This presentation was live at:

Smart Buildings SHOW

18-19 October 2023 • ExCel London

URECSYS

HEALTHY AIR

ANYTIME, ANYWHERE

Presentation by: Dr. Maor Ganz

Smart Buildings SHOW

INTRODUCTION TO URECSYS TEAM

BRINGING SCIENTIFIC KNOWLEDGE TO THE FACILITY MANAGEMENT FIELD

NIR BASSA
CANCER RESEARCH
FOUNDER AND CEO

- M.Sc in cancer research and biochemistry, with honors
- International academic publications
- Registered several approved patents
- Served as a scientific and technological innovation consultant for multiple entrepreneurs and companies on behalf of the Ministry of Economy and Industry

DR. KOBI RICHTER
NEUROBIOLOGY
FOUNDER AND SHAREHOLDER

- Founder of Medinol and Orbotech
- Intellectual property luminary
- Developed groundbreaking medical products and founded several leading companies
- CTO of world-renowned medical engineering firms

DR. MAOR GANZ
COMPUTER SCIENCE
CTO

- Expert in mathematics, algorithm development and machine learning
- International academic publications
- Multiple academic awards and grants.

DR. YOTAM HARPAZ
PHYSICS
PhD*

- International academic publications
- Multiple academic awards and grants.
- Expertise in algorithm development, applied physics and gas diffusion models

DR. IMMANUEL LERNER
CANCER RESEARCH
FOUNDER

- Extensive background in cancer-research, biochemistry and medical science
- International academic publications – Including a publication co-authored with a Nobel Prize Laureate
- Multiple academic awards and grants.

DR. SHIMON AMIT
BIOLOGY
FOUNDER

- Has developed innovative medical urology devices
- Multiple academic awards and grants.
- Publishes several academic publications
- Registered several approved patents

Urecsys

BENEFITS TO END CUSTOMER

HEALTHY BUILDING

- Unprecedented protection against the penetration of Urban / Transportational / Industrial Air Pollution into the building
- **All-around holistic solution** – pollution, carcinogenic pollutants, biological factors, CO_2 levels, humidity, temperature & more
- Better **long-term health** of employees
- **Fewer sick days**
- Improved employee **productivity and cognitive**

SMART GREEN BUILDING

- Constant assurance of ventilation levels in accordance with the **most advanced international standards**
- AI and Scientific Algorithms for HVAC functionality & effectiveness and **constant system fault detection**
- Up to **9 LEED points** (Approved by the USGBC)
- **Dynamic and remote control** of the buildings' ventilation systems (real-time response to fires)
- Reduces **greenhouse gas emissions**
- Easy installation – **inexpensive to maintain**
- **+25% reduction in energy consumption** related to buildings' ventilation systems
- **Simple interface** to existing systems – smart management

Urecsys

SOME OF OUR CUSTOMERS AND PARTNERS

CLEAN AIR, ANYTIME, ANYWHERE

intel | JLL | WORLD GREEN BUILDING COUNCIL | Schneider Electric

CBRE | Google | hp | Microsoft

wework | Unilever | Nestlé | CLAL INSURANCE & FINANCE

SAMTECH AC SYSTEMS | LCS LEADING CONTROL SYSTEMS | gm | HAREL Insurance & Finance

MINISTRY OF HEALTH משרד הבריאות | teva | orbia | PHOENIX Insurance Group, Inc.

Avi Zoaretz - DIRECTOR OF INNOVATION
MEXICHEM-Orbia (Netafim)
"Three months after the Urecsys technology was installed in our building, employees reported that they __breathe better__. The bottle of Painkillers available for the employees remained full and almost unused."

https://www.ukgbc.org/solutions/urecsys-ventilation-management/

WIDE PIPELINE OF NEW HIGH-PROFILE CLIENTS AND PARTNERS IS RAPIDLY EVOLVING

Urecsys

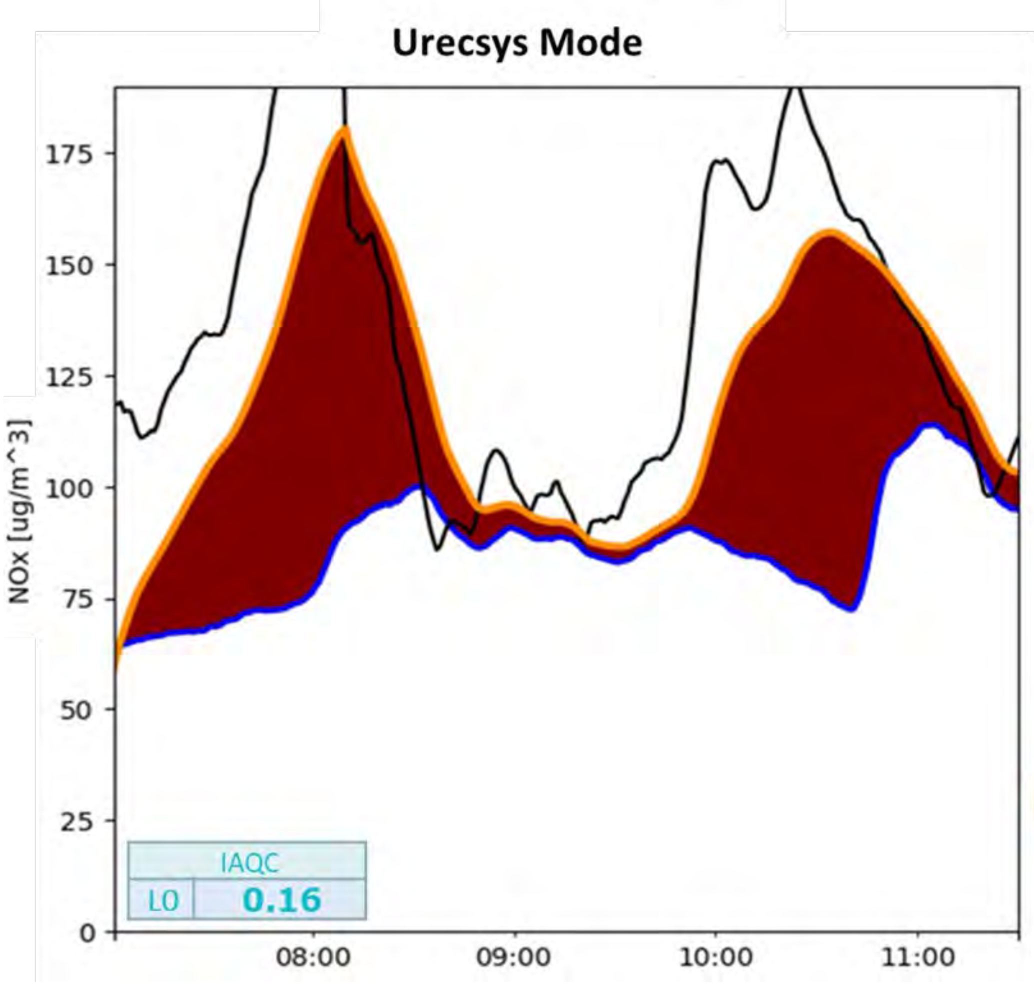
hp
Cu BY TIDHAR
MIGDAL
MIGDAL
MKB BANK
JLL
ויתניה
ROGOVIN TIDHAR
Real Estate Since 1936
ronimor PROPERTY MANAGEMENT
SGS
חברה לבניין בע"מ
Elmo Motion Control
SHIKUN&BINUI
Israel Land Development Company
intel
TADIRAN
ELECTRA FM
MAINTENANCE DIVISION
MENORA MIVTACHIM
מנורה מערכות
GAV YAM
wework
קבוצת נכסי אריאל
שירות ניהול נדל"ן
FOR YOUR PEACE OF MIND
Michlol
APPgrade your services
טכנולוגיות
CONSIDER IT DONE
LEXUS
orbia
CLAL INSURANCE & FINANCE
SHIKUN&BINUI
wework
Microsoft
MIGDAL
ELECTRA M&E
ELECTRO-MECHANICAL SYSTEMS
HAREL Insurance & Finance
gm
Google
MARVELL
Schneider Electric
Phoenix
Nestlé
fiverr.
CBRE
bank hapoalim
SAMTECH AC SYSTEMS
teva
Strauss
ORRIS
CREATING YOUR CLIMATE
WD Western Digital
ONE
LUDAN Engineering Israel Ltd
Radion Engineering Company
Unilever
פלאש
BarAkiva ENGINEERS
gm

Joint pilot with the Israeli Chief Scientist and Ministry of Health

MINISTRY OF HEALTH
משרד הבריאות
מדינת ישראל
משרד החינוך
STATE OF ISRAEL
MINISTRY OF EDUCATION
OCS-Office of the Chief Scientist
MINISTRY OF ECONOMY
OCS-Office of the Chief Scientist
MINISTRY OF ECONOMY
OCS-Office of the Chief Scientist
MINISTRY OF ECONOMY

בינת יישום מערכות
Care Facilities Management
אפקון
בקרה ואוטומציה
ישומי בקרה בע"מ
מערכות בקרה ושליטה
AES
LEADING ENERGY SINCE 1980
לשם שפר
איכות סביבה בע"מ
LCS
LEADING CONTROL SYSTEMS

WeWork Offices



Outdoor Pollution Levels

The Measured Indoor Pollution Levels (in the building)

The Accurately Predicted Indoor Pollution Levels without Urecsys' System = Standard Mode

Actual Reduction of the public's hazardous air pollution exposure

Omri Porat – VP Operations WeWork

"We started working with Urecsys due to repeated complaints about headaches & lack of air from our tenants. The installation was efficient and connected to the building's systems (an LG system).

- *Complaints about "lack of air", suffocation or **headaches have stopped**.*
- ***Energy reduction** – as evident from the electricity bills of the building.*
- ***Solving problems with the LG systems** that were unsolvable.*

***Bottom line - highly recommended!**"*

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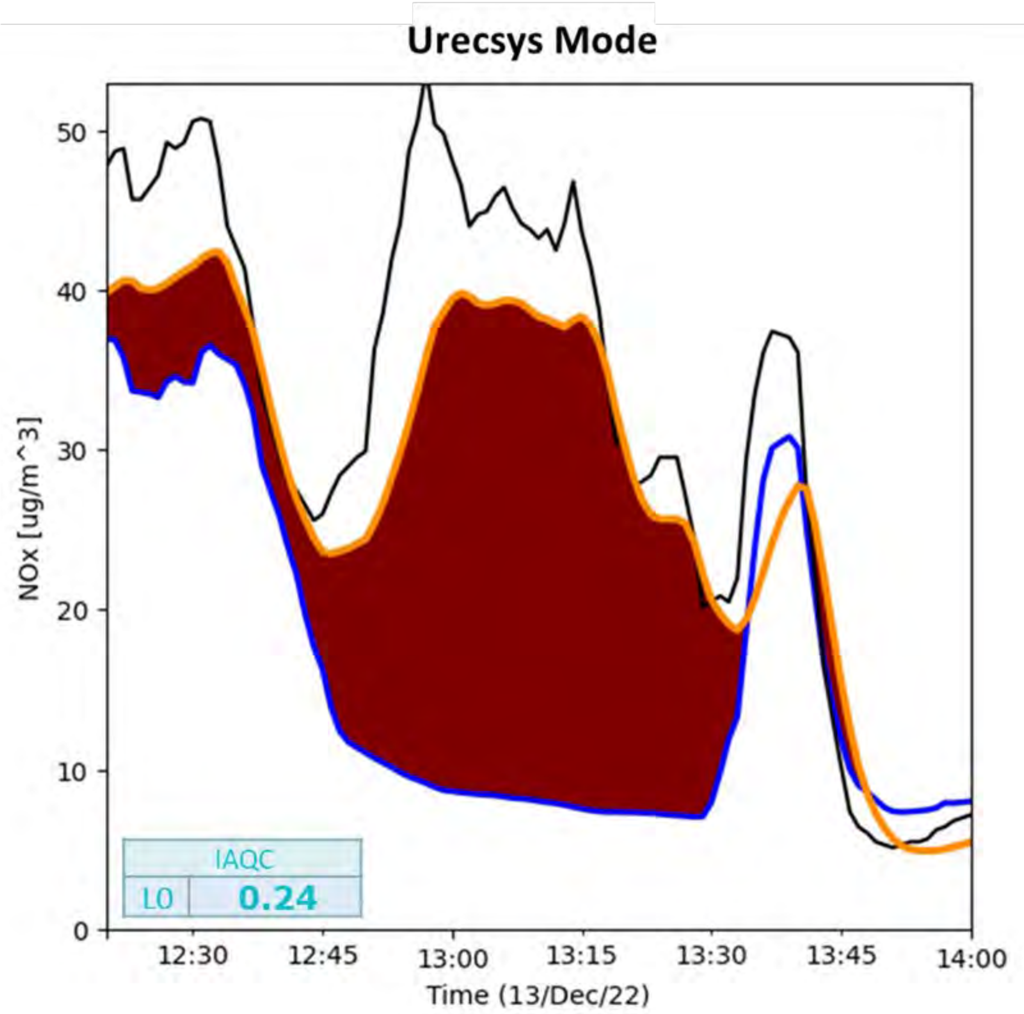
General Motors Offices



Outdoor Pollution Levels

The Measured Indoor Pollution Levels (in the building)

The Accurately Predicted Indoor Pollution Levels **without Urecsys' System = Standard Mode**

Actual Reduction of the public's hazardous air pollution exposure

Shelly Itach – Chief Operations Officer General Motors

"Our partnership with Urecsys has yielded impressive results.

*Since implementing their service, **workplace health complaints, notably headaches, have dramatically decreased**.*

*This improvement has not only enhanced overall employee well-being but also fostered a **noticeable increase in office attendance**.*

Employee feedback reflects the positive impact, with remarks highlighting enhanced comfort and vitality.

