MERALCO MSERV

Total Energy Solutions and Urban Services Provider

Indoor Air Quality Solutions

People are becoming more conscious about health and environmental well-being

People spend almost **90% of their time indoors** (office and home), yet **indoor air quality is 2-5x worse** than outdoor air. This results in a worldwide health concern called **sick building syndrome.**

Sick building syndrome (**SBS**) is a condition where people in a building suffer from symptoms of illness or become infected with chronic disease from the building they work in or reside in. It is usually attributed to **poor indoor air quality.**

Potential Implications

Health Issues and Concerns	Uncomfortable Work Environment	Inefficient Operations of HVAC System
• Cost for Health Care • Work Absence • Diminished Productivity	• Diminished Productivity • Poor Customer Satisfaction	• Higher Energy Cost • Risk of Equipment Breakdown

What are the typical issues in a sick building?

Poor Ventilation	• Lack of Outdoor Air • Inefficient HVAC Design • Poor HVAC Maintenance
Biological Contaminants	• Viruses • Bacteria • Molds • Pollens
Chemical Contaminants	• Volatile Organic Compound • Radon Gas • Carbon Monoxide/Dioxide • Particulate Matter
Other Factors	• Inadequate Lighting • Bad Acoustics • Poor Ergonomics

MSERV can provide indoor air quality solutions to address these concerns

MSERV Indoor Air Quality Solutions

	Solutions	Description
1	HVAC Design Consultancy, Audit and Testing Services	**Engineering, design and overall recommendation** for the HVAC system and indoor air quality solution can be provided to the client
2	HVAC System Upgrade and Retrofit	**Upgrade** of HVAC equipment due to **inefficient facility design or equipment performance** to improve overall HVAC system performance and indoor air quality
3	HVAC Cleaning and Maintenance	Proper **cleaning and maintenance of HVAC system** including air conditioning unit, air filters, coils, duct systems and ventilation system help **maximize indoor air quality**
4	Filters and Purifiers	Air filters **help remove airborne particles and pollutants** up to 99.97% of particles from 0.3 microns or larger Air and Surface purifiers are **designed to kill bacteria, molds and fungus and other contaminants** using UV lamps
5	Air Quality Sensors and Monitoring System	Sensors/devices can detect **several air quality parameters real-time** to provide overview of the area through a visualization dashboard
6	Humidifiers and Dehumidifiers	Humidifiers/Dehumidifiers can help manage humidity to a **recommended level of 45-55%**. High levels will result in risk of mold and bacteria growth and low levels will result in a dry feeling and difficulty to breathe

MSERV Indoor Air Quality Solutions

Typical Issues in Indoor Air Quality

	Solutions	Poor Ventilation	Biological Contaminants	Chemical Contaminants
1	HVAC Design Consultancy, Audit and Testing Services	●	●	●
2	HVAC System Upgrade and Retrofit	●		
3	HVAC Cleaning and Maintenance	●	●	●
4	Filters and Purifiers		●	●
5	Air Quality Sensors and Monitoring System	●	●	●
6	Humidifiers and Dehumidifiers		●	

● **Reports/Informs Issue** ● **Resolves Issue**

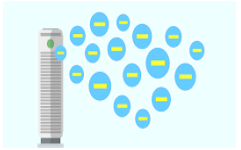
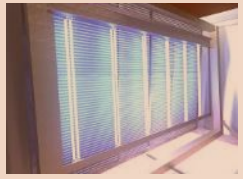
HVAC System Upgrade and Retrofit

Services	Chillers and Inverters
	Re-piping/Re-tubing of HVAC System
	Chiller Plant Optimization
	Chiller Energy Management System
	AHU Optimization
	Variable Pumping System
	Cooling Tower Optimization
	Demand Control Ventilation System
	Heat Pump for Hot Water
	Heat Recovery System
	Heat Recovery Wheel Application
	Humidity Control

HVAC Cleaning and Maintenance

Services	General Visual Inspection of HVAC System
	Retightening of Wirings and Connections
	Recharging of Refrigerant Level
	Oil Sampling and Analysis
	Clearing of Drain Pans and Condensate Lines
	Cleaning of Coils
	Cleaning of Blowers
	Cleaning of Air Ducts
	Replacement or Cleaning of Air Filters
	Lubrication of Belts, Fan Motors and Blade
	Calibration of Field Sensors and Chiller Management System
	Cleaning of Cooling Towers and Water Quality Sampling

Filters and Purifiers

				
	Air Filters	**Activated Carbon Air Filters**	**Air Ionizers**	**UV Lamps (UVGI)**
Overview	Multiple layers of fiber-like material are combined to trapped particles to separate it from the air	Molecular sized pores that have high absorbent ability and chemical bonding	Negative ions released attach to airborne particles causing it to stick to charged surfaces	Exposure to UV light kills micro-organisms
Advantages	Remove particles larger than 0.3 microns such as dust, spores, allergens and most bacteria	Removes odor by capturing chemical fumes, gases and smoke	Removes ultra-fine particles up to 0.01 microns	Destroys germs, viruses, molds, and bacteria
Disadvantages	• Not effective with inactivating viruses, bacteria and microorganisms	• Does not remove dust, allergens, bacteria and viruses • Requires regular replacement • Difficult maintenance	• Removes particles from the air, but not from the room • Produces ozone as by-product	• Does not remove most allergens and dusts

Source: Allergy and Air, Oxygenland

It is recommended to utilize Air Filters and UV Lamps together to yield best results

Type of Air Filters

Key Considerations for Air Filters:

- Upgrading of air filters might restrict airflow and may require HVAC Upgrades/Retrofit
- Better air filters will also require higher electricity consumption

	Usual Application	Particle Size	Controlled Contaminants	MERV Rating
Fiberglass	Residential window AC units	> 10.0 µm	Pollen, dust mites, cockroach debris, sanding dust, spray paint dust, textile fibers, carpet fibers	1–4
Pleated	Better residential, general commercial, industrial workspaces	10.0–3.0 µm	Mold spores, dust mite debris, cat and dog dander, hair spray, fabric protector, dusting aids, pudding mix	5–8
Semi-HEPA	Superior residential, better commercial, hospital laboratories	3.0–1.0 µm	Legionella, humidifier dust, lead dust, milled flour, auto emission particulates, nebulizer droplets	9–12
HEPA	Hospital, general surgery, food, pharmaceutical	1.0–0.3 µm	Bacteria, droplet nuclei (sneeze), cooking oil, most smoke and insecticide dust, most face powder, most paint pigments	13–16
ULPA	Clean rooms	< 0.3 µm	Viruses, carbon dust, combustion smoke	17-20

RECOMMENDED

Average size of COVID-19 is at 0.125 µm

Notes:

- *Particle Size – only particles larger than 10*µm *are visible to the human eye*
- *HEPA – High Efficiency Particulate Air*
- *ULPA – Ultra Low Particulate Air*
- *MERV – Minimum Efficiency Reporting Value – ASHRAE Standard Measurement for Air Filter Effectiveness*

Source: Mechanical Reps Inc.

100% CHEMICALFREE DISINFECTION

WHAT IS UV-C LIGHT?

UVA

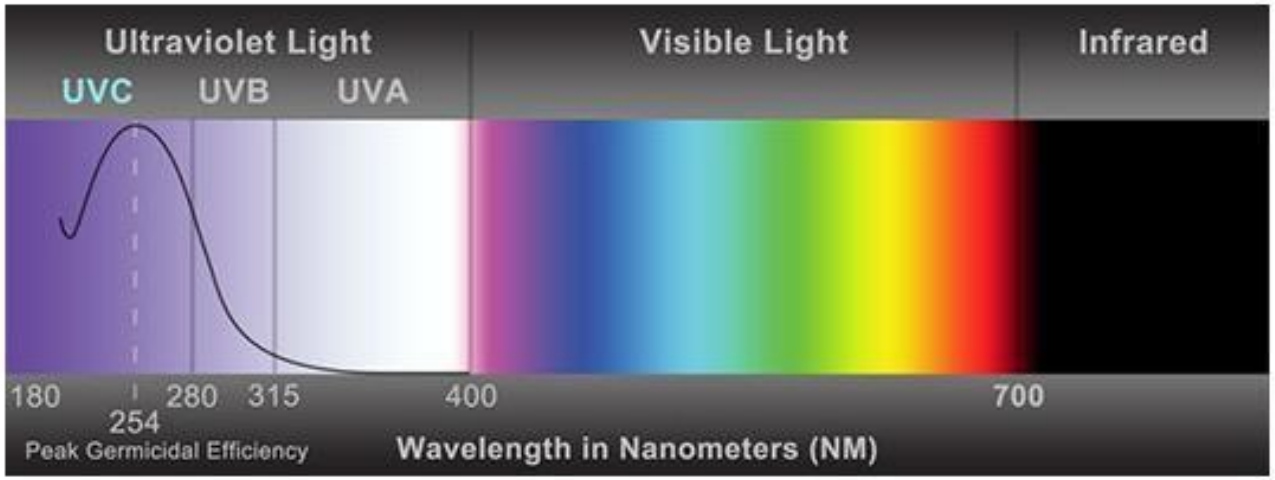
"Black lights" are harmless fun

UVB

Causes sunburn

UV-C

Most effective at killing microbes



Ultraviolet (UV) light is a range of light frequencies that are mostly invisible to the human eye. The UV-C band is most effective at killing germs because its short wavelength is able to penetrate the cell walls of microorganisms and scramble their DNA. Also, UV-C is filtered out by the earth's atmosphere so microbes have no defense against it.

UVGI is a proven and tested technology

Tested for killing bacteria

CHINESE GENERAL HOSPITAL and MEDICAL CENTER

Bacteriology Results

FOR UV LIGHT EXPOSURE	BEFORE	AFTER
1. Pseudomonas aeruginosa	HEAVY GROWTH	NO GROWTH
2. Klebsiella pneumoniae	HEAVY GROWTH	NO GROWTH
3. Yeast Cells	HEAVY GROWTH	NO GROWTH
4. Staphylococcus	HEAVY GROWTH	NO GROWTH
5. Escherichia coli	HEAVY GROWTH	NO GROWTH
6. Methicillin-resistant Staphylococcus	HEAVY GROWTH	NO GROWTH
7. Serratia marcescens	HEAVY GROWTH	NO GROWTH
Source of Specimen: AIR SAMPLE	Aerobic C/S: Coagulase negative staphylococcus	NOTHING FOUND
	Fungal spores and hyphae	NEGATIVE

Tested for killing viruses

SARS and MERS with pending test for COVID-19

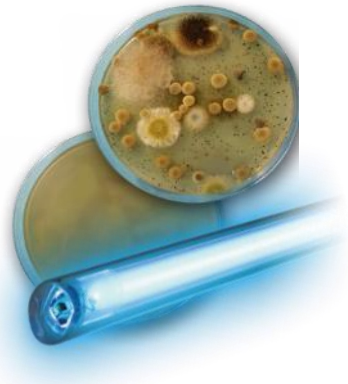
UV light, specifically between 200-280nm[iii] (UVC or the germicidal range), inactivates (aka, 'kills') at least two other coronaviruses that are near-relatives of the COVID-19 virus: 1) SARS-CoV-1[iii] and 2) MERS-CoV[iii] [iv] [v]. An important caveat is this inactivation has been demonstrated under controlled conditions in the laboratory. The effectiveness of UV light in practice depends on factors such the exposure time and the ability of the UV light to reach the viruses in water, air, and in the folds and crevices of materials and surfaces.

Table 1 summarizes the results of studies that have been performed on Coronaviruses under ultraviolet light exposure, with the specific species indicated in each case. The D90 value indicates the ultraviolet dose for 90% inactivation. Although there is a wide range of variation in the D90 values, this is typical of laboratory studies on ultraviolet susceptibility. The range of D90 values for coronaviruses is 7-241 J/m^2 the mean of which is 67 J/m^2, should adequately represent the ultraviolet susceptibility of the SARS-CoV-2 (COVID-19) virus.

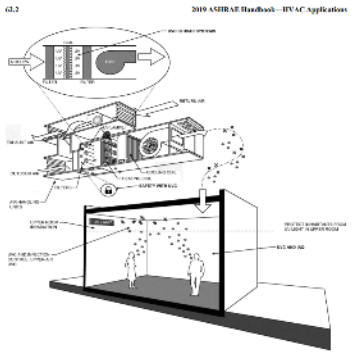
Table 1: Summary of Ultraviolet Studies on Coronaviruses

Microbe	D_{90} Dose J/m^2	UV k m^2/J	Base Pairs kb	Source
Coronavirus	7	0.35120	30741	Walker 2007[a]
Berne virus (Coronaviridae)	7	0.32100	28480	Weiss 1986
Murine Coronavirus (MHV)	15	0.15351	31335	Hirano 1978
Canine Coronavirus (CCV)	29	0.08079	29276	Saknimit 1988[b]
Murine Coronavirus (MHV)	29	0.08079	31335	Saknimit 1988[b]
SARS Coronavirus CoV-P9	40	0.05750	29829	Duan 2003[c]
Murine Coronavirus (MHV)	103	0.02240	31335	Liu 2003
SARS Coronavirus (Hanoi)	134	0.01720	29751	Kariwa 2004[d]
SARS Coronavirus (Urbani)	241	0.00956	29751	Darnell 2004
Average	**67**	**0.03433**		

[a] (Jingwen 2020) [b] (estimated) [c] (mean estimate) [d] (at 3 logs)



Approved by several international organizations



ASHRAE Shaping Tomorrow's Built Environment Today

2019 ASHRAE Handbook HVAC Applications

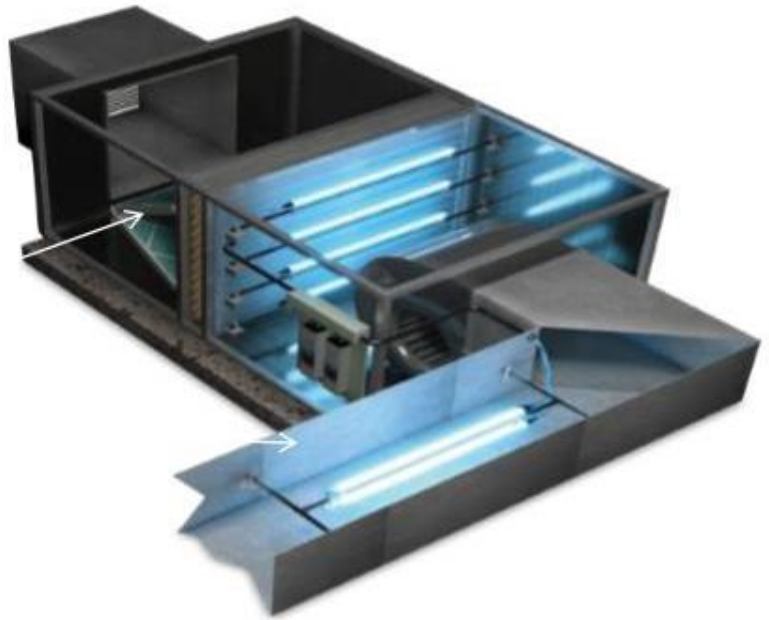
CDC Centers for Disease Control and Prevention

LEED Leadership in Energy & Environmental Design

UVGI Air Treatment

UV Air Treatment aims to sterilize air flowing through HVAC systems. UV lamps are permanently installed and operational 24/7.

- UV AHU Solution is placed in the coil area and air duct system of the centralized HVAC system
- UV Aircon Sterilizers are designed to be installed in split-type and window-type air conditioners
- UV Air Purifiers are positioned in the room to help treat ceiling cassette air-conditioners



Technical Specifications

- UV AHU Solution uses 90, 120 and 150 Watts for centralized HVAC systems
- UV Aircon uses 10 Watts for HP 1-3 and 23 Watts for HP 3-5 air-conditioners
- UV Air Purifiers uses multi-stage treatment solution
  - 6-stage (45 Watts) : 30 sqm
  - 7-stage (45 Watts) : 60 sqm
  - 8-stage (65 Watts) : 80 sqm

UVGI Surface Treatment

UV Surface Treatment aims to sterilize **all surfaces of a certain area** to prevent human contact or transmission. Areas should be **properly vacated** prior to sterilization.

- UV Room Sterilizers are mobile and can be placed in different areas for proper sterilization (120 Watts for Double-Arm and 60 Watts for Single-Arm)
- UV Overhead Lamps are fixed and can be turned on and off any time (40 Watts)

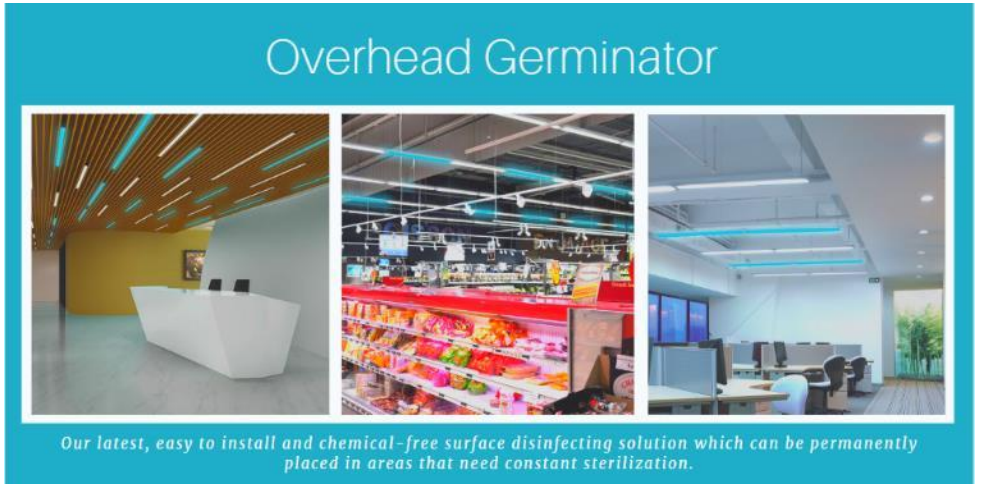
Sterilization Time: ~30-60 minutes

Sterilization Coverage

- 120 Watts: 60 sqm (Room)
- 60 Watts: 30 sqm (Room)
- 40 Watts: 20 sqm (Overhead)

Technical Specifications

- 120 Watts: Motion Sensor, Timer
- 60 Watts: Timer



UVGI can provide air and surface treatment solutions

Surface Treatment

Germ Terminator

Pocker Sterilizer

Portable Germ Zapper

Overhead Germinator

with louver housing (optional)

Room Sterilizers

Escalator Handrail Sterilizer

Air Treatment

6-Stage Air Purifier

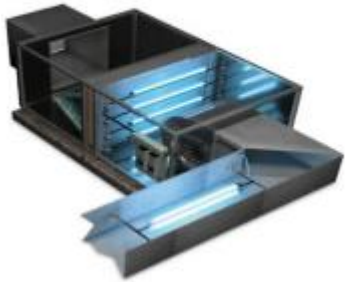
7-Stage Air Purifier

8-Stage Air Purifier with Humidifier

Aircon Sterilizer

2x Aircon Sterilizer Lamp. A/C unit not included.

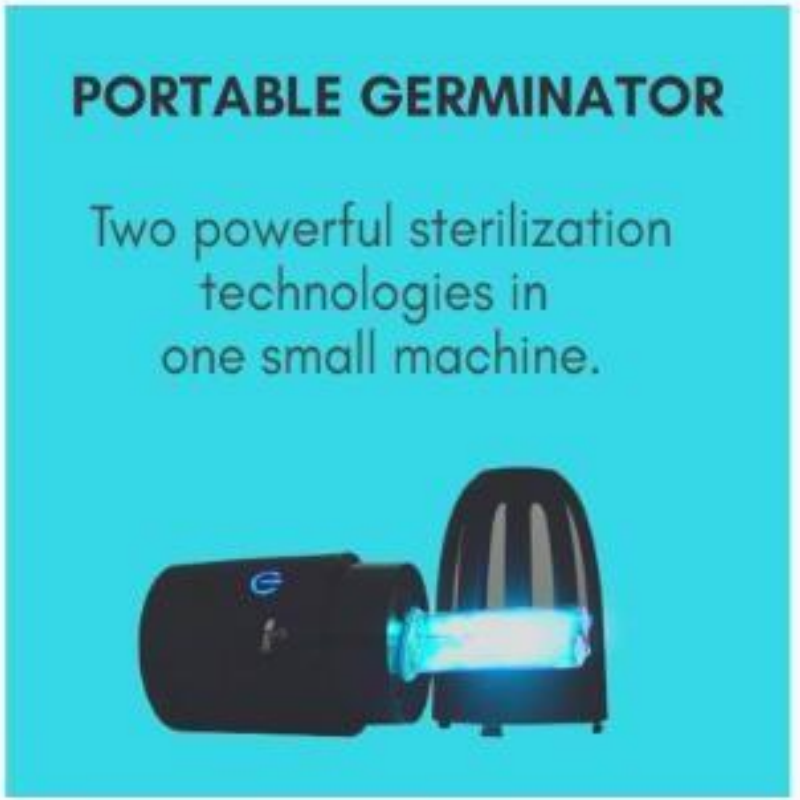
HVAC Coil & Duct Sterilizer



Pocket Sterilizer & Germ Terminator

Hand-held UV sterilizers that can be used on personal items like cellphone, keys, laptops

Portable Germ Zapper & Germinator



Portable UV-C and Ozone sterilizers for rooms, offices, cabinets, storage space, cars, service vehicles and many more!

Room Sterilizers

HOSPITALS

CLASSROOMS

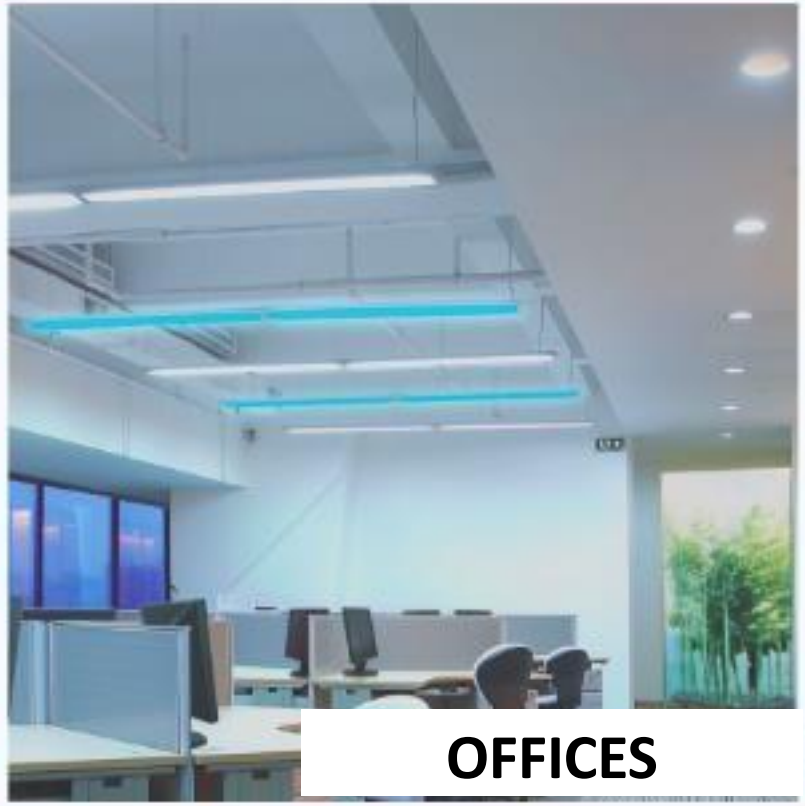
OFFICES

This is best used for surface sterilization of areas that can be vacated and sterilized for some time.

Overhead Germinator

BUILDINGS

GROCERIES



OFFICES

Our latest, easy to install and chemical-free surface disinfecting solution which can be permanently placed in areas that need constant sterilization.

Escalator Handrail Sterilizer

UPTOWN MALL

RESORTS WORLD

POWERPLANT MALL

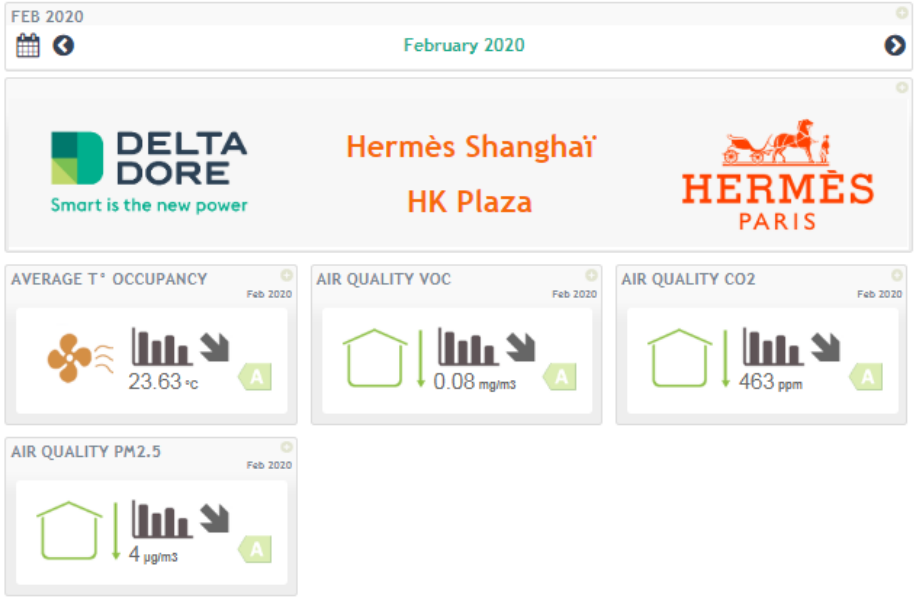
EASTWOOD

Features	UV Care Clean Air 6- Stage Air Purifier	UV Care Super Air Cleaner (7 Stage)	UV Care Air Purifier and Humidifier (8 Stage)
Coverage Area	30 sqm	60 sqm	80 sqm
Filters	6 Stages Filtration (Washable Prelimary Filter, 99.97% True HEPA Filter, Activated Carbon, Photo Catalyst Filter, UV-C Filter, Negative Ions)	7 Stages Filtration (Washable Elementary Pre-Filter, 99.97% True HEPA Filter, Molecular Sieve Absorption Layer, Activated Carbon, Photo Catalyst Filter, UV-C Filter, Negative Ions)	8 Stages Filtration (Elementary Filter, 99.97% True HEPA Filter, Molecular Sieve Absorption Layer, Activated Carbon,Cold Catalyst Filter, UV-C Filter, Negative Ions, Anti-bacterial Humidifier)
Filter Placement	Back of the unit	Front of the unit	Front of the unit
Negative Ion	20 million pcs/ cm3	20 million pcs/ cm3	10 million pcs/ cm3
Air Quality Light Indicator	Green- Excellent Air Quality, Blue- Good Air Quality, Yellow- Okay Air Quality, Red- Poor Air Quality	Green - Excellent Air Quality, Orange - Normal Air Quality, Red- Poor Air Quality	Green- Excellent Air Quality, Blue- Good Air Quality, Yellow- Okay Air Quality, Red- Poor Air Quality
Functions	Auto Function, Sleep Child Lock (Sleep + Timer), UV- C Lamp	Auto Fnction, Sleep, Child Lock, UV-C Lamp	Auto Fnction, Sleep, Child Lock, UV-C Lamp
Wind Speed	Low, Medium, High	Low, Medium, High	Low, Medium, High, Super
Timer	1-12 hours	1-12 hours	1-12 hours
Room Temperature Display	Yes (Sleep + Speed)	No	Yes
Dimension	L- 33 cm x W-17 cm x H- 51 cm	L-37 cm x W- 19.5 cm x H- 65 cm	L-39.1 cm x W- 24.5 cm x H- 60.3 cm
Weight	4.5 kg	8 kg	10.8 kg
Main Material	ABS Plastic	ABS Plastic	ABS Plastic
Power Rating	45 W	45 W	65 W
Voltage	220 V	220 V	220 V

Air Quality Sensors and Monitoring System

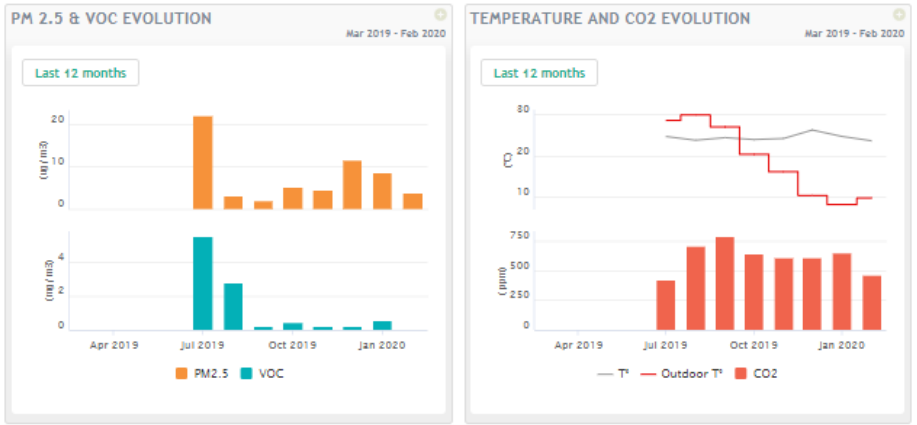
Air Quality Sensors and Monitoring System help provide **real-time indoor air quality data** to the facilities manager

- Data input is received through **multi-sensors deployed** throughout the facilities
- Data is sent to the **cloud** for proper transfer and storage
- Real-time information can be viewed through a **central dashboard**
- This can be integrated with the existing **Building Management System**

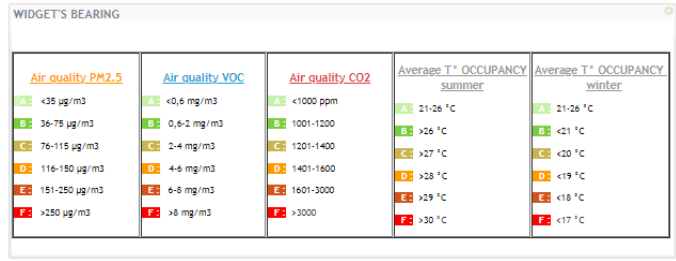


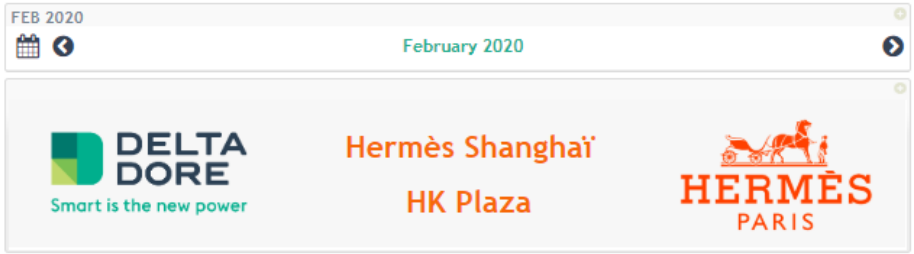
Key Parameters

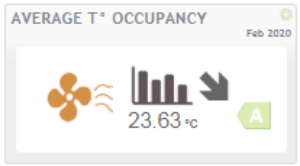
- Temperature and Humidity
- Particulate Matter
- Volatile Organic Compound
- Carbon Dioxide, Carbon Monoxide, Ozone, Radon Gas

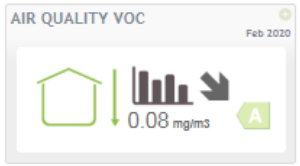


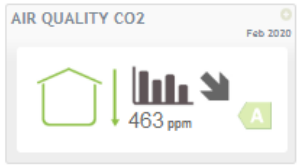
Air Quality Sensors and Monitoring System

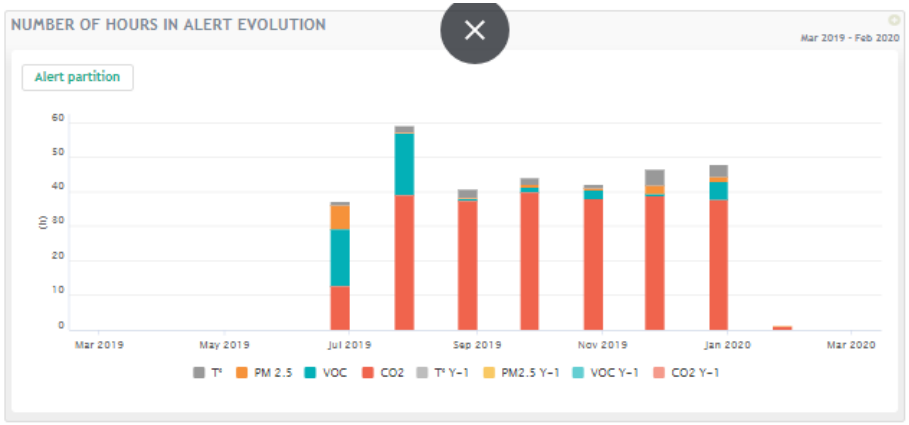


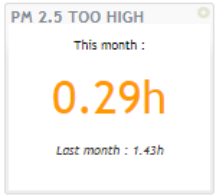


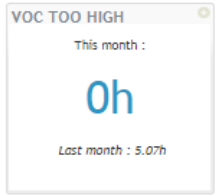


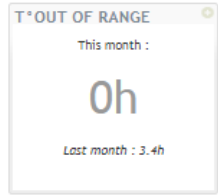


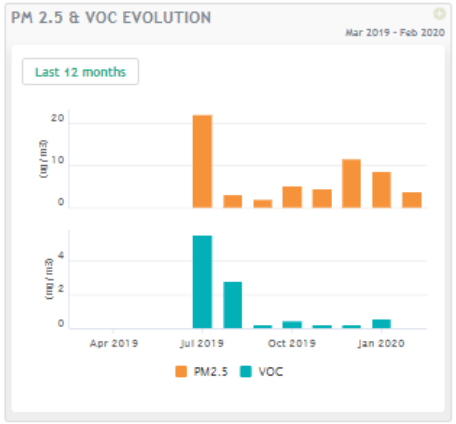


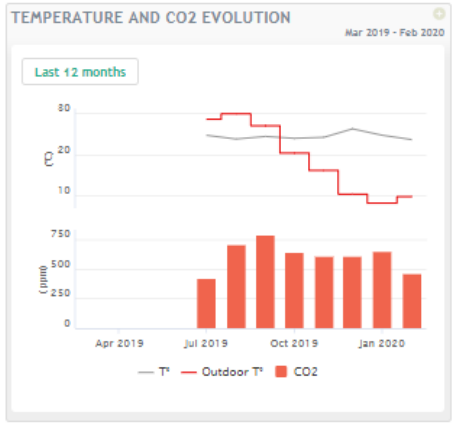


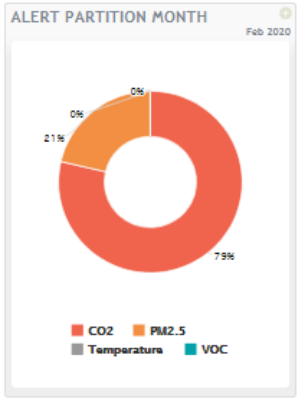


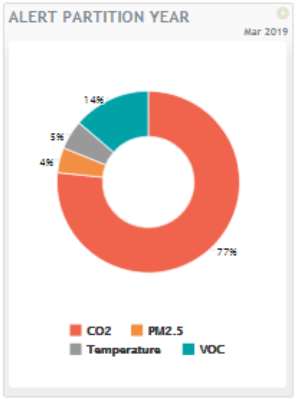


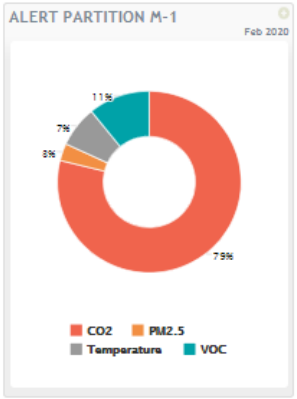












Indoor Air Quality Process Flow

Audit and Commissioning

MSERV will conduct proper assessment and commissioning of HVAC facilities to ensure proper operations and maintenance

- Assessment of HVAC Equipment
- Initial Measurement of Indoor Air Quality
- Commissioning of HVAC Equipment

Site Testing and Analysis

MSERV will conduct proper testing and audit of HVAC facilities to develop proper test parameters and recommendations moving forward

- Site Inspection
- Mechanical and Environmental Testing
- Lab Analysis
- Comprehensive Report and Recommendation

HVAC System Rectification

MSERV will conduct corrective measures and recommendations to improve overall performance and quality of facilities

- Project Development
- Engineering and Design
- Supply and Installation
- Operations and Maintenance
- Other Services

MSERV Product Offerings (Personal)

	Item	Specifications
Surface	Germ Terminator	• Hand-held UV Sterilizers for Personal Items
	Pocket Sterilizer	• Hand-held UV Sterilizers for Personal Items
	Portable Germ Zapper	• Portable Sterilizer for Homes and Offices Coverage: 15 sqm
Air	Aircon Sterilizer 10W	• For window and split-type air conditioners (HP 1 to 3) • Inclusions: 2pcs UV bulb, consumables, installation, user manual and caution UV light sticker
	Aircon Sterilizer 23W	• For split-type air conditioners, floor mounted type (HP 3 to 5) • Inclusions: 2pcs UV bulb, consumables, installation, user manual and caution UV light sticker
	6-Stage Air Purifier	• Coverage: 30 sqm • 6-Stage Process: Pre-Filter, HEPA Filter, Activation Carbon, Photo Catalyst Filter, UVC, Negative Ions
	7-Stage Air Purifier	• Coverage: 60 sqm • 7-Stage Process: Pre-Filter, HEPA Filter, Molecular Absorption Layer, Activation Carbon, Photo Catalyst Filter, UVC, Negative Ions
	8-Stage Air Purifier	• Coverage: 80 sqm • 8-Stage Process: Pre-Filter, HEPA Filter, Activation Carbon, Photo Catalyst Filter, Molecular Absorption Layer, UVC, Negative Ions, Humidifier

MSERV Product Offerings (Commercial)

	Item	Specifications
Surface	Overhead Germinator	• Capacity: 40 Watts • Coverage: 20 sqm (Note : Supply of UV lamp only)
	Overhead Germinator Package	• Inclusions: 4 pcs UV bulbs (40 Watts), ballast, troffer luminaire (slim type), motion sensor, timer switch, installation, testing and commissioning
	Room Sterilizer (Double Arm)	• Capacity: 120 Watts, 10,000 burning hours • Coverage: 60 sqm (30 minutes) • Features: Motion sensor, digital timer and time delay
	Room Sterilizer (Single Arm)	• Capacity: 60 Watts, 10,000 burning hours • Coverage: 30 sqm (30 minutes) • Features: Digital timer
	Escalator Handrail Sanitizer	• Sterilizers installed at escalator handrails for continuous sterilization • Wireless: Uses power from movement of escalator rails • Inclusion: Installation, testing and commissioning
Air	Industrial 7-Stage Air Purifier	• Coverage: 100 sqm • 7-Stage Process: Pre-Filter, HEPA Filter, Activation Carbon, Molecular Absorption Layer, Photo Catalyst Filter, UVC, Negative Ions • Features: Air Quality Light Indicator and Wi-Fi
	UV AHU Solution (70TR)	• Includes UV lamps and lamps mounting assembly, power wiring, installation and other consumables
	UV AHU Solution (50TR)	• Includes UV lamps and lamps mounting assembly, power wiring, installation and other consumables
	UV AHU Solution (30TR)	• Includes UV lamps and lamps mