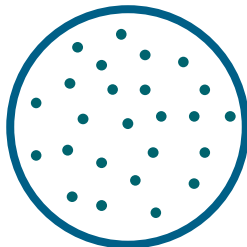### The damage

PM10+
10+ μm
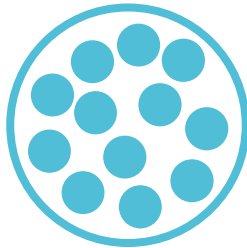
Blocked by nose

PM2.5 – 10
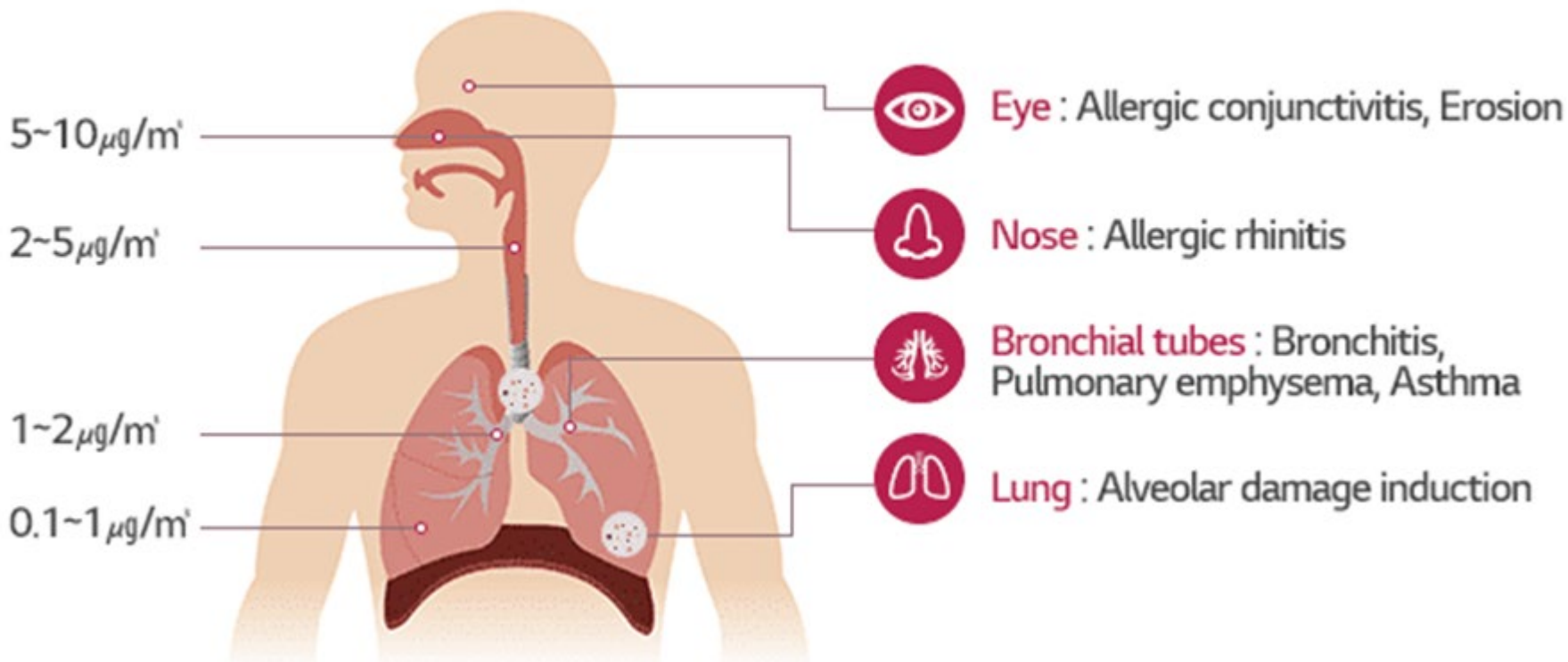2.5 – 10 μm

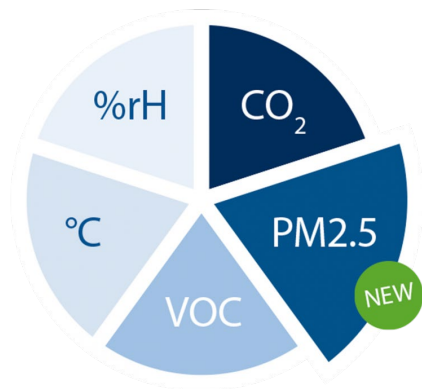Blocked in mouth and throat

PM2.5
2.5 μm

Can penetrate deep into the lungs, causing lung and cardiovascular diseases

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What is IAQ

Fine Dust PM 10 & PM2.5

Dust size absorbable in the body

5~10 μg/m³

2~5 μg/m³

1~2 μg/m³

0.1~1 μg/m³

Eye : Allergic conjunctivitis, Erosion

Nose : Allergic rhinitis

Bronchial tubes : Bronchitis, Pulmonary emphysema, Asthma

Lung : Alveolar damage induction

%rH | CO₂ | PM2.5 | VOC | °C | NEW

Air quality
150
35   200
12   300
PM2.5
0   999

Temperature	22.0	°C
Humidity	47	%
PM2.5	20	ug/m3
VOC	0.01	mg/m3

PM2.5
113 μg/m³
Poor

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IAQ Index

IAQ Index			
PM2.5	**VOC**	**CO2**	
$\mu g/m^3$	$\mu g/m^3$	ppm	Hazard Level
<12	100	700	Good
35	200	800	Moderate
56	300	1100	Poor
150	400	1500	Unhealthy
250	500	2000	Very Unhealthy
300	600	3000	Hazardous
500	700	5000	Extreme

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What is Indoor Environmental Quality (IEQ)

The conditions inside the building. It includes air quality, but also access to daylight and views, pleasant acoustic conditions, and occupant control over lighting and thermal comfort
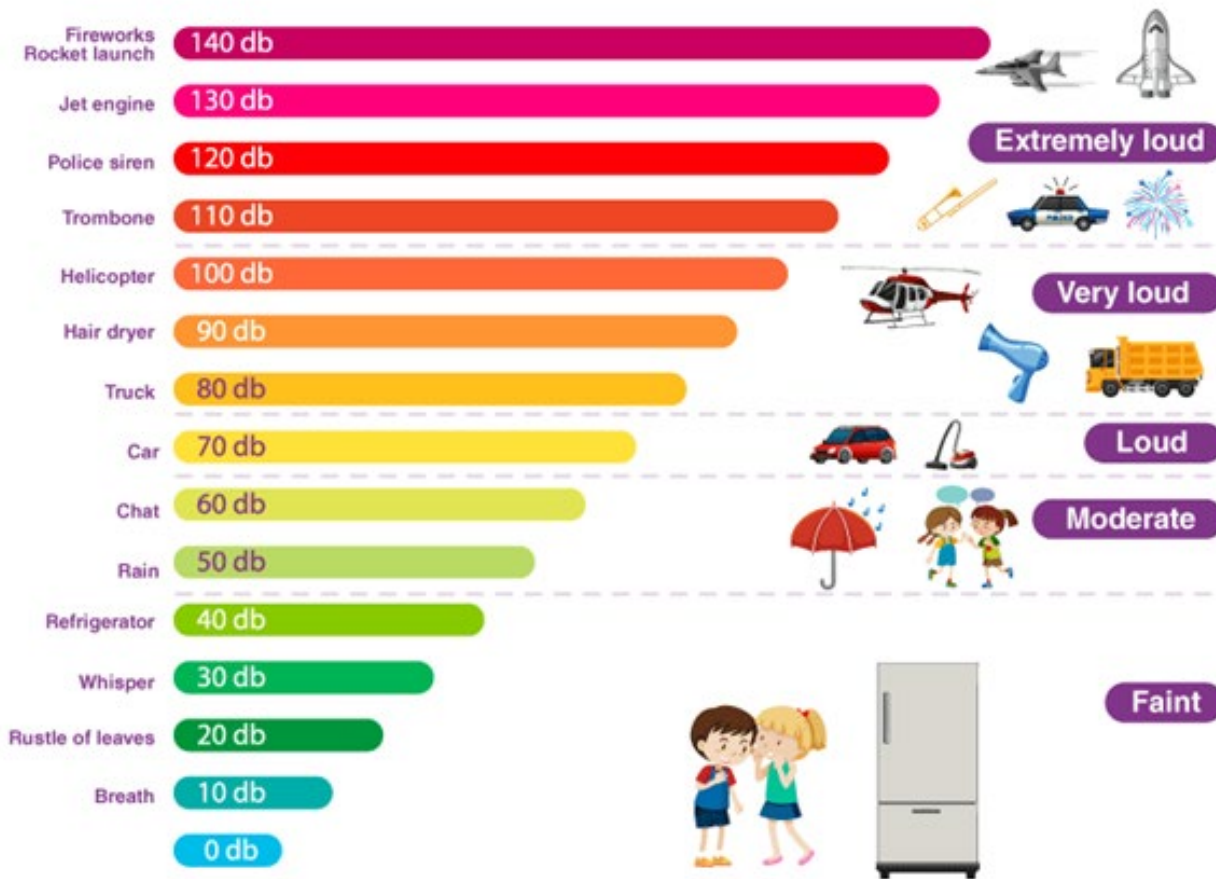

WHAT is IEQ Vs IAQ ?

IAQ is about the air that we breathe, whereas IEQ is about the what we breathe, see, hear and feel inside a building.

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Sound Pollution   Indoor Environmental Quality (IEQ)

A human can normally hear sounds between 0 and 130 dB Prolonged exposure to loud noises (75 dBA over eight hours a day for years) can lead to hearing loss

Sound	Level	Category
Fireworks Rocket launch	140 db	Extremely loud
Jet engine	130 db	
Police siren	120 db	
Trombone	110 db	
Helicopter	100 db	Very loud
Hair dryer	90 db	
Truck	80 db	
Car	70 db	Loud
Chat	60 db	Moderate
Rain	50 db	
Refrigerator	40 db	
Whisper	30 db	Faint
Rustle of leaves	20 db	
Breath	10 db	
	0 db	

MUSIC FOR HEADACHES

SOUND POLLUTION

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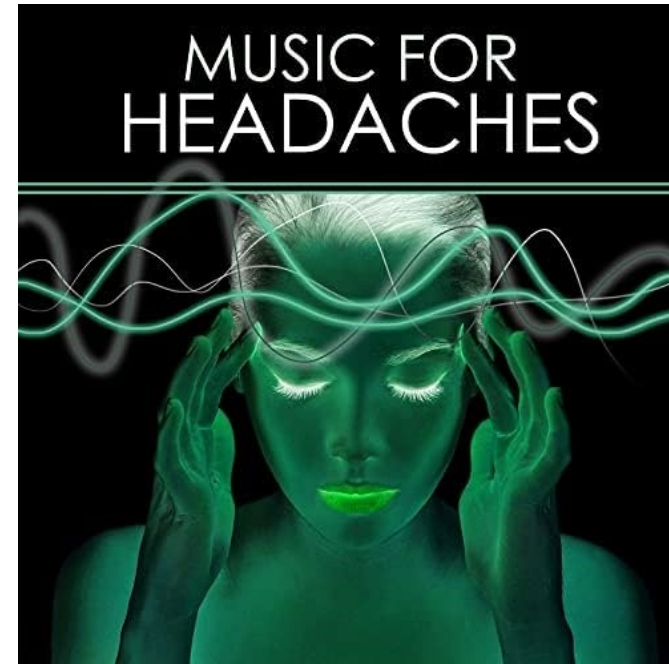
Tired of feeling tired all the time?

Human Centric Lighting Control

LIGHT (lx)	Effect
0-0.3	Blinding
0.4-2	Dark
3-10	Dusky
11-50	Gloomy
51-100	Dim
101-200	Satisfactory
201-400	Good
401-600	Bright
600+	Glaring

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IAQ & IEQ Options within Siemens Building Products

Wired 0-10 Volts or 4-20mAmps
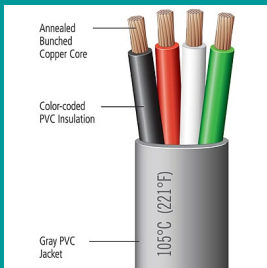
QSA2700D, QPA 2060 \...

IAQ

Wired BACnet IP BACnet MSTP

QNA2700D.BA1 & 2

IEQ

KNX- S mode / PL / LTE

QMX, RDG DB51, TC5 ....

IAQ

KNX- IoT to BACnet IP

QPA289, OCT200.KNBA

IAQ

LoRa WAN

QNA2820D.EU

IEQ

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IAQ Monitor Control and Purify

Monitor

Cloud gateway
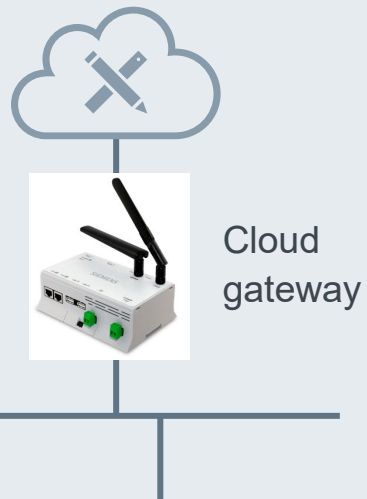
Siemens has sensors & cloud platform to monitor IAQ esp. in existing buildings

CO_2, r.h., VOC, fine dust

Control

Room sensor(s), thermostat, damper actuator and controller

Air
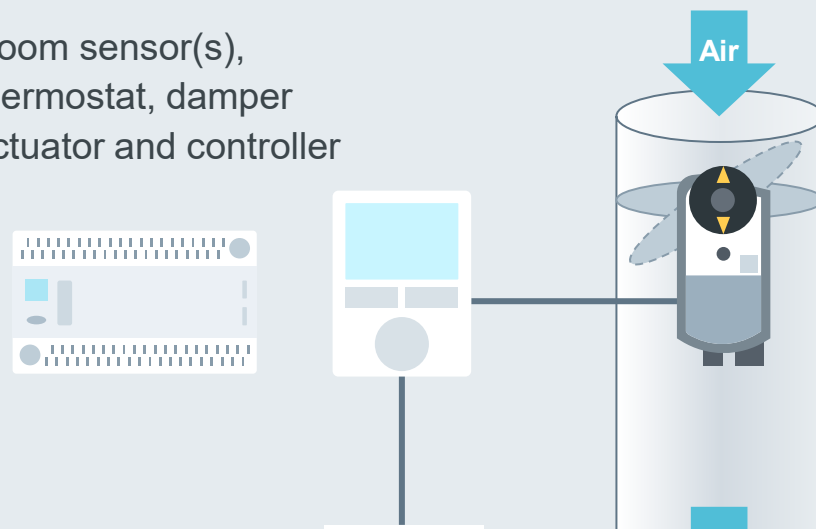
Siemens has wide range of sensors, controls & OEM-partners

CO_2, r.h., VOC
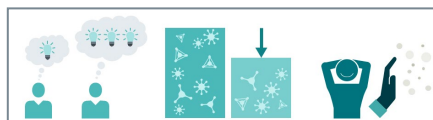
Purify

Room sensor and controller
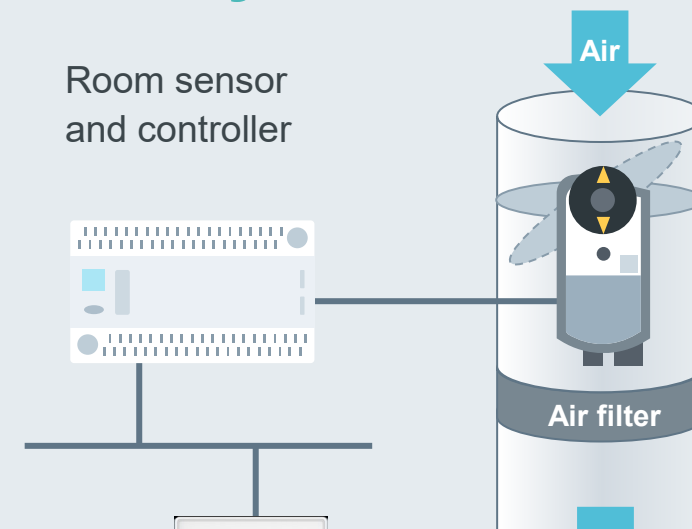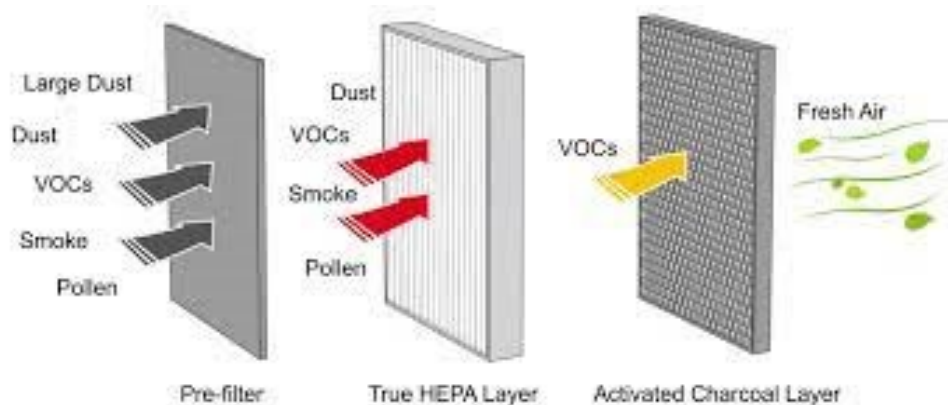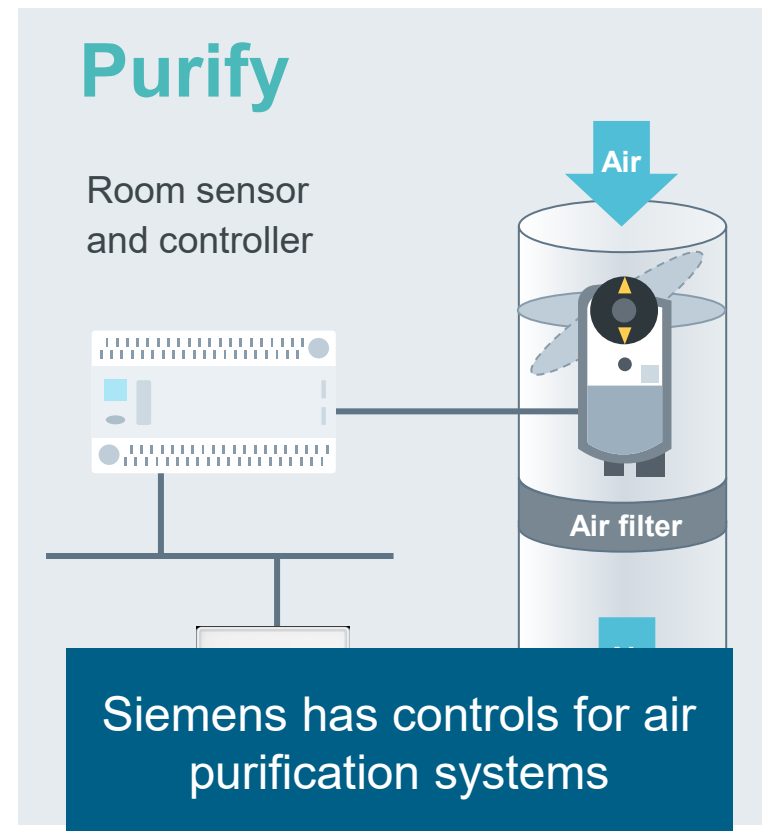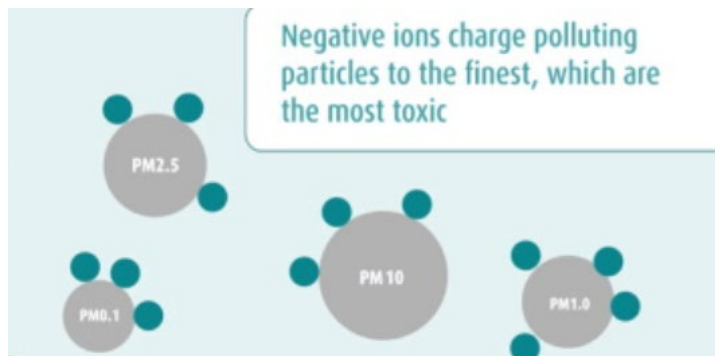
Air

Air filter

Siemens has controls for air purification systems

Fine dust

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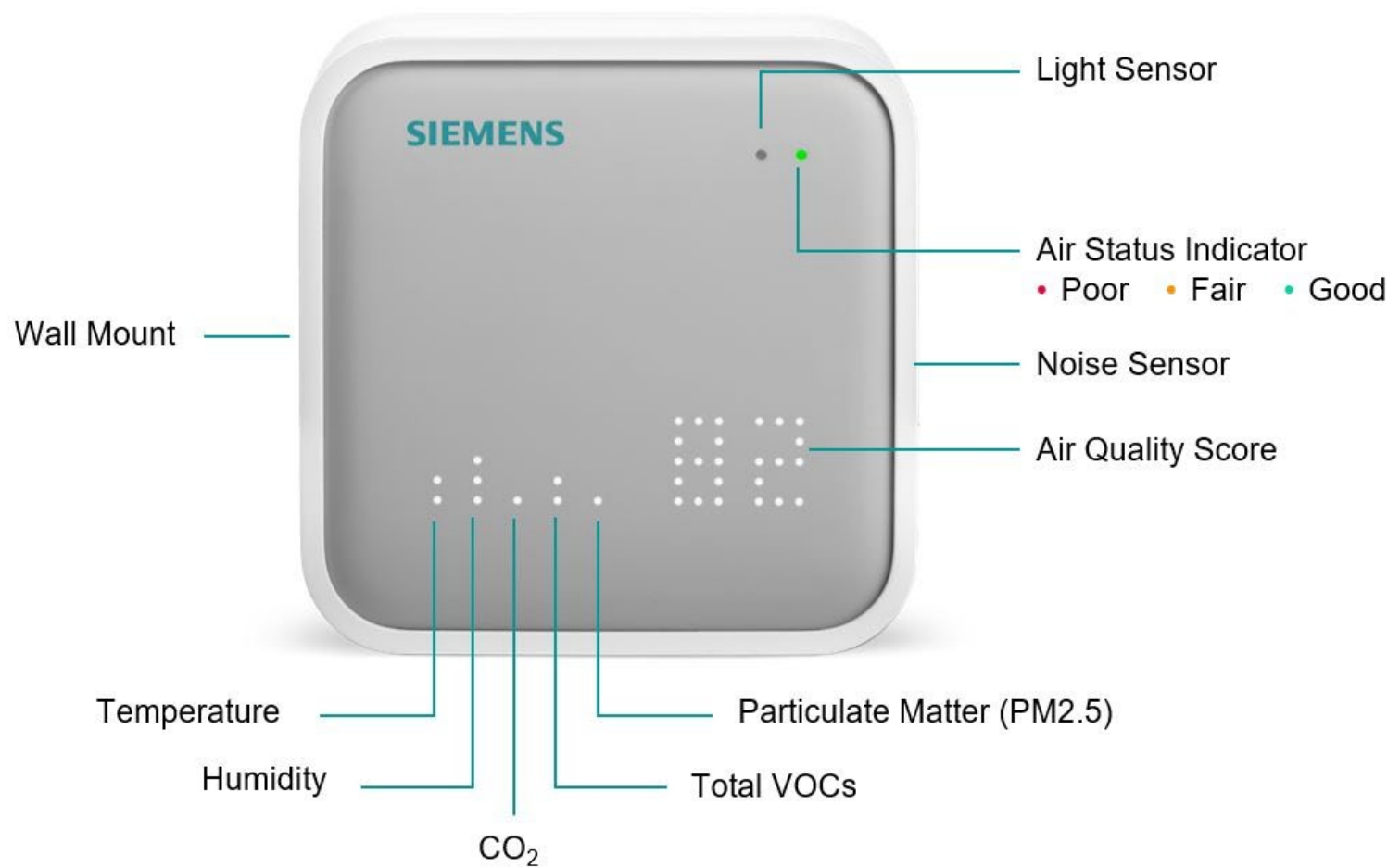
IAQ Monitor Control and Purify

Negative Ion Diffuser

Negative ions charge polluting particles to the finest, which are the most toxic

PM2.5

PM0.1

PM 10

PM1.0

Large Dust
Dust
VOCs
Smoke
Pollen

Pre-filter

Dust
VOCs
Smoke
Pollen

True HEPA Layer

VOCs

Fresh Air

Activated Charcoal Layer

Purify

Room sensor and controller

Air

Air filter

Siemens has controls for air purification systems
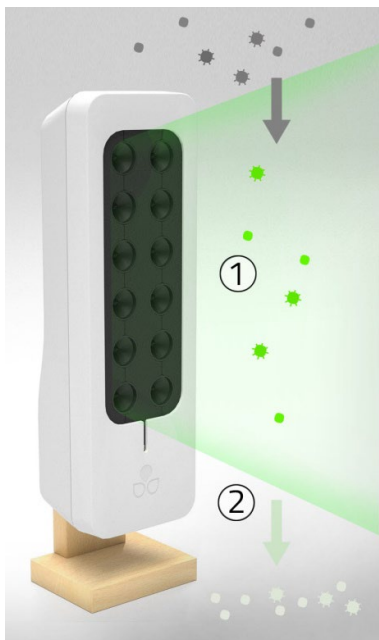
Fine dust

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Siemens IEQ Solution

QNA2700D.BA 1 (BACnet IP)

QNA2700D.BA 2 (BACnet MSTP)

ASHRAE BACnet™

Light Sensor

Air Status Indicator
• Poor   • Fair   • Good

Noise Sensor

Air Quality Score

Wall Mount

Temperature

Humidity

CO$_2$

Total VOCs

Particulate Matter (PM2.5)

WELL PLATINUM — INTERNATIONAL WELL BUILDING INSTITUTE

RESET — HEALTHY BUILDINGS — INTERNATIONAL STANDARD

U.S. GREEN BUILDING COUNCIL — USGBC®

INTERNATIONAL LIVING FUTURE INSTITUTE℠

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Connect Box (Your simple IoT solution to connect and monitor your building)

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Why Connect Box ?

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Energy Performance of Building Directive

A bigger challenge
Mastering the infrastructure

Operating costs

User satisfaction

Environmental impact

Legal constraints

Operator

EPBD

EPBD recast: energy monitoring and HVAC system mandatory Inspection. Findings from two IEE funded projects

M.Masoero, C.Silvi, J.Toniolo

Dipartimento Energia, Politecnico di Torino

Introduction

Air conditioning systems can account for up to 50% of the energy used in a building, and are therefore specifically targeted in the new legislation. The Energy Performance of Buildings Directive (EPBD) was established in 2002 (Directive 2002/91/CE). Article 14 of the 2010 EPBD recast, which is aimed at reducing CO_2 emissions within the building sector, requires a regular inspection for HVAC systems with more than 12 kW cooling capacity. However, so far only a few Member States have transferred this prescription into national law.

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Approval from TDRA UAE, Qatar & Saudi Arabai

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Introduction to Siemens Connect Box

Your simple IoT solution to connect and monitor your building

3rd party applications
(via API)

Connect Box supports **11 communication protocols,** connecting a wide range of Siemens and third-party building devices, wired or wireless

M-Bus   LoRaWAN   KNX

MQTT   Modbus   ASHRAE BACnet

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Connect Box Cloud Vs On-Premise

Connect Box Cloud

Main feature	IoT	Small	Medium	Large	Satellite
IoT connectivity	✓	✓	✓	✓	✓
Wired connectivity	-	Meters only	✓	✓	✓
Local server	✓	✓	✓	✓	-
Data points included	100	100	200	1 000	20
Max. data points	200	200	400	10 000	50
4G SIM card & data plan	✓	✓	✓	✓	✓
Alarms, schematics, graphs	✓	✓	✓	✓	✓
Configuration wizard	✓	✓	✓	✓	✓
Multi-sites management	✓	✓	✓	✓	✓
API access	✓	✓	✓	✓	✓

Connect Box On-premise

Main feature	IoT	Small	Medium	Large	XLarge
IN protocols (client)					
LoRoWAN	✓	✓	✓	✓	✓
BACnet	-	✓	✓	✓	✓
Modbus	-	✓	✓	✓	✓
M-Bus	-	✓	✓	✓	✓
LON	-	✓	✓	✓	✓
LPB	-	✓	✓	✓	✓
KNX	-	✓	✓	✓	✓
Diematic	-	✓	✓	✓	✓
OUT protocols (server)					
BACnet IP, Modbus TCP, MQTT	✓	✓	✓	✓	✓
Connected IN points					
	100	100	250	1 000	5 000
Other features					
Configuration wizard	✓	✓	✓	✓	✓
4G modem	✓	✓	✓	✓	✓

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BACnet IP Wired IEQ Solution with Connect Box

Connect Box + Cloud license
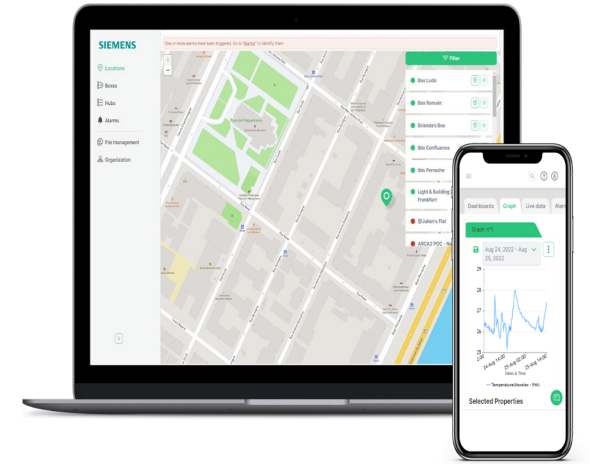
4G
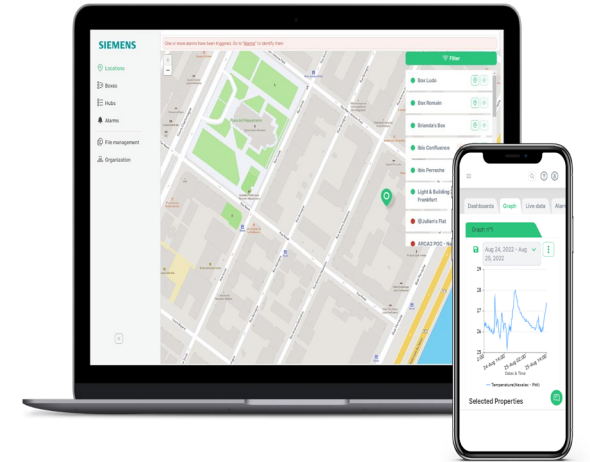
QNA2700D.BA 1 (BACnet IP)

BACnet IP →

1) CWG.BOX-EU
2) CWG.L1-M   (200 DP & 1yr)

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LoRa WAN Wireless IEQ Solution with Connect Box

Connect Box + Cloud license

4G

QNA2820D.EU

1) CWG.BOX-EU
2) CWG.L1-IOT   (100 DP & 1yr)

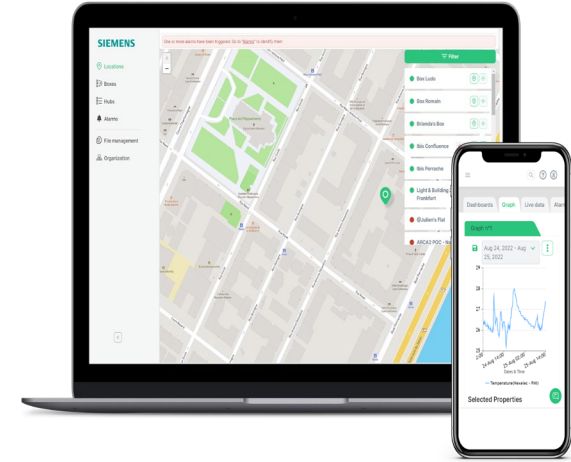SIEMENS

KNX Wired IAQ (Temp + CO2 + RH) Solution with Connect Box

Connect Box + Cloud license

4G

1) CWG.BOX-EU
2) CWG.L1-M   (200 DP & 1yr)

5WG11251AB02 KNX PS
QMX3.P70 Sensor

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KNX Wired IAQ (Brightness + Presence + Temp + CO2 + RH) Solution with Connect Box

Connect Box + Cloud license

4G

1) **CWG.BOX-EU**
2) **CWG.L1-M   (200 DP & 1yr)**

5WG11251AB02 KNX PS
5WG12582DB51 Sensor
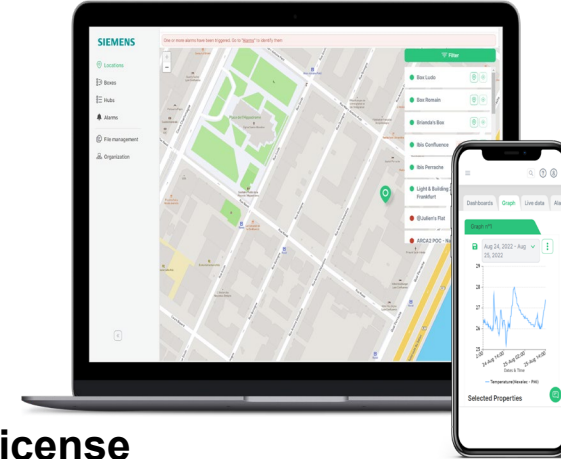
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KNX Wired IAQ (Temp + CO2 + RH) Solution with Connect Box

Connect Box + Cloud license

4G

1) CWG.BOX-EU
2) CWG.L1-M   (200 DP & 1yr)

5WG11251AB02 KNX PS
RDG204KNRLP
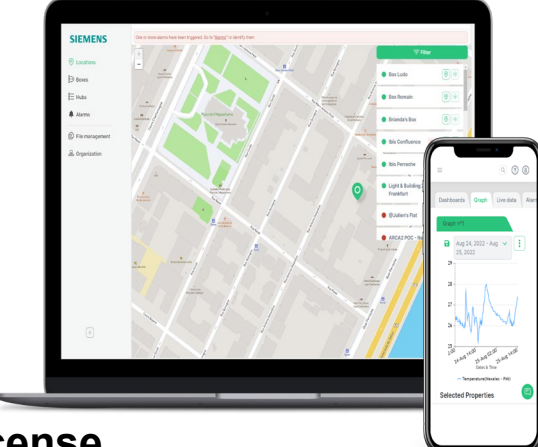
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KNX IoT to BACnet Gateway for IAQ monitoring

DXR PXC Climatix Desigo CC Building X 3rd Party

BACnet

OCT200.KNBA
KNX IoT to BACnet IP gateway

KNX IoT THREAD

QAA2890/WI; QFA2890/WI; QPA2892/WIKNX
Wireless room sensor(s)

OCT100.R
Thread Mesh Extender
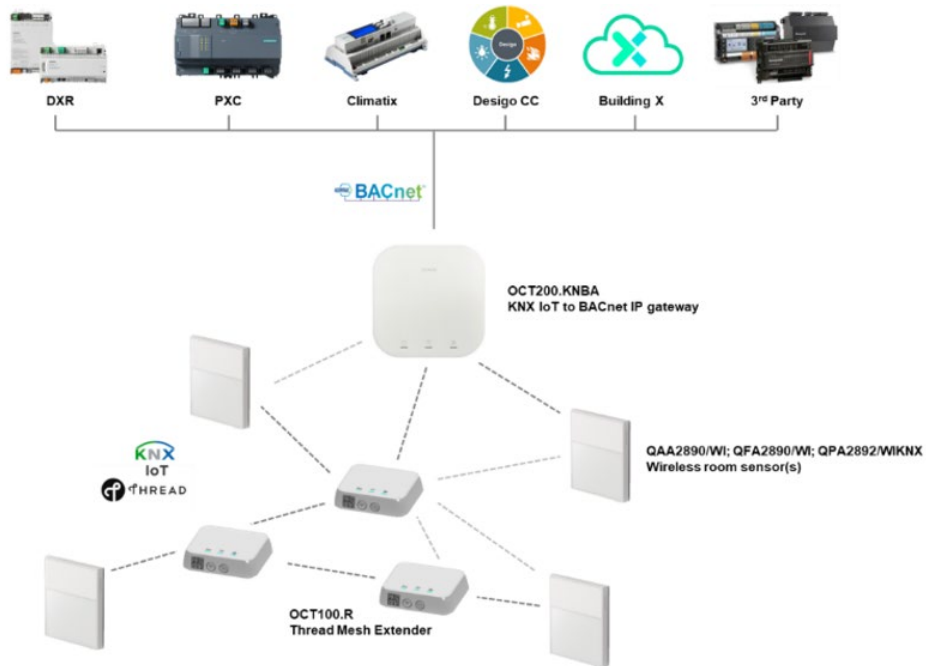
Gateway

Extender

Sensor

In a KNX IoT to BACnet IP gateway Thread network, the total number of connected sensors and extenders is 100. ● Gateway: A max. of 32 sensors and 22 extenders can be connected directly. ● Extenders: A max. of 32 sensors can be connected directly

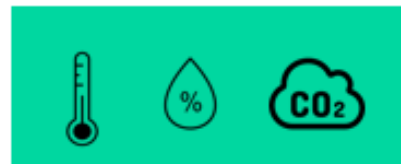| Communication range	
Distance (line of sight)	
● Sensor and gateway	● Max. 50 m
● Sensor and extender	● Max. 50 m
● Extender and gateway	● Max. 50 m
● Extender and extender	● Max. 50 m

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KNX IoT to BACnet Gateway for IAQ monitoring

Wireless Room Sensor

Sensor variants

Product Highlights

- Super slim new design (14mm and 18mm)

- Easy mounting (wall, conduit box, tape mounting)

- Configuration via Gateway web application

- Configurable transmission rate (max. 1min)

- Configurable Changes Of Value (COV)

- Long battery lifetime (up to 10 years)

- Protocol: KNX IoT Thread

SIEMENS

KNX IoT Wireless Sensor to BACnet IP wired (Temp + CO2 + RH) Solution using Connect Box
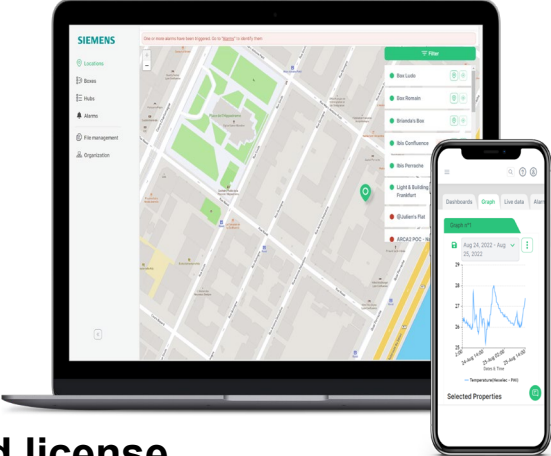

OCT200.KNBA

ASHRAE **BACnet**™

KNX IoT

Connect Box + Cloud license

4G

OCT200.KNBA
QPA2892/WI Sensor

QPA2892/WI Sensor

1) CWG.BOX-EU
2) CWG.L1-M   (200 DP & 1yr)

SIEMENS

KNX IoT Wireless Sensor to BACnet IP wired (Temp + CO2 + RH) Solution using Desigo Control point
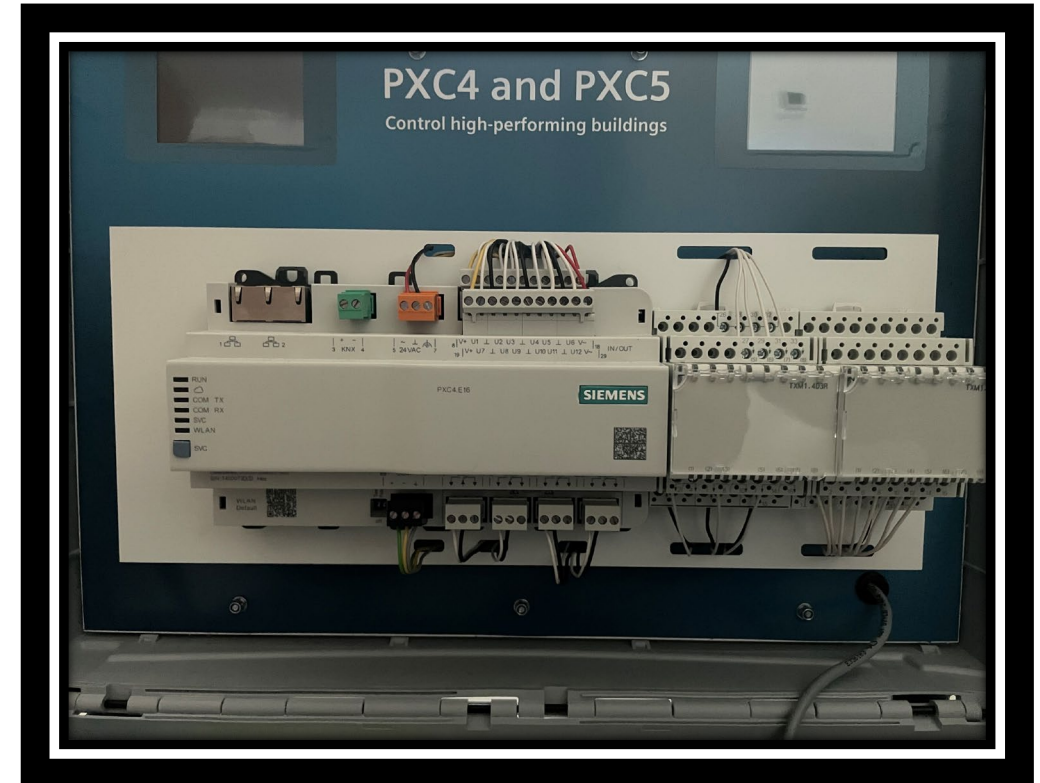
OCT200.KNBA

Desigo Control Point

OCT200.KNBA   RLP = AED 2812
QPA2892/WI Sensor RLP = AED 1262

QPA2892/WI Sensor

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Time for Live Demo

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