*Clearly, Urecsys' solution has significantly **bolstered productivity, reduced sick days and encouraged a more active presence at the office**.*

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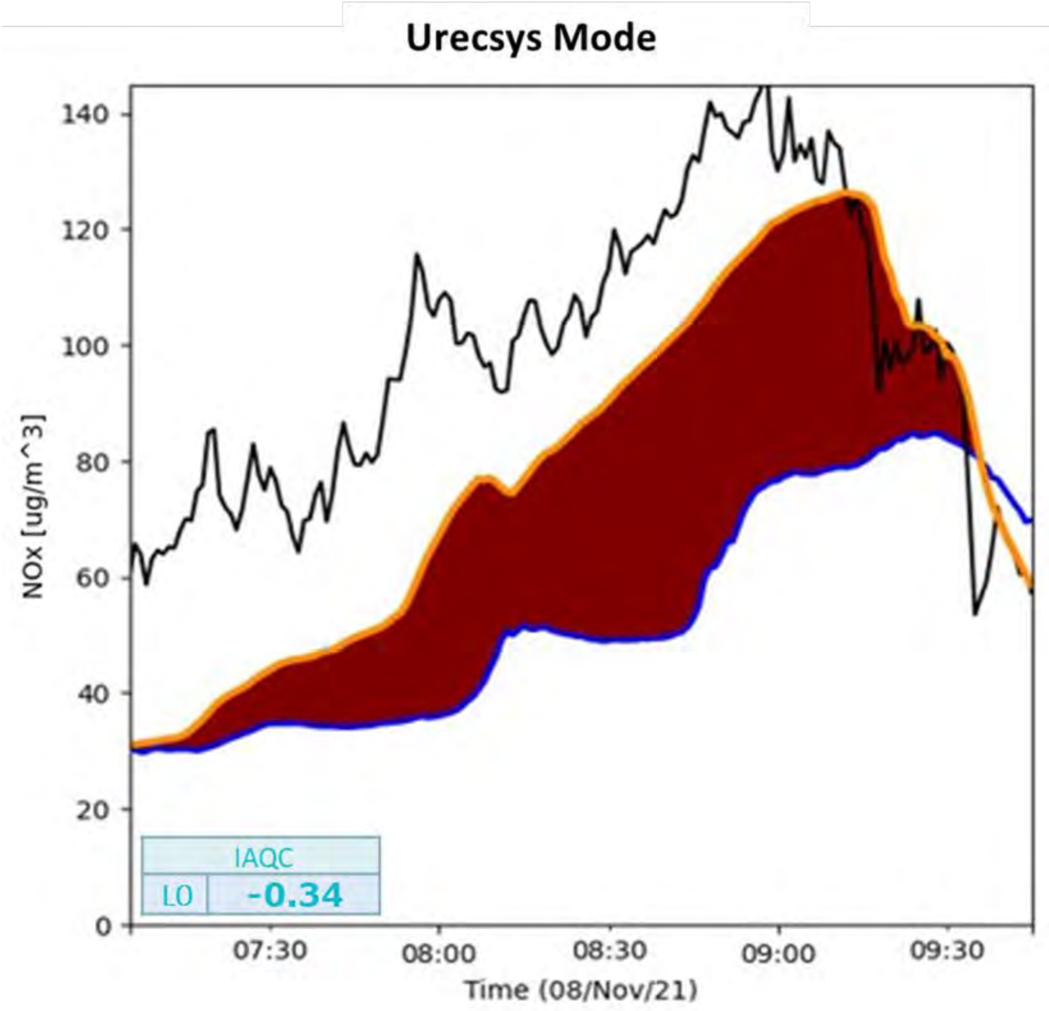
HP Offices



Outdoor Pollution Levels

The Measured Indoor Pollution Levels (in the building)

The Accurately Predicted Indoor Pollution Levels **without Urecsys' System** = **Standard Mode**

Actual Reduction of the public's hazardous air pollution exposure

Keren Shinhar – Sustainable Business Manager, HP

*"The Urecsys system has reached unprecedented achievements in reducing the amount of urban pollutants entering our buildings, so we have promoted the installation of the system **in three more of our buildings**."*

URBAN AIR POLLUTION

Nitrogen Oxides (NO_x): NO, NO_2

MOLECULAR SIZE: ANGSTROMS

- Contribute to DNA strand breakage, increased mutations and cancer
- Damage lung tissue and increase sensitivity to infections
- Damage enzymes and lipids, promote metastasis
- Damage the respiratory and immune systems
- One of the most significant factors increasing mortality and morbidity rates
- Shorten overall life expectancy

Hydrocarbons (HC), Volatile Organic Compounds (VOC) and Polycyclic Aromatic Hydrocarbons (PAH)

MOLECULAR SIZE: ANGSTROMS

- Promote cancer development and interfere with fetal development
- Detrimental at the epigenetic level
- Interfere with control of cell division, cell-cell interactions, and more

Suspended Particulate Matter (SPM): $PM_{0.1}$, $PM_{2.5}$, PM_{10}

MOLECULAR SIZE: ANGSTROMS – FEW MICRONS

- Carry carcinogenic materials
- Penetrate deep into the lungs and mucosa
- Cause biochemical, genetic, and mechanical damages

Sulfur Oxides (SO_x): SO_2, SO_3

MOLECULAR SIZE: ANGSTROMS

- Promote cancer and cardiopulmonary diseases
- Induce respiratory system irritation
- Increase overall mortality rates

Carbon monoxide (CO)

MOLECULAR SIZE: ANGSTROMS

- Displaces oxygen by binding between hemoglobin and atmospheric oxygen (CO binding to hemoglobin is 249 times stronger than the affinity to atmospheric oxygen)
- Causes asphyxiation at high concentrations

Smog and Ozone (O_3)

MOLECULAR SIZE: ANGSTROMS

- Extremely reactive molecules
- Cause irritation of the eyes and respiratory system

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POLLUTANTS – HEALTH & MEDICAL EFFECTS

Health Risks of Air Pollution In Europe – HRAPIE Project

World Health Organization
REGIONAL OFFICE FOR Europe

Recommendations for concentration-response functions for cost-benefit analysis
of particulate matter, ozone and nitrogen dioxide page

Table 1. CRFs recommended by the HRAPIE project

NO_2, long term and short-term exposure						
Pollutant Metric	Health Outcome	Group	RR (95% CI) per 10 μg/m³	Range of Concentration	Source of background health data	Comments
NO_2, Annual mean	Mortality, all-cause (natural), age 30+ years	B*	1.055 (1.031–1.080)	>20 μg/m		
NO_2, Daily maximum 1 hour mean	Mortality, all (natural) causes, all ages	A*	1.0027 (1.0016–1.0038)	All		
NO_2, 24-hour mean	Hospital admissions, respiratory diseases, all ages	A*	1.0180 (1.0115–1.0245)	All	European hospital morbidity database (WHO, 2013f), ICD-9 codes 460– 519; ICD-10 codes J00– J99	

Every addition of 10 μg/m³ to the **NO_2** annual mean **raises the Mortality Rate by 5.5%** (All-Cause Mortality, aged 30+)

Every addition of **10 μg/m³** of **NO_2** to the most polluted hour of the day **raises the Mortality Rate by 0.27%** (as a short-term impact)

POLLUTANTS – HEALTH & MEDICAL EFFECTS

Health Risks of Air Pollution In Europe – HRAPIE Project

World Health Organization
REGIONAL OFFICE FOR Europe

Recommendations for concentration-response functions for cost-benefit analysis of particulate matter, ozone and nitrogen dioxide page

Table 1. CRFs recommended by the HRAPIE project

$PM_{2.5}$, long term and short-term exposure						
Pollutant Metric	Health Outcome	Group	RR (95% CI) per 10 μg/m^3	Range of Concentration	Source of background health data	Comments
$PM_{2.5}$, annual mean	Mortality, all-cause (natural), age 30+ years	A*	1.062 (1.040-1.083)	All	European mortality database (MDB) (WHO, 2013c), rates for deaths from all natural causes (International Classification of Diseases, tenth revision (ICD-10) chapters I-XVIII, codes A-R) in each of the 53 countries of the WHO European Region, latest available data	
$PM_{2.5}$, two-week average, converted to $PM_{2.5}$, annual average	Workdays lost, working-age population (age 20-65)	B*	1.046 (1.039-1.053)	All		g

Every addition of **10 μg/m^3** to the $PM_{2.5}$ concentration **raises the number of Workdays lost by 4.6%**

THE PROBLEM:

URBAN AIR POLLUTION – A GLOBAL CHALLENGE

CLEAN AIR, ANYTIME, ANYWHERE

Air pollution is the leading environmental cause of death, morbidity, and health problems. It Affects every urban area, including nonindustrial areas.

Accounts for ~**7,000,000 DEATHS PER YEAR = 12% OF DEATHS WORLDWIDE.**

World Health Organization

Ambient air pollution: Health impacts

Worldwide ambient air pollution accounts for:

- 29% of all deaths and disease from lung cancer
- 17% of all deaths and disease from acute lower respiratory infection
- 24% of all deaths from stroke
- 25% of all deaths and disease from ischaemic heart disease
- 43% of all deaths and disease from chronic obstructive pulmonary disease

Pollutants with the strongest evidence for public health concern, include particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2).

https://www.who.int/airpollution/ambient/health-impacts/en/

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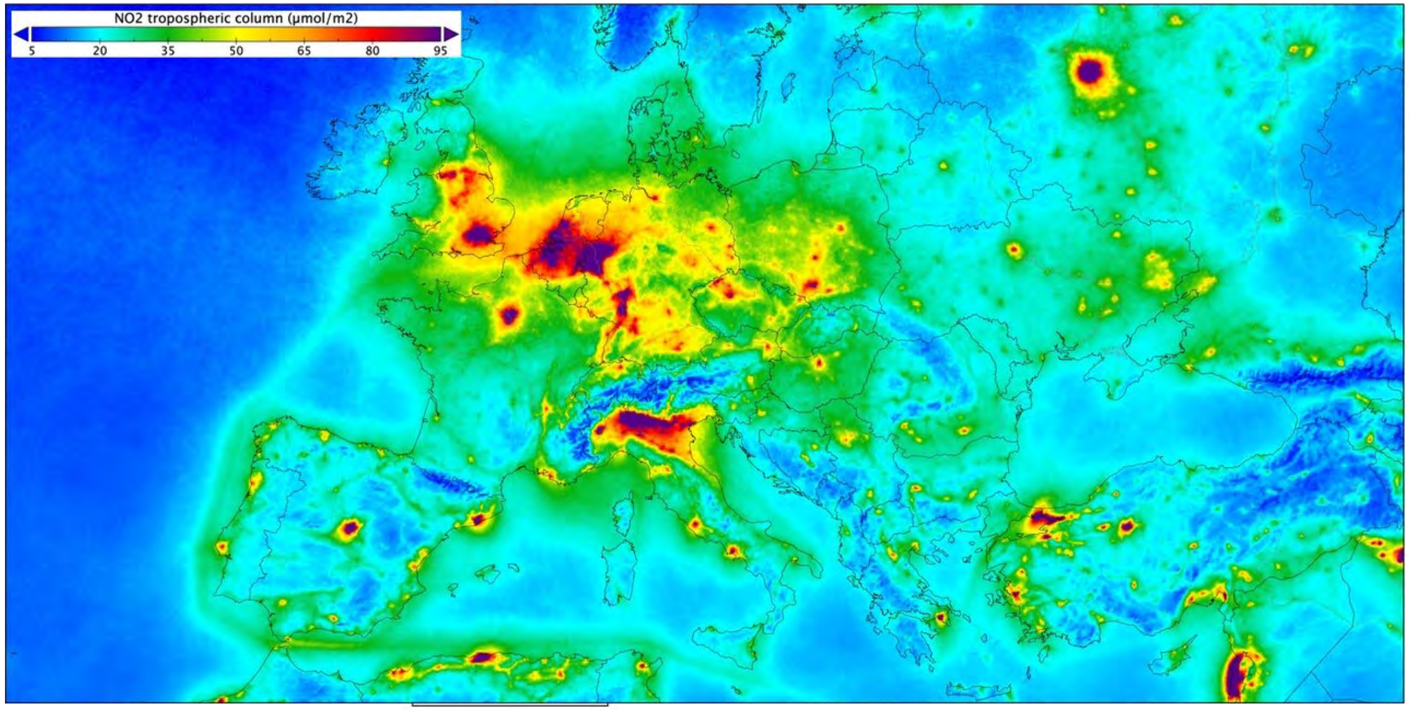
Urban Air Pollution from Varied Sources

- Construction
- Industrial Processes
- Sewage Systems
- Waste Incinerators
- Factory Work
- Transportation
- Medical Centers
- Power Plants
- Building Heating Systems
- And many more…



FILTERATION ALONE IS NOT THE ANSWER

Pollutants Size Comparison

Most urban air pollutants fit 1,000,000,000,000 times within the volume of a single bacteria

CH, VOCs, PAHs

NO NO_x NO_2 Benzene,

CO SO_2, SO_3^- Diesel-Exhaust

O_3 UFPs - $PM_{0.1}$

A single bacteria
=
$PM_{2.5}$
=
aerosol

2.5µm

0.3µm

100 nm

State-of-the-Art filtration (which exists in surgical rooms) can filter up to 0.3µm

Such pore size compared to those pollutants would be analogous to **a door 2 km wide and 2 km tall** compared to the average person

A single Coronavirus
=
$PM_{0.1}$
(always carried within aerosol/droplets)

The vast majority of urban air pollutants fit within a single Coronavirus **27 million times**

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INDOOR POLLUTION: NOWHERE IS SAFE

CLEAN AIR, ANYTIME, ANYWHERE

Contrary to popular belief, most exposure to air pollution is caused inside buildings, where according to the United States Environmental Protection Agency (EPA), people spend

90%

OF THEIR TIME

The most common indoor environments are the home and workplace.

The workplace is usually in a more centralized area (more polluted area) than the home.

We are usually in the workplace during the day, when pollution levels are more commonly higher.

While sleeping, breathing rates drop drastically, taking all that into account –

THE MOST SIGNIFICANT PUBLIC EXPOSURE TO AIR POLLUTION OCCURS IN THE WORKPLACE

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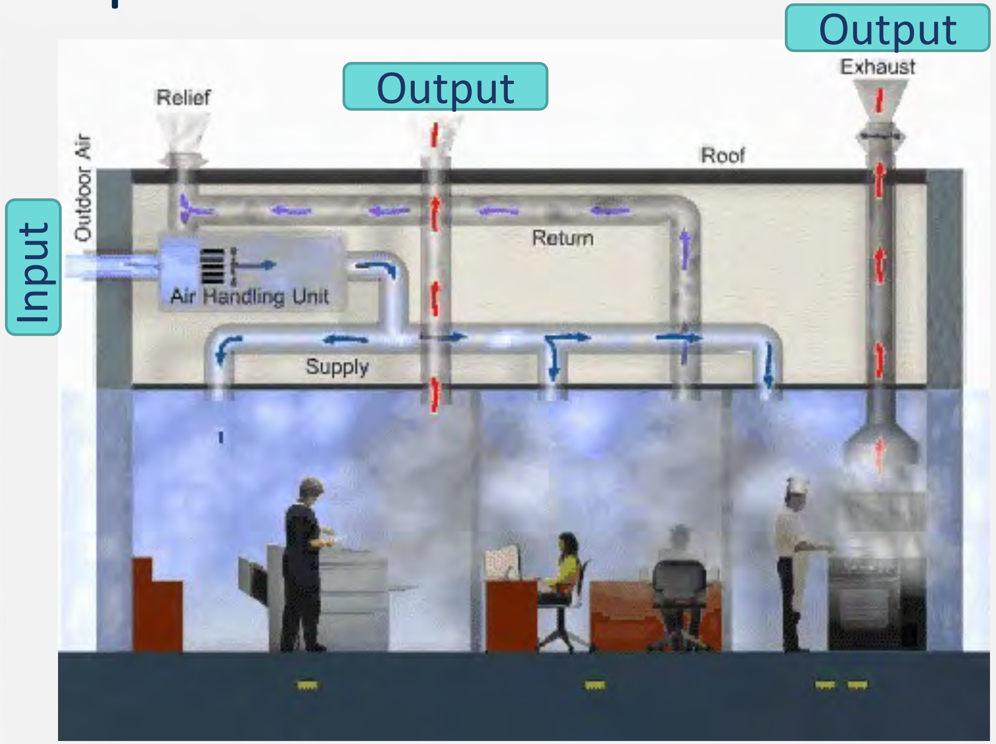
VENTILATION ALONE IS NOT THE ANSWER

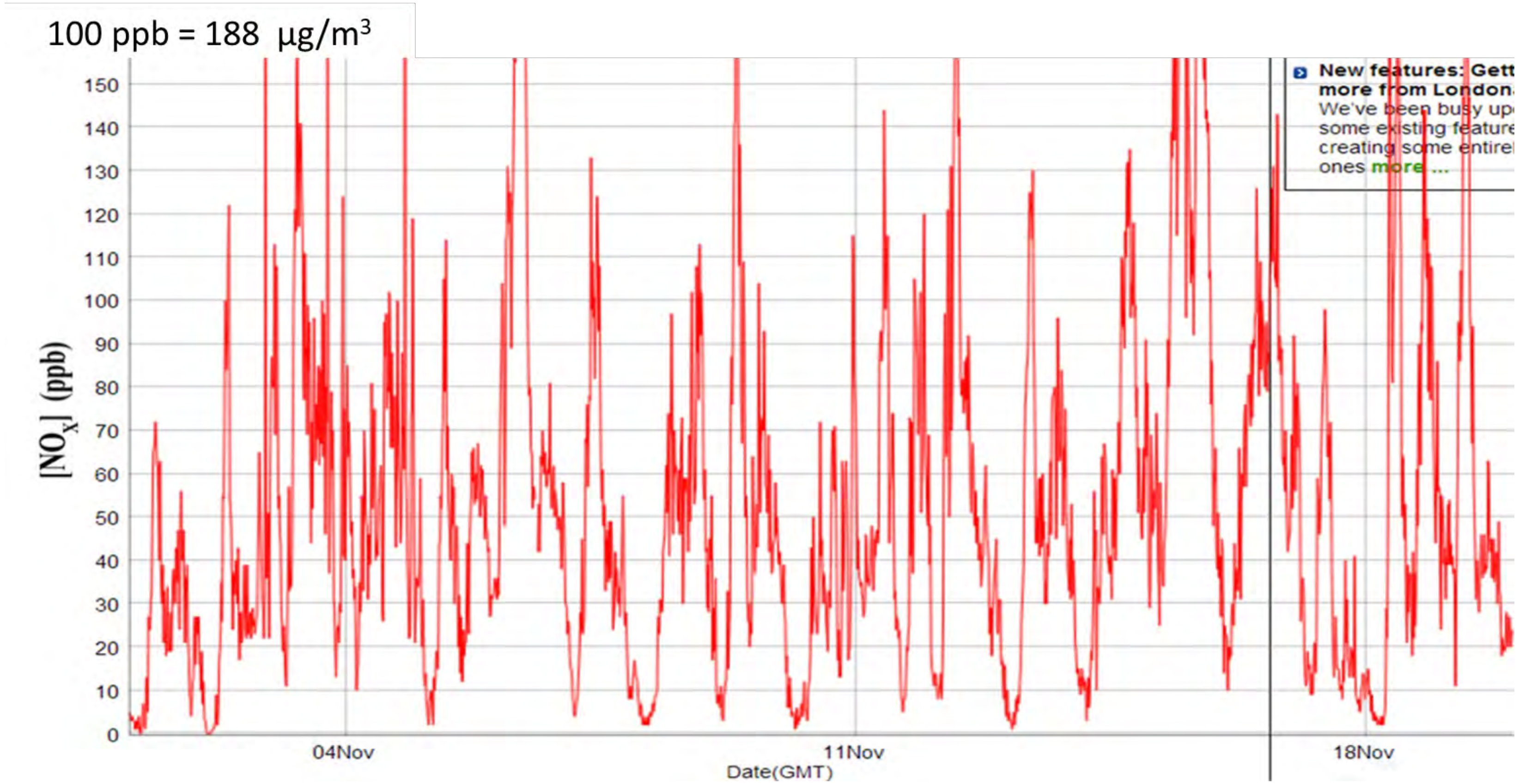
Just **as humans breathe oxygen, the building's ventilation system is a kind of respiratory system** for the building and its tenants; **constantly removing CO_2 and introducing new outdoor air** into the building.

Unfortunately, **that new air is the same polluted air from outside.**



5 ESSENTIAL PRINCIPLES OF THE SYSTEM

- Urban / Transportational / Industrial Air Pollution is highly fluctuating – both temporally & spatially



London: Urban Air Pollution Measurements – approx. 2 weeks

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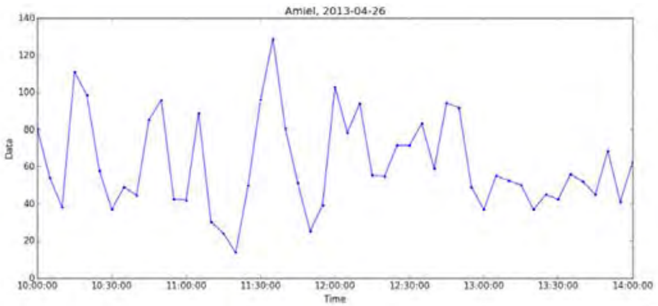
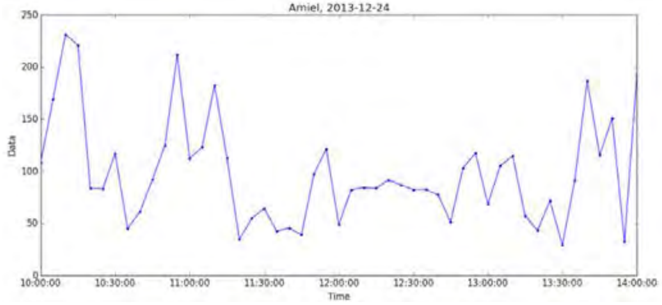
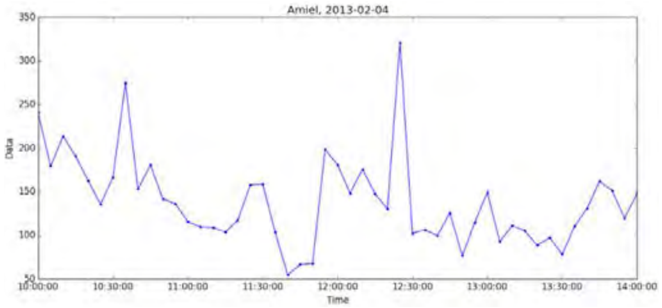
5 ESSENTIAL PRINCIPLES OF THE SYSTEM

- Urban / Transportational / Industrial Air Pollution is highly fluctuating
- **Air Pollution cannot be predicted by standard methods** (schedules / timetables), **each day's pollution graph is unique – like a fingerprint**

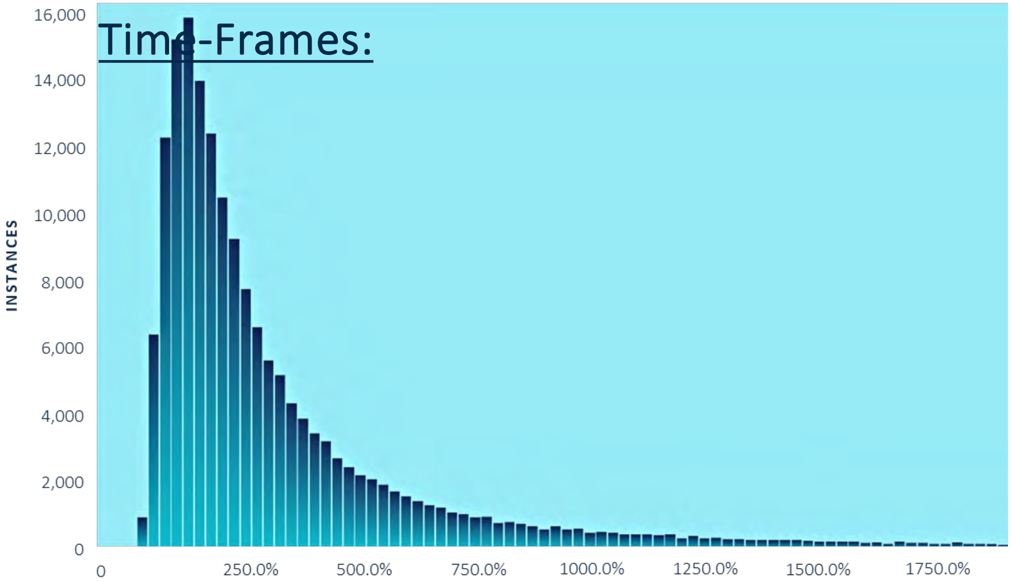






- ❑ **Same** station
- ❑ **Same** time of day (10:00-14:00)
- ❑ **Different** days

Pollution Change was Analyzed in 20 Monitoring Stations for 4 Years in 2-hour Time-Frames:



- Average change: 344 %
- Median change: 207 %
- In less than 4.2% of cases, the change is at most 50%

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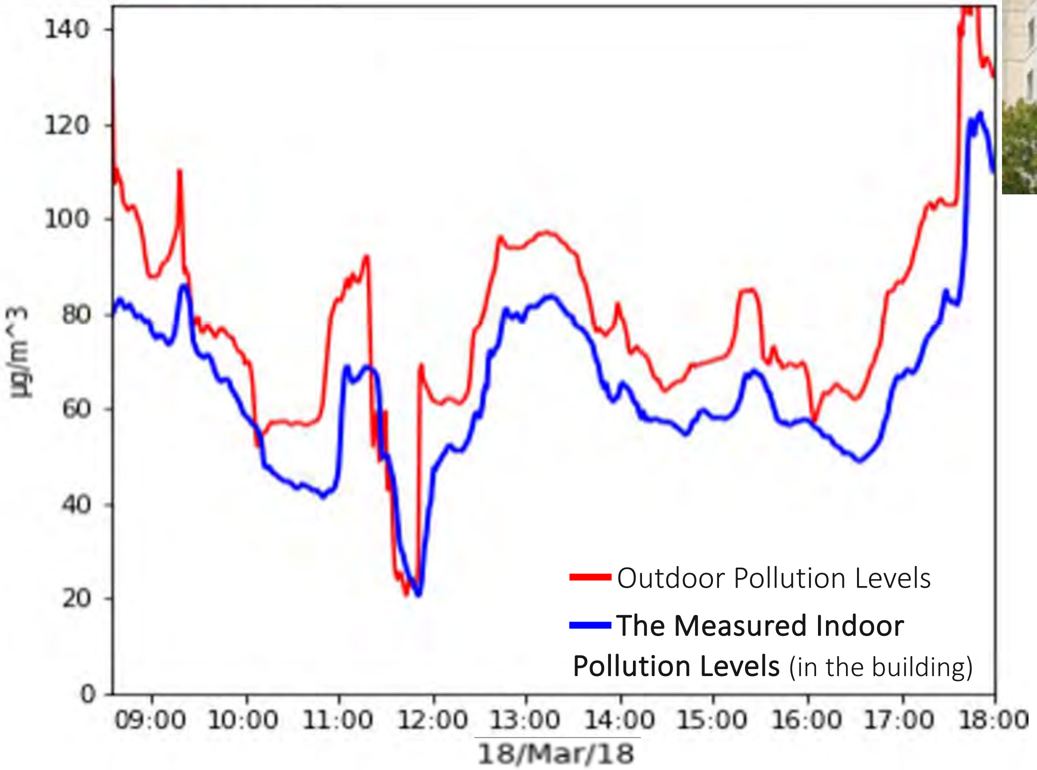
5 ESSENTIAL PRINCIPLES OF THE SYSTEM

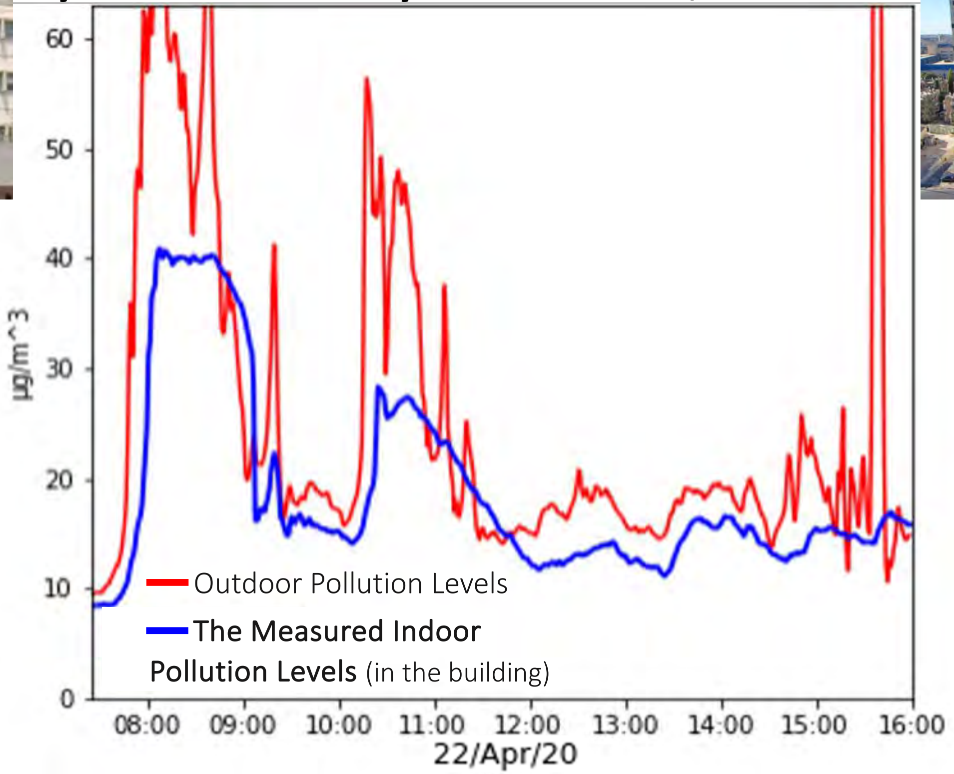
- Urban / Transportational / Industrial Air Pollution is highly fluctuating
- Air Pollution cannot be predicted by standard methods (schedules / timetables)
- Air Pollution effectively penetrates the building via the building's outdoor ventilation systems

Pollution intake efficiency = depends on both constant building parameters & on a set of rapidly changing climate variables

Standard Operation of the Ventilation Systems in Electra M&E HQ, Rehovot



Standard Operation of the Ventilation Systems in Ministry of Health HQ, Jerusalem

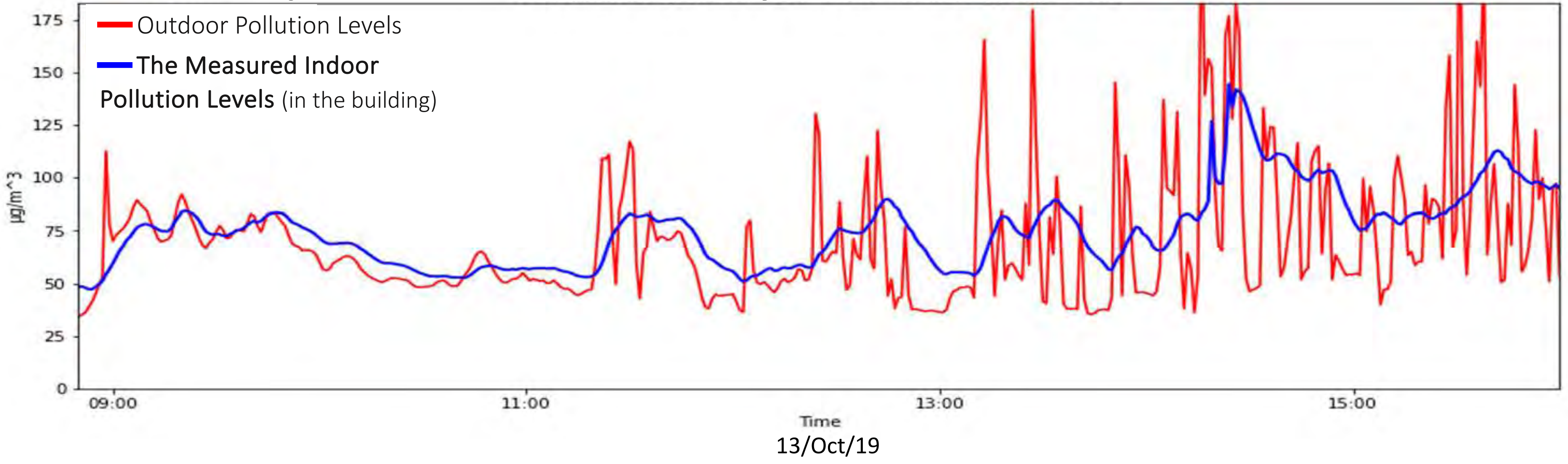


5 ESSENTIAL PRINCIPLES OF THE SYSTEM

- Urban / Transportational / Industrial Air Pollution is highly fluctuating
- Air Pollution cannot be predicted by standard methods (schedules / timetables)
- Air Pollution effectively penetrates the building via the building’s outdoor ventilation systems

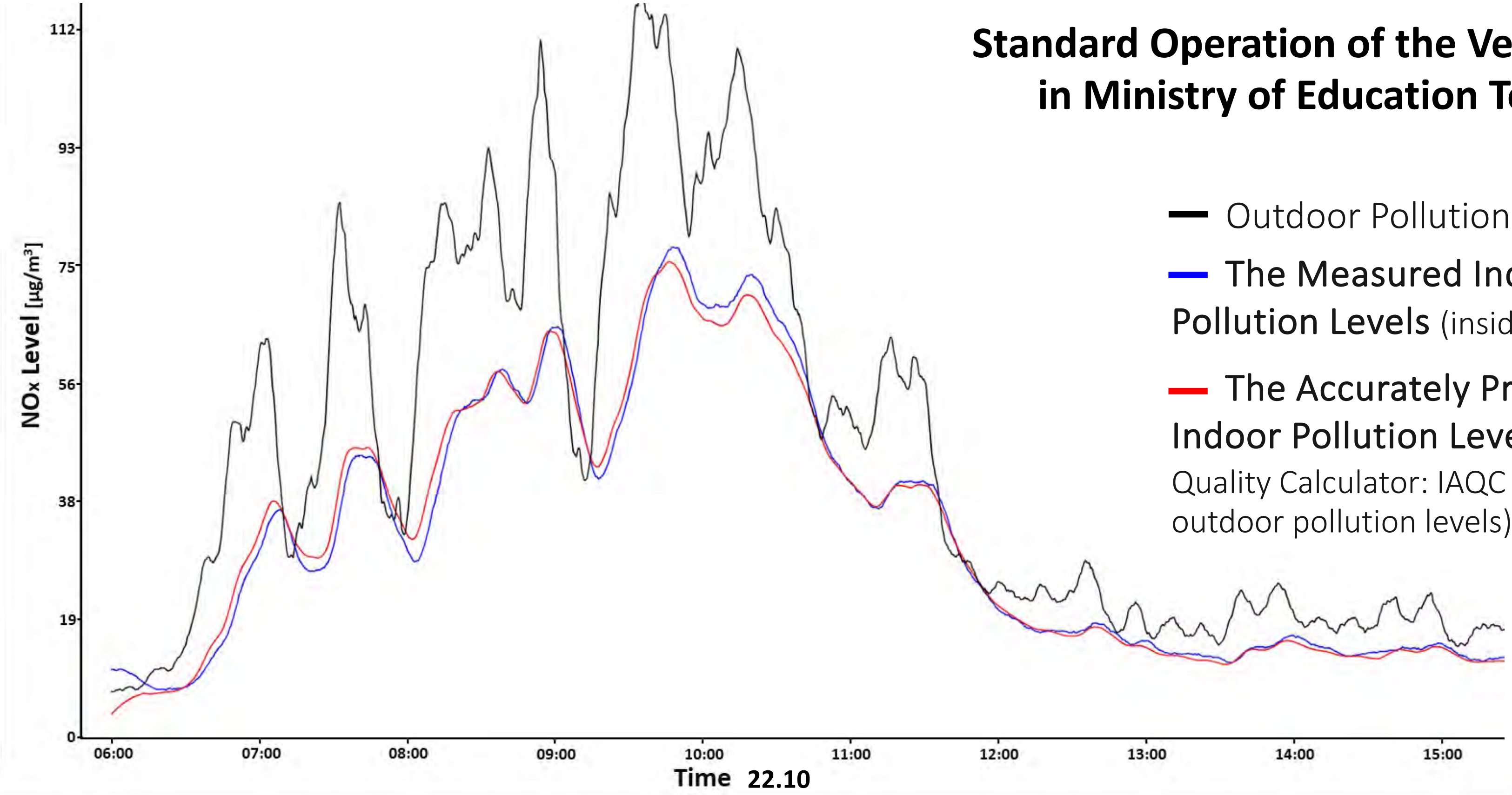
Pollution intake efficiency = depends on both constant building parameters & on a set of rapidly changing climate variables

Standard Operation of the Ventilation Systems in ‘Sail Tower’ Governmental HQ, Haifa



5 ESSENTIAL PRINCIPLES OF THE SYSTEM

- Urban / Transportational / Industrial Air Pollution is highly fluctuating
- Air Pollution effectively penetrates the building via the ventilation systems
- Air Pollution cannot be predicted by standard methods (schedules / timetables)
- **Machine Learning and AI methods effectively calculate Indoor Air Pollution when fed by Outdoor Data** (IAQC – Indoor Air Quality Calculator, No need for indoor monitoring)



Standard Operation of the Ventilation Systems in Ministry of Education Tower, Tel-Aviv

- Outdoor Pollution Levels
- The Measured Indoor Pollution Levels (inside the building)
- The Accurately Predicted Indoor Pollution Levels (Indoor Air Quality Calculator: IAQC – Based on outdoor pollution levels)

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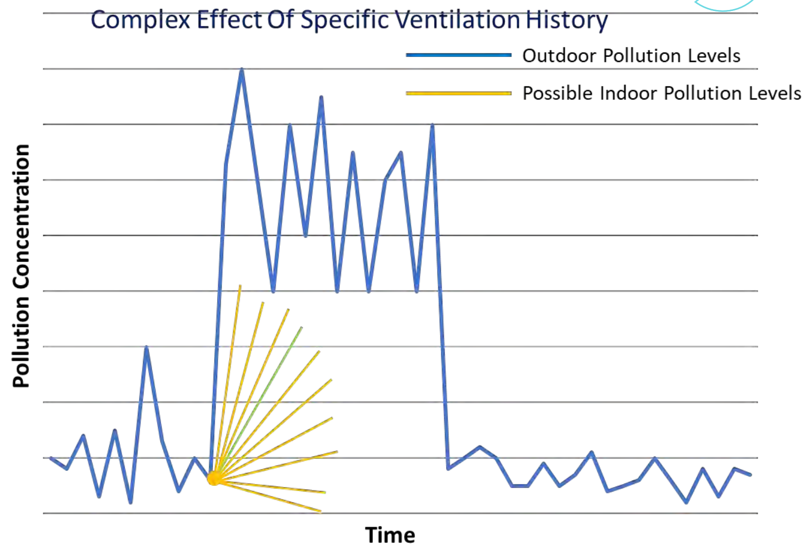
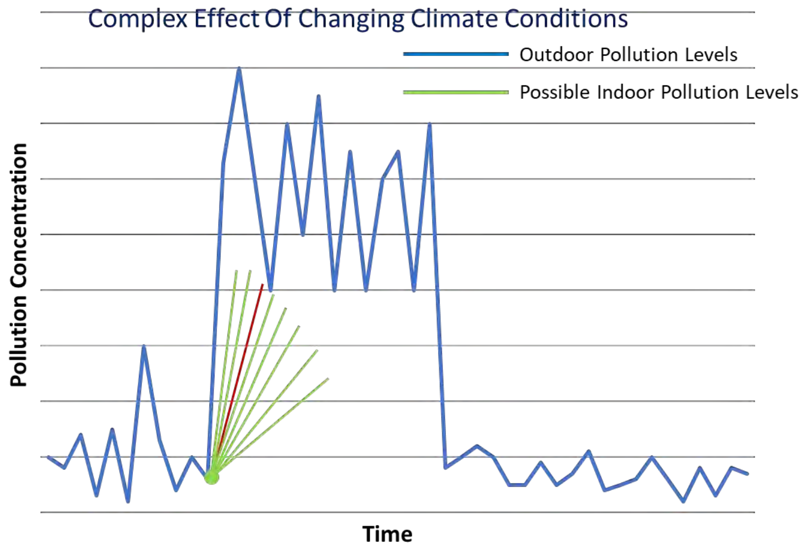
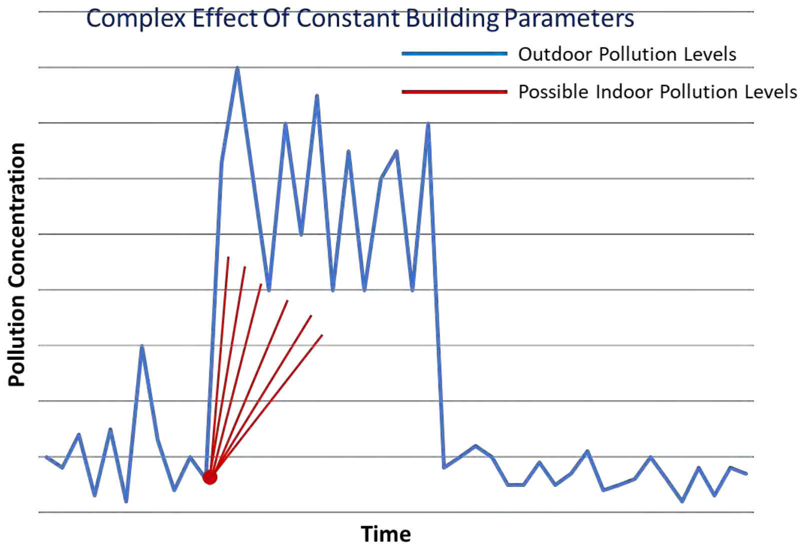
THE CHALLENGE OF MODELLING INDOOR AIR POLLUTION LEVELS







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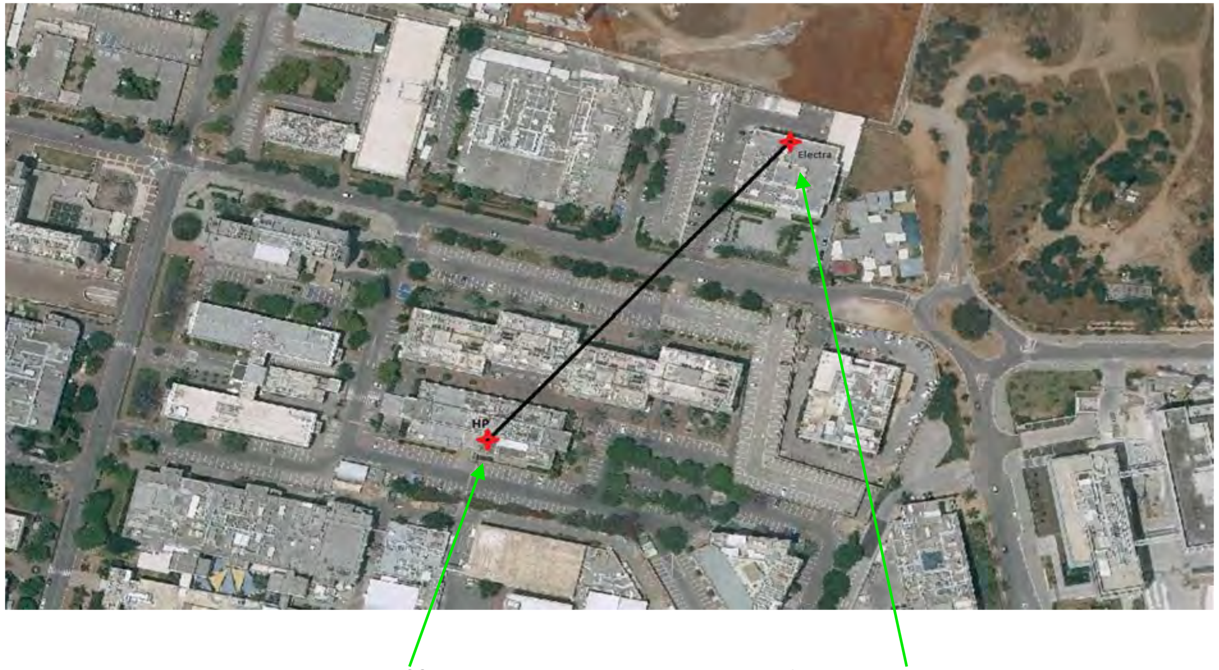
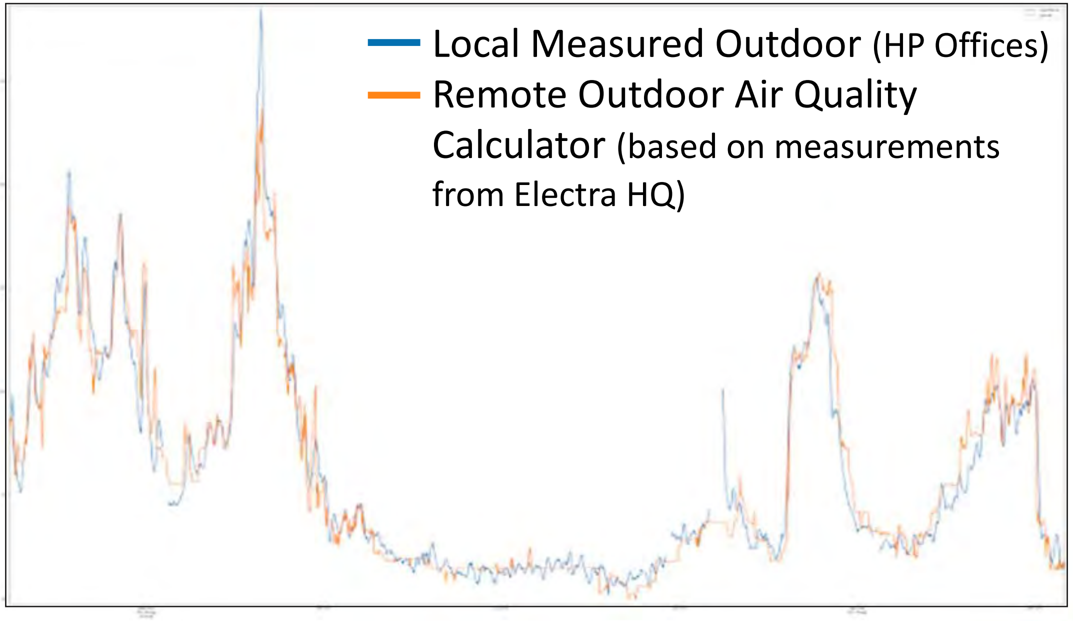
5 ESSENTIAL PRINCIPLES OF THE SYSTEM

- Urban / Transportational / Industrial Air Pollution is highly fluctuating
- Air Pollution effectively penetrates the building via the ventilation systems
- Air Pollution cannot be predicted by standard methods (schedules / timetables)
- **Machine Learning and AI methods effectively predict spatial changes in Urban Air Pollution when fed by Data in Real-Time** (few strategic monitoring stations can support entire CBDs)





UK ventilation - Approved Document F (1).pdf 57 / 63 150%

Appendix D: Minimising ingress of external pollution into buildings in urban areas

Typical urban pollutants that need to be considered include those covered by the UK Air Quality Strategy (www.defra.gov.uk/environment/airquality/strategy/index.htm (2007)). These are:

- carbon monoxide, CO
- nitrogen dioxide, NO_2
- sulphur dioxide, SO_2
- ozone, O_3
- particles (PM_{10})
- benzene
- 1,3-butadiene
- polycyclic aromatic hydrocarbons (PAHs)
- ammonia
- lead.

Although nitrogen oxide, NO, is not included in the UK Air Quality Strategy, it is a normal constituent of combustion discharges and in many cases (for example, from gas-fired plant) the largest polluting emitter. Therefore, it also needs to be taken into account.

Internal contamination of buildings from outdoor pollution sources therefore depends upon the pollutant sources, the physical characteristics of the building and its relation to its surroundings, the ventilation strategy employed and the location of the air intake. Whatever type of ventilation system is used, it is important to ensure that the intake air is not contaminated. This is especially important in air quality management areas where, by definition, pollution levels of at least one pollutant are already close to the air quality standards. Simplified guidance on ventilation intake placement for minimising ingress of pollutants may be summarised, as in Table D1.

Control of ventilation intakes

For pollutant sources such as urban road traffic, whose concentration fluctuates with the time of day, reducing the flow of external air or closing ventilation intakes during peak periods of high external pollutant concentrations, for example during rush hours, for up to an hour may be an option.

From Approved Document F of the Building Regulations (p. 55):

World Health Organization | Health Topics | Countries | Newsroom | Emergencies

Nitrogen dioxide (NO_2)

Guideline values

NO_2

10 µg/m^3 annual mean

25 µg/m^3 24-hour mean

The current WHO guideline value of 10 µg/m^3 (annual mean) was set to protect the public from the health effects of gaseous nitrogen dioxide.

Definition and principal sources

NO_2 is the main source of nitrate aerosols, which form an important fraction of $PM_{2.5}$ and, in the presence of ultraviolet light, of ozone. The major sources of anthropogenic emissions of NO_2 are combustion processes (heating, power generation, and engines in vehicles and ships).

Health effects

Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long-term exposure to NO_2. Reduced lung function growth is also linked to NO_2 at concentrations currently measured (or observed) in cities of

UK Governmental Building Regulations, 2010

Table 2.1 Limit values from Schedule 2 to the Air Quality Standards Regulations 2010

Pollutant	Exposure limit	Exposure time
Sulphur dioxide	350µg/m^3	1-hour average
	125µg/m^3	1-day average
Nitrogen dioxide	200µg/m^3	1-hour average
	40µg/m^3	1-year average

UK DEFRA Air Quality Objectives, 2023

National air quality objectives and European Directive limit and target values for the protection of vegetation and ecosystems

Pollutant	Applies	Objective	Concentration	Date	European Obligations
Nitrogen oxides	UK	30 µg/m^3	annual mean	31 December 2000	30 µg/m^3

Thresholds

I. **10 µg/m^3** - **The Medically Significant Threshold** determined by the **World Health Organization** and published in the WHO Air Quality Guidelines (2021) as **an annual mean**

II. **25 µg/m^3** - **The Medically Significant Threshold** determined by the **World Health Organization** and published in the WHO Air Quality Guidelines (2021) as **a daily average**

III. **30 µg/m^3** - The Threshold indicated by **State Law / Governmental Regulatory Requirement** – The Target Limit/Threshold as **an annual mean**

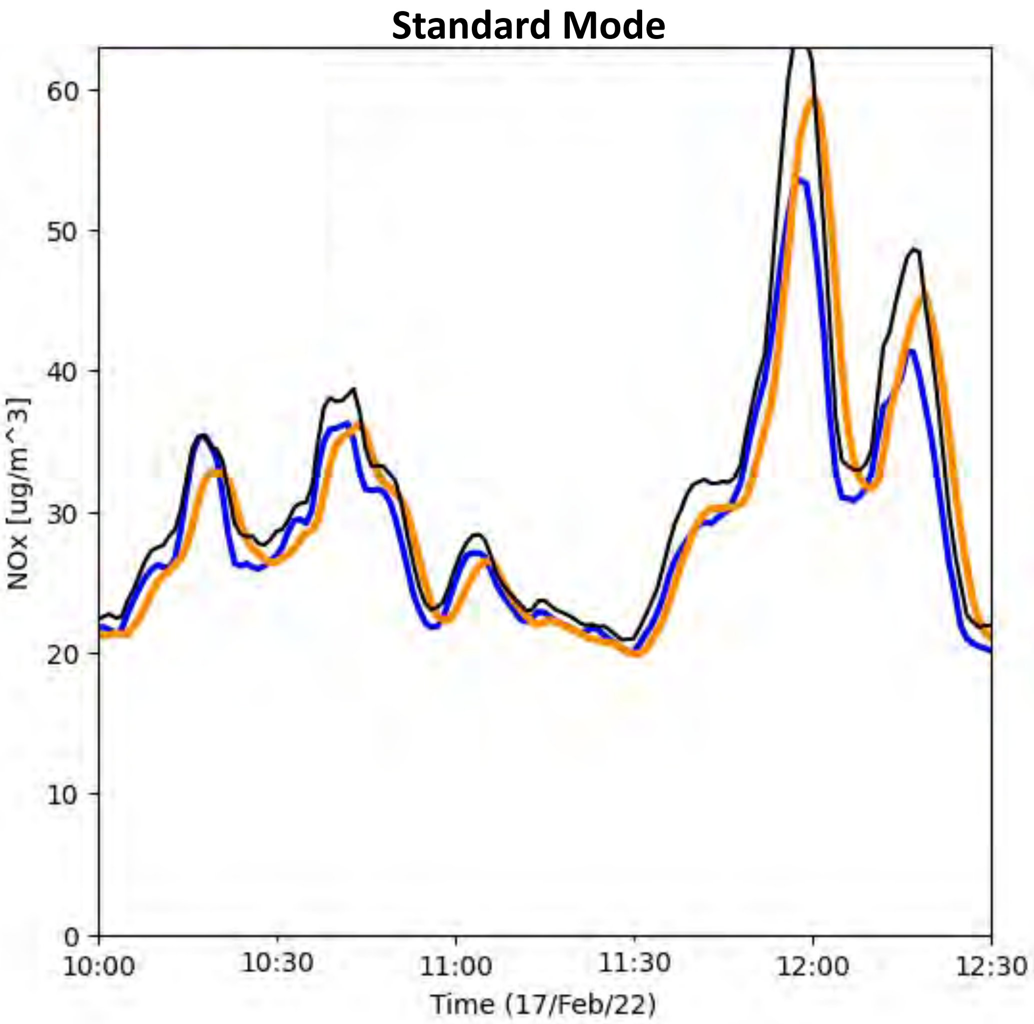
IV. **40 µg/m^3** - The Threshold indicated by the **State Law / Governmental Regulatory Requirement** – The Environmental Limiting Threshold as **an annual mean**

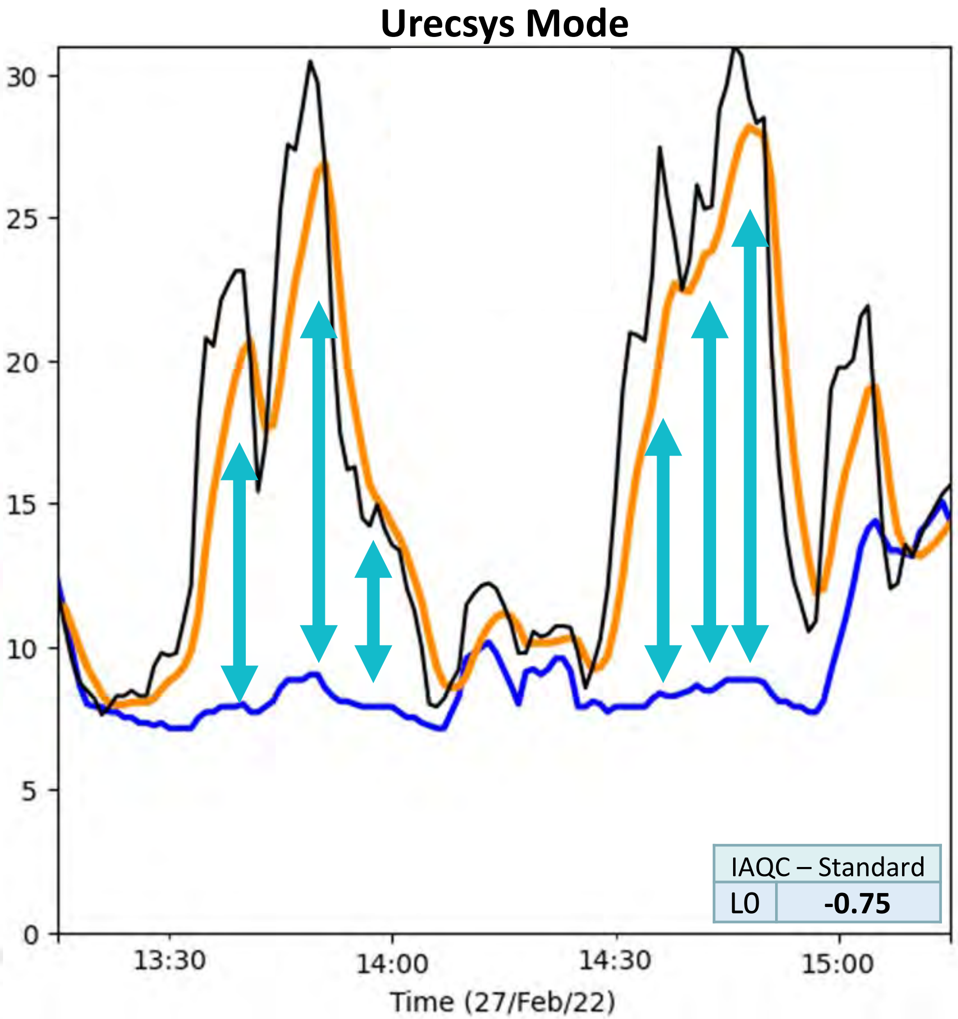
10.0	25.0	30.0	40.0	Threshold

World Health Organization

Urecsys

Intel IDC9, Haifa





Outdoor Pollution Levels

The Measured Indoor Pollution Levels (in the building)

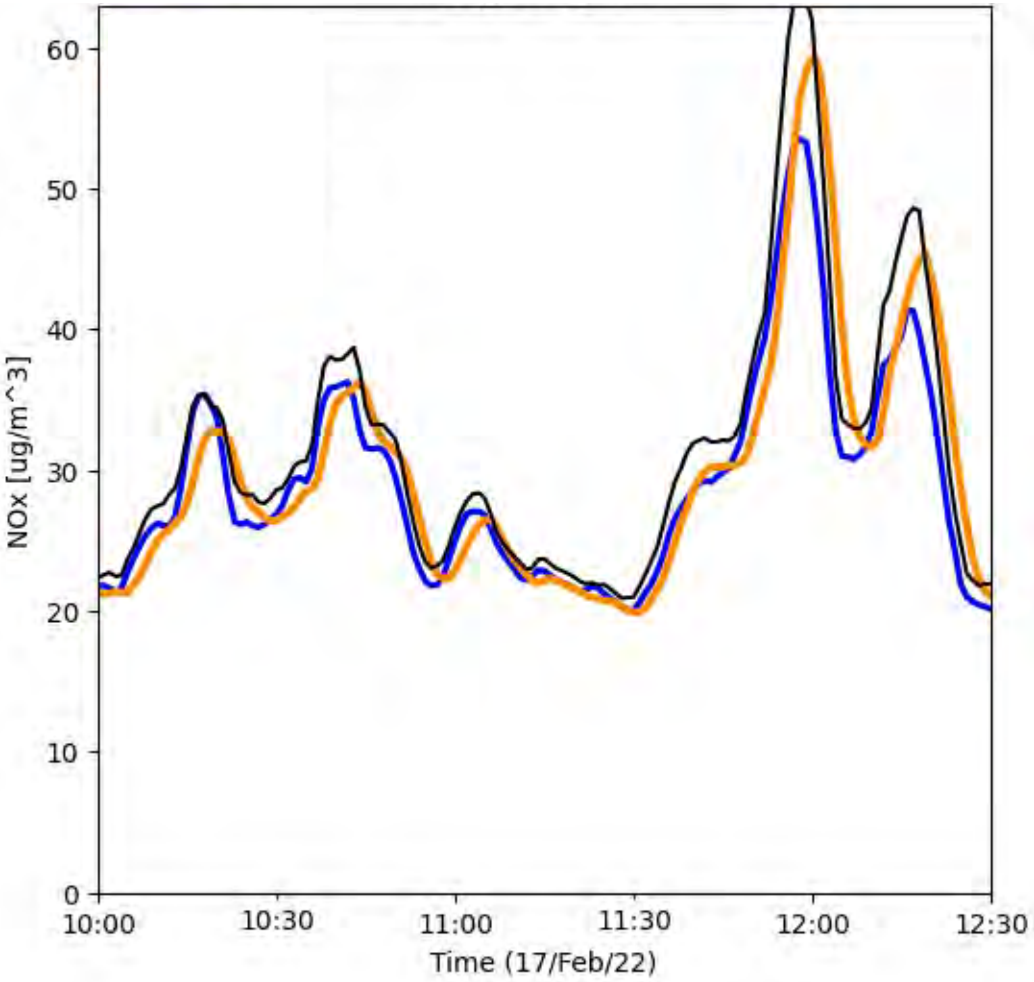
The Accurately Predicted Indoor Pollution Levels **without Urecsys' System = Standard Mode**

Actual Reduction of the public's hazardous air pollution exposure

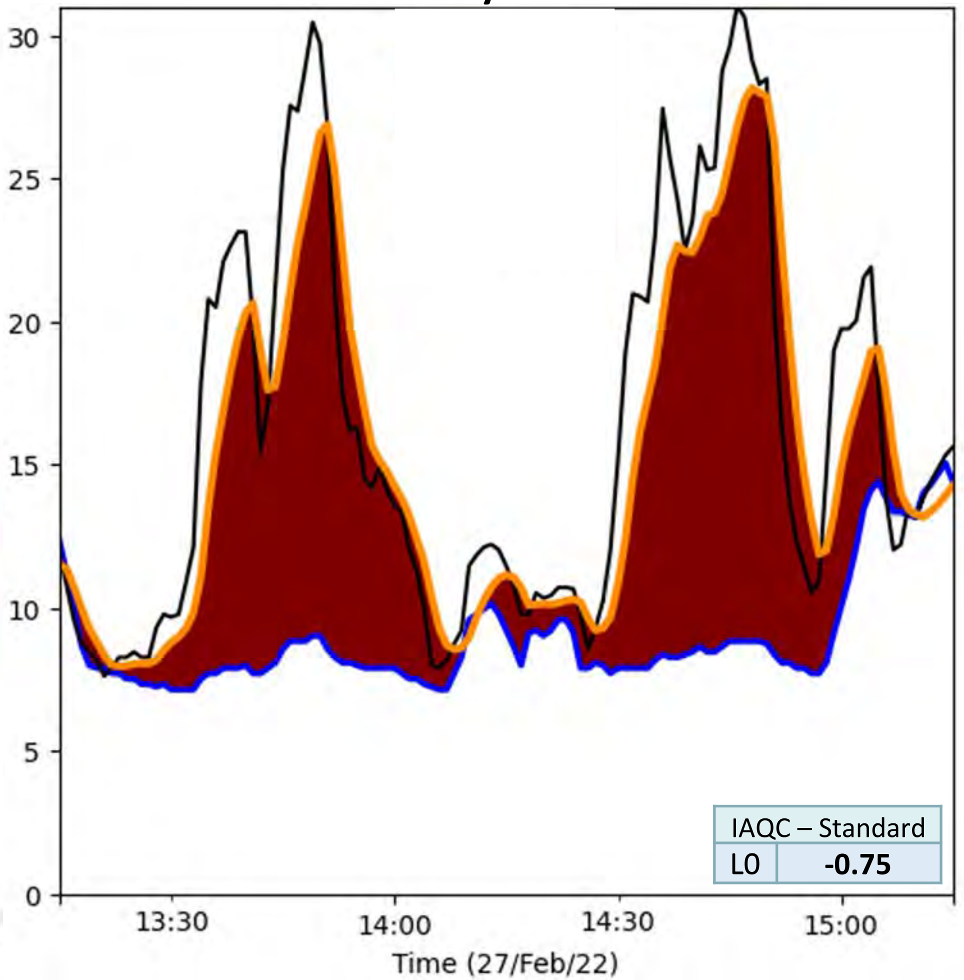
Urecsys

Intel IDC9, Haifa

Standard Mode



Urecsys Mode



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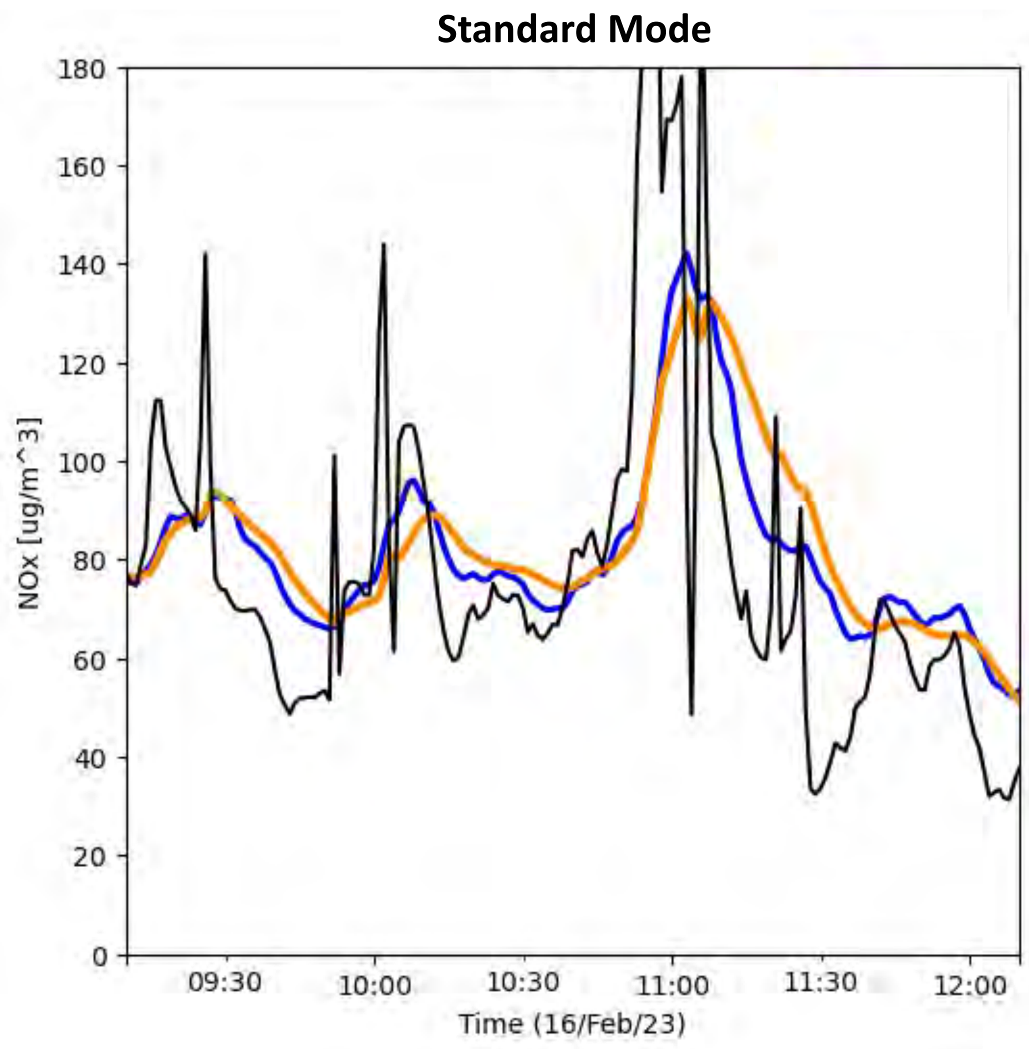
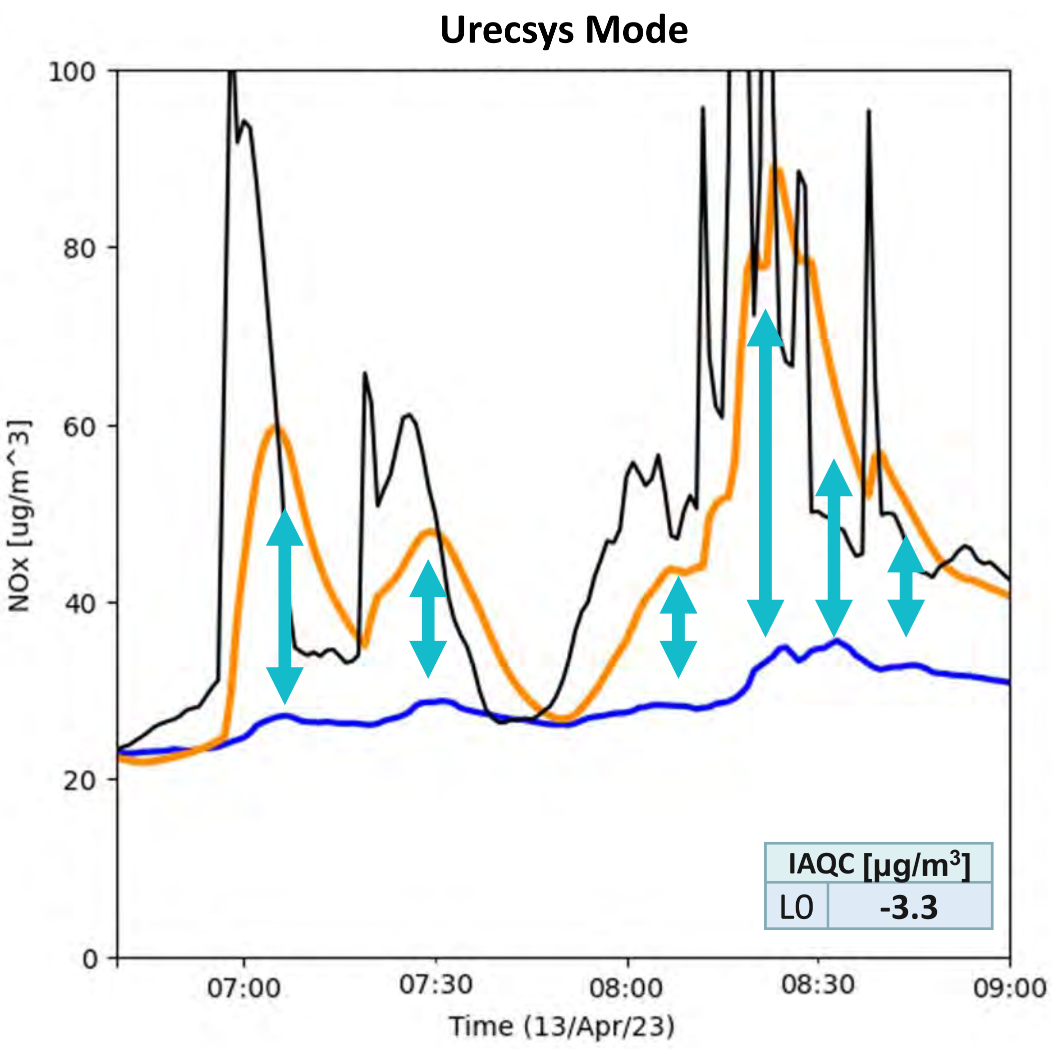
Urecsys

Google Offices, Tel Aviv





Outdoor Pollution Levels

The Measured Indoor Pollution Levels (in the building)

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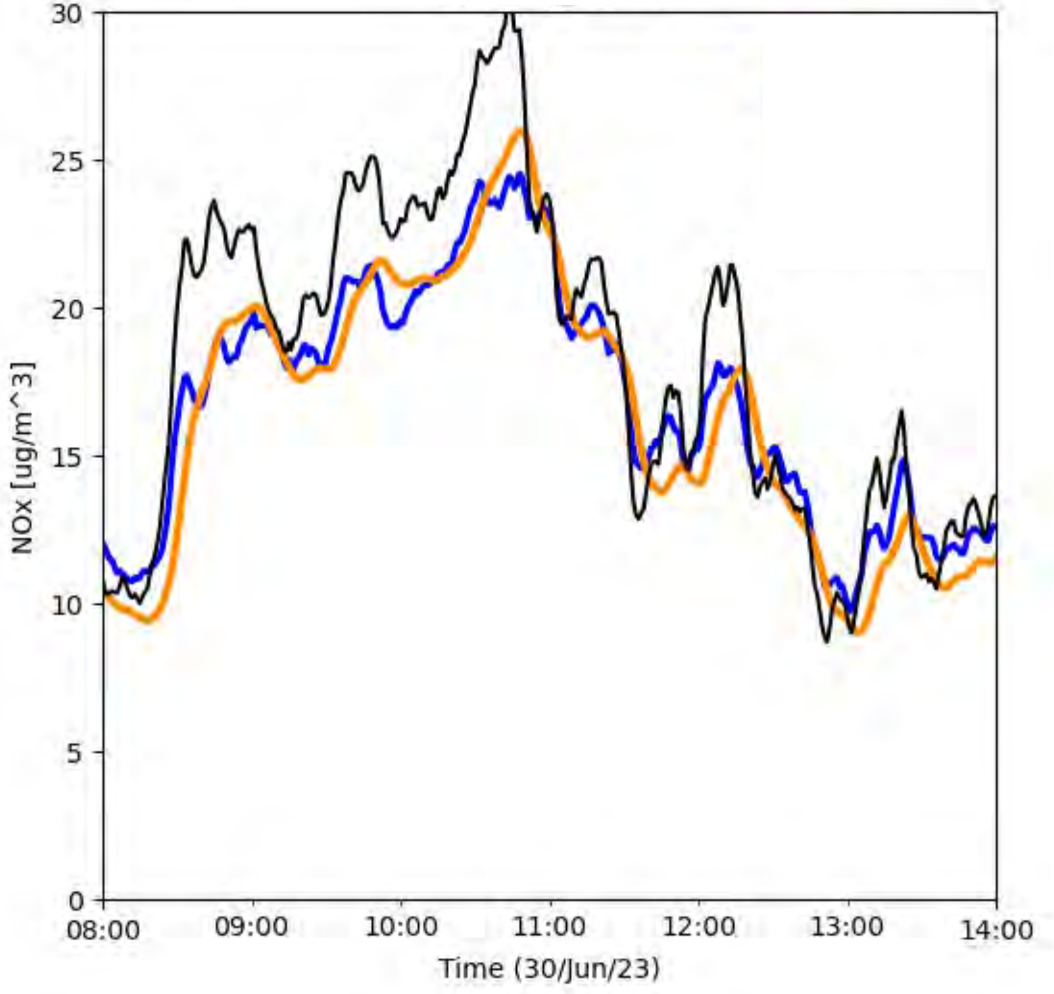
Actual Reduction of the public's hazardous air pollution exposure

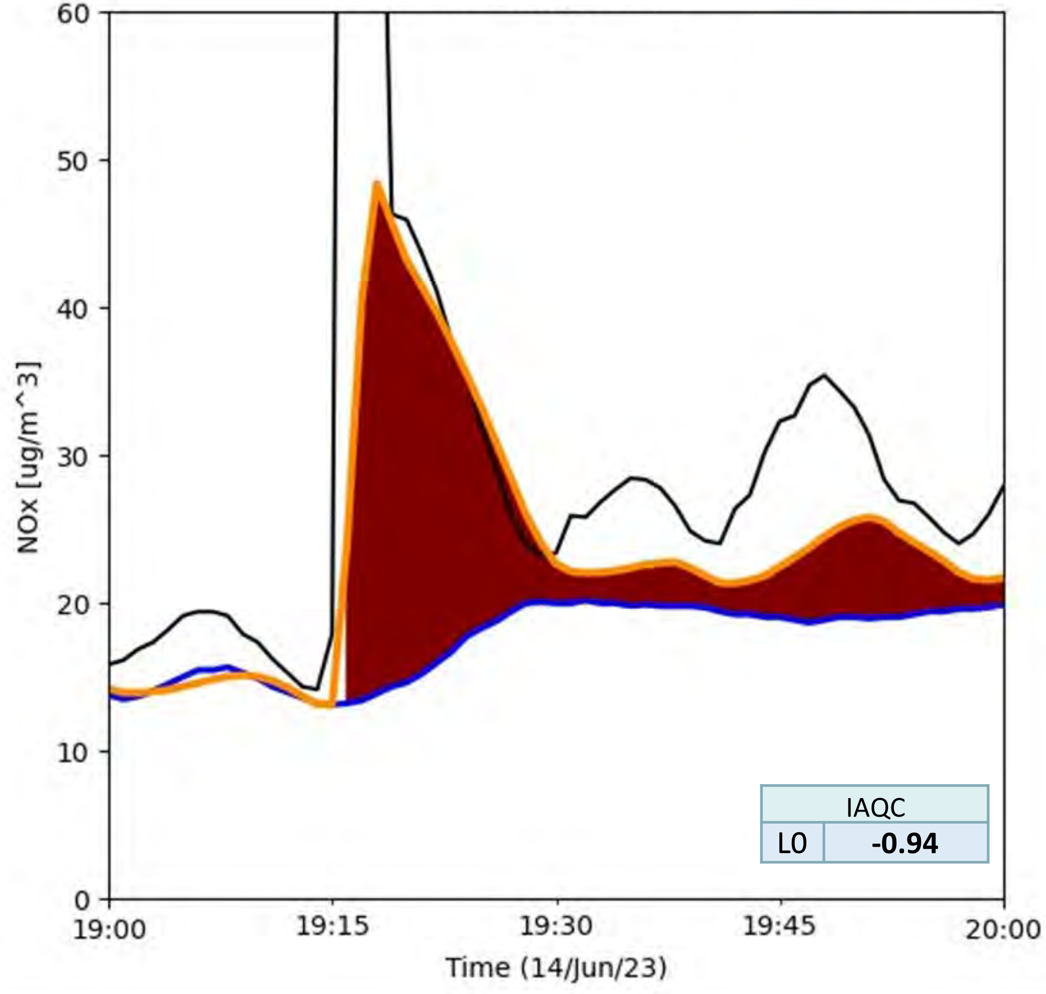
Urecsys

Fox Court, Holborn, London

Standard Mode



Urecsys Mode



Outdoor Pollution Levels

The Measured Indoor Pollution Levels (in the building)

The Accurately Predicted Indoor Pollution Levels **without Urecsys' System = Standard Mode**

Actual Reduction of the public's hazardous air pollution exposure

RESULTS ANALYSIS
Schneider Electric HQ, Netanya
NO_x , 29.08.2021-10.02.2022

Threshold	10.0	25.0	30.0	40.0
Average pollutants concentration in the building during exception - Standard mode [μg/m^3]	42.5	59.5	66.7	81.8
Average pollutants concentration in the building during exception - Urecsys mode [μg/m^3]	26.2	33.5	35.9	41.4
Actual Air Pollution Reduction – Average pollutants concentration in the building during exception	**38.5%**	**43.8%**	**46.1%**	**49.4%**
Percentage of time in which pollutant concentrations in the building exceeded the threshold – Standard Mode	74.6%	44.8%	36.7%	24.9%
Percentage of time in which pollutant concentrations in the building exceeded the threshold – Urecsys Mode	66.9%	25.9%	17.9%	10.7%
Actual Air Pollution Reduction – Percentage of time in which pollutant concentrations in the building exceeded the threshold	**10.2%**	**42.1%**	**51.0%**	**56.8%**
The average threshold exception – Standard Mode [μg/m^3]	32.5	34.5	36.7	41.8
The average threshold exception – Urecsys Mode [μg/m^3]	16.2	8.5	5.9	1.4

Bottom Line :

Actual air pollution reduction of the average threshold exception	**49.3%**	**64.3%**	**66.9%**	**70.7%**

# of Control days - 46, # of Urecsys days - 65

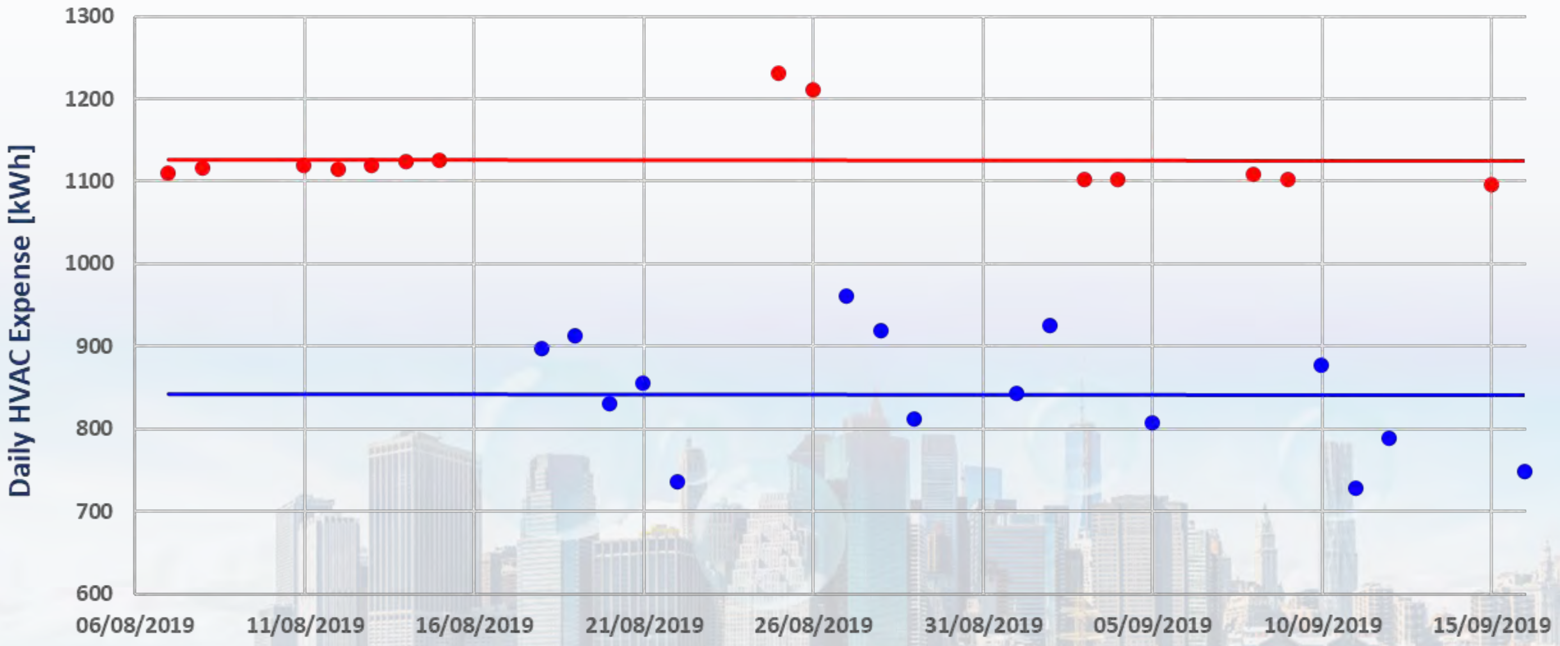
Average pollution level concentration outdoors [μg/m^3]	**42.15**
Upper quartile pollution level threshold outdoors [μg/m^3]	47.09
Average pollution level in the upper quartile outdoors [μg/m^3]	108.66
Percentage of pollution penetrations – in Standard Mode	**79.00%**
Upper Quartile Threshold in the building – in Standard Mode [μg/m^3]	39.91
Average pollution concentration in upper quartile – during Std [μg/m^3]	81.59
Reduction of upper quartile threshold exception – Urecsys Mode	**70.63%**
Average reduction from the most polluted hour in the day [μg/m^3]	**70.4**
Average reduction from the most polluted hour in the day – in %	**66.1%**
Number of days exceeding 25 μg/m^3 – in standard mode	42
Number of days exceeding 25 μg/m^3 – in Urecsys mode	16
Reduction of exceeding days – in %	**61.9%**

Energy Reduction as a By-Product of Improving Health

Energy Conservation as evidenced by installations in Israel is achieved by:

- Reducing ventilation rates for short periods of times during times of peak pollution levels
- HVAC Economizer: increased ventilating when outdoor air temp. & humidity are close to indoor set-point
- Integrating changing energy rates into the algorithm – ventilating more at times each kWh costs less

EMPIRICAL ENERGY REDUCTION ANALYSIS; Adgar 360° Tower, Tel Aviv



Every point indicates an entire operating day (excluding weekends & holidays):

● – Control Day: Total daily energy expense of the ventilation systems when operating in Standard Mode

● – Urecsys Day: Total daily energy expense of the ventilation systems when operating according to Urecsys recommendations

Monthly reduction of 6,182 kWh = 0.34 kWh per m^2, per month

Urecsys

OPTIONAL DEVICES & Installed Equipment

CLEAN AIR, ANYTIME, ANYWHERE

Urecsys

Quality assurance

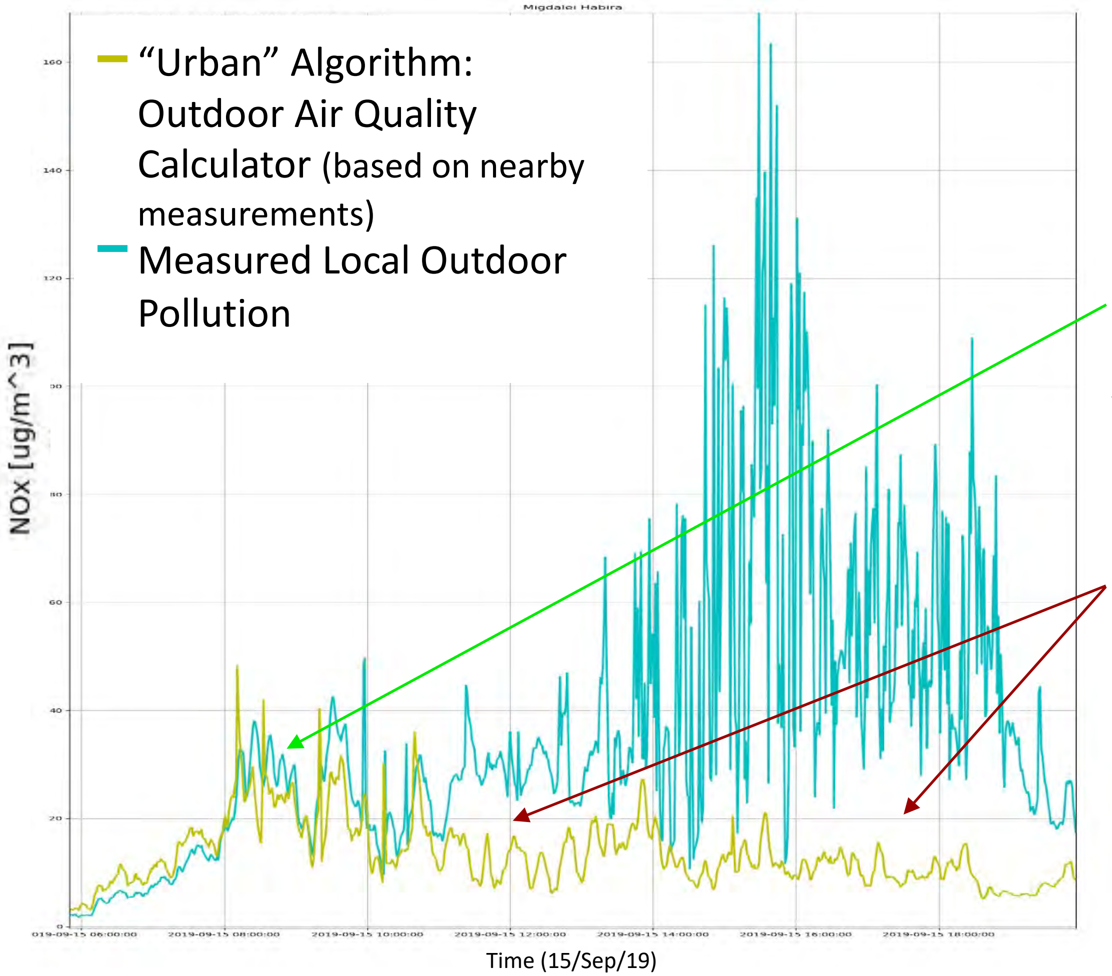
Differences between calculated values of air pollution levels Vs measured values raised an alert

In this instance, a quick check showed that the AHU’s motor belt was torn

URECSYS AS AN AID TO FACILITY MANAGERS

AI Algortihms for Identifying Construction Failures

Migdalei Ha'Bira (Capital Towers), Jerusalem



Most of the time (and at the beginning of the day), Local Empirical Measurements are similar to the Urban Algorithm Calculation

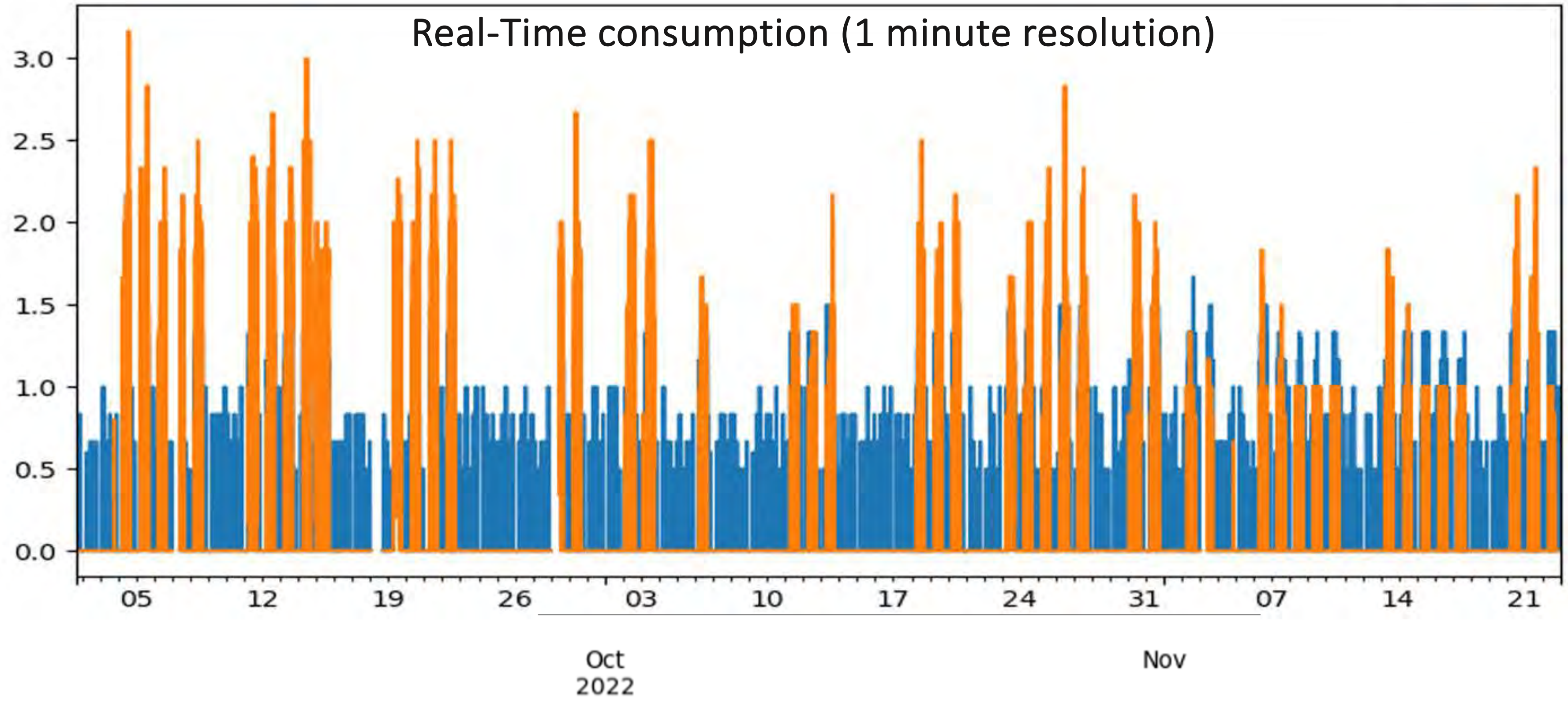
Occasionally there was a gap between the expected values (Yellow line) and the measured values (Blue line)

Parking Lot Exhaust

Ventilation Units (AHUs)

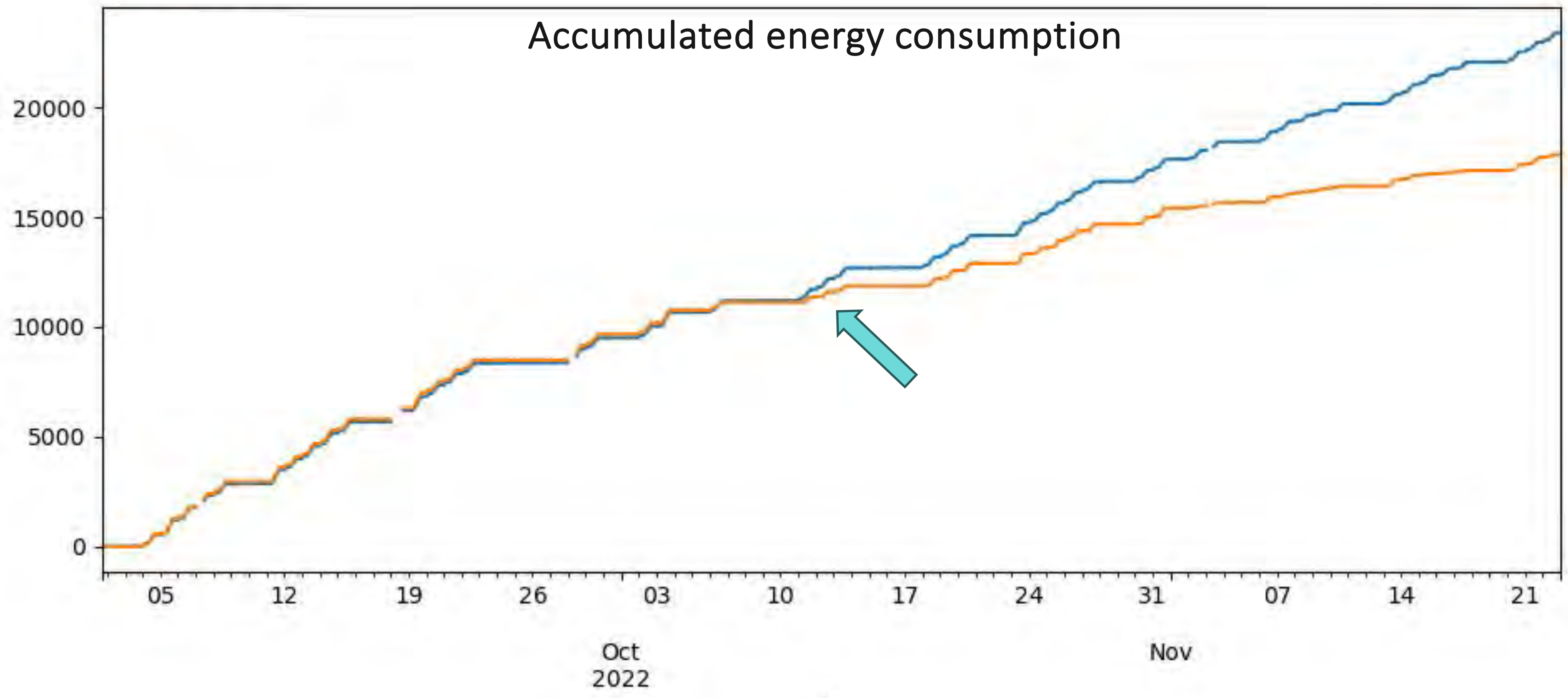
Sometimes a more thorough analysis is necessary

In this graph there doesn't seem to be any anomaly in the data



Sometimes a more thorough analysis is necessary

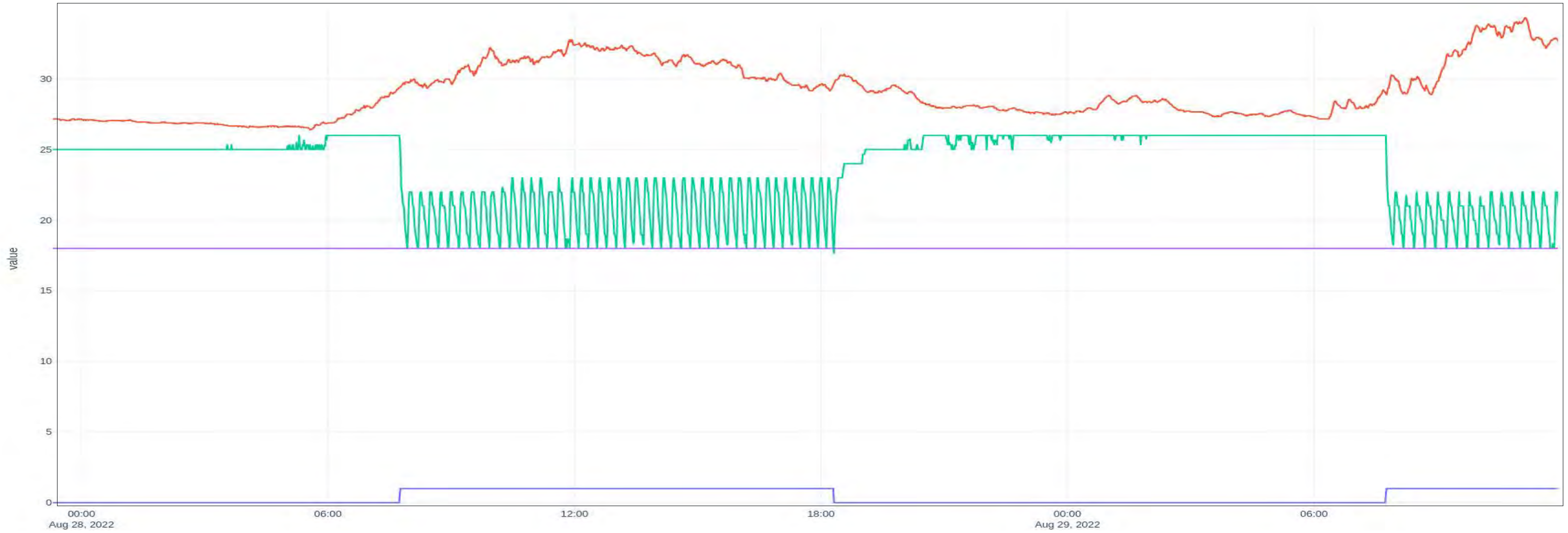
But after a smarter analysis, the anomaly pops

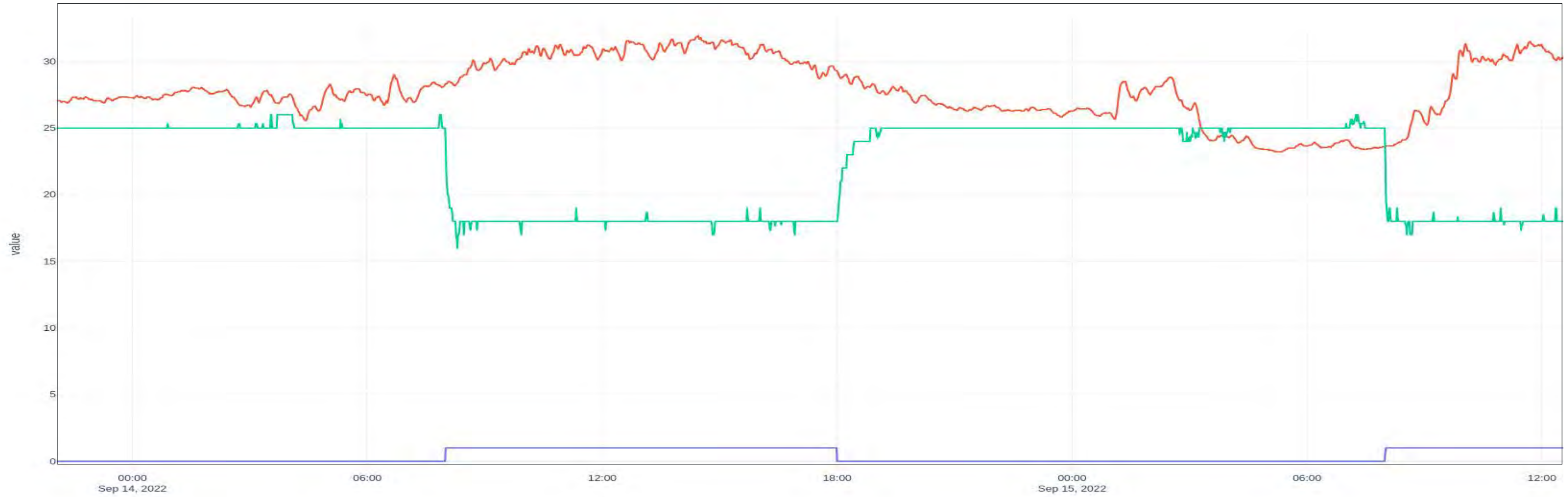


Urecsys

AI ALGORITHMS FOR DIAGNOSING ELECTRO-MECHANICAL FAILURES

Human errors & logical failures in climate controls of OA ventilation





AHU Activity
Supply Air Temp [°C]
Outdoor Air Temp [°C]
Temp Set-Point [°C]

Urecsys

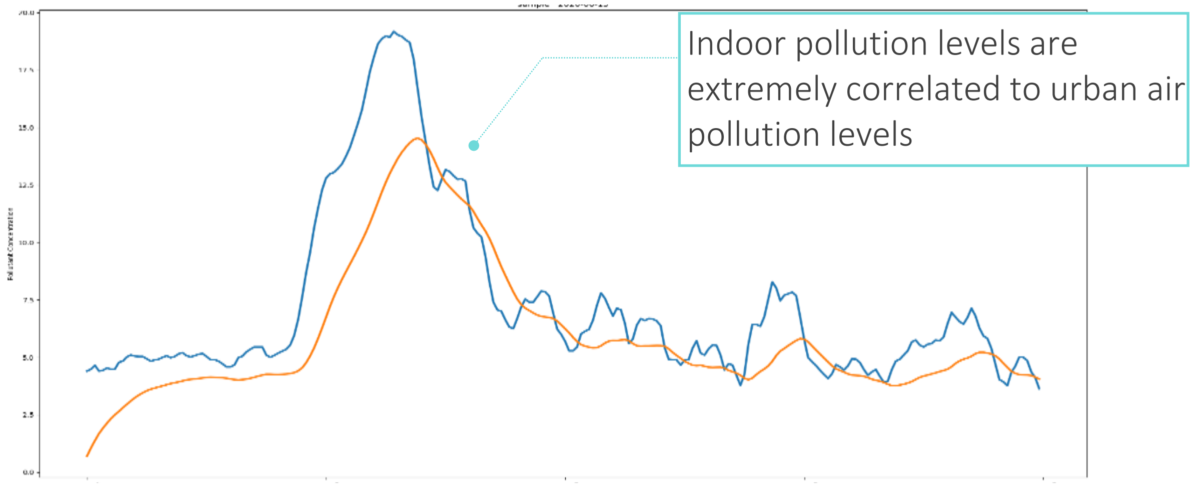
VENTILATION SYSTEMS TODAY

CLEAN AIR, ANYTIME, ANYWHERE

Maximum Ventilation VS. **Acceptable Minimum Ventilation by intermittent operation**

Constant ventilation

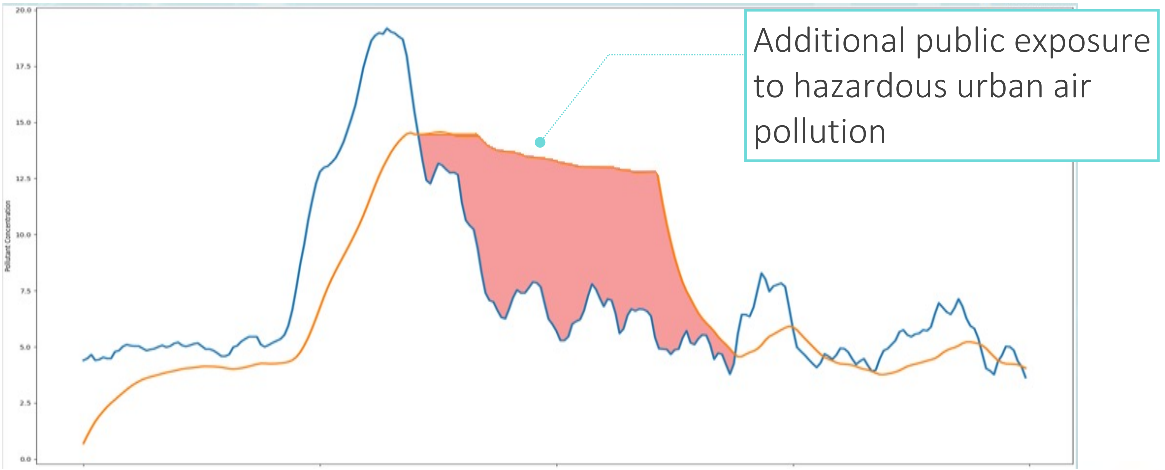
Introduces the outdoor pollution levels into the building, throughout the whole day



Intermittent ventilation - DCV

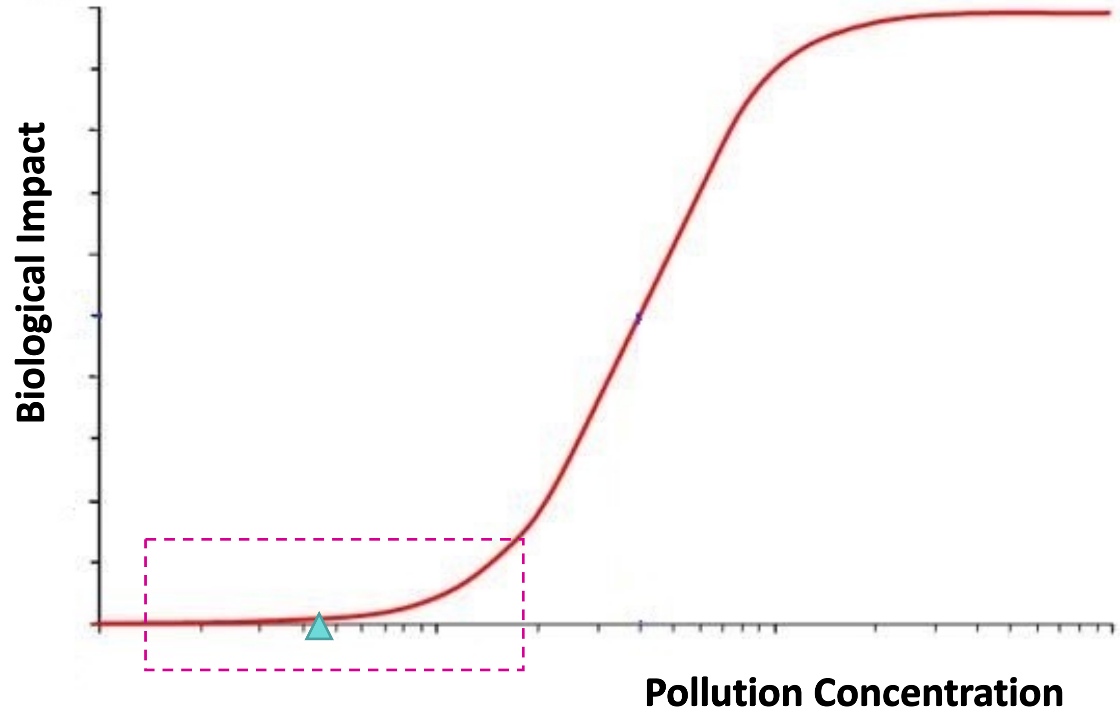
Preserves and stores the worst pollution levels inside the building, in many times

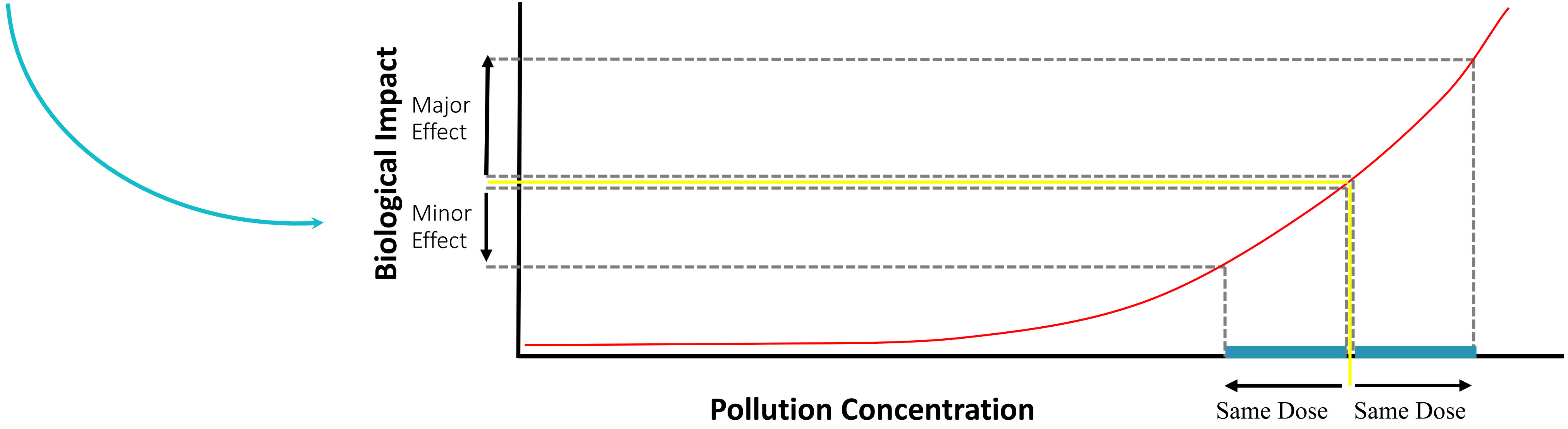
Increases pollution from indoor sources & health impact of outdoor pollution



Urecsys

Dose Response





Urecsys

Table 2.1 Limit values from Schedule 2 to the Air Quality Standards Regulations 2010

Pollutant	Exposure limit	Exposure time
Carbon monoxide	10mg/m³	8-hour average
Sulphur dioxide	350µg/m³	1-hour average
	125µg/m³	1-day average
Nitrogen dioxide	200µg/m³	1-hour average
	40µg/m³	1-year average
Benzene	5µg/m³	1-year average
Lead	0.5mg/m³	1-year average
$PM_{2.5}$	25µg/m³	1-year average
PM_{10}	50µg/m³	1-day average
	40µg/m³	1-year average

Control of ventilation intakes

2.2 Ventilation intakes should be located away from the direct impact of the sources of local pollution.

NOTE: CIBSE's TM64 and TM40 give further guidance.

2.3 Where urban traffic is a source of pollution, the air intakes for buildings next to busy urban roads should be both of the following.

a. As high as possible.

b. Located on the less polluted side of the building.

Mechanical ventilation may be the most practical way of achieving this requirement.

2.4 If practicable, ventilation intakes should not be located in courtyards or enclosed urban spaces where air pollutants are discharged. If this is unavoidable, intakes should be located to meet both of the following conditions.

a. As far as possible from the source of pollutants.

b. In an open or well-ventilated area.

2.5 In areas where wind often comes from opposing directions (e.g. a valley), the air intakes should point in the opposite direction to the exhaust outlets.

2.6 Where sources of pollution vary with the time of day, such as urban road traffic, it may be acceptable, for time-limited periods, to take one of the following actions.

a. Reduce the flow of external air into ventilation intakes.

b. Close ventilation intakes when the concentrations of external pollutants are highest.

ONLINE VERSION

From Approved Document F of the Building Regulations

Smart Buildings SHOW

9-10 October 2024 • ExCeL London

We look forward to seeing you in 2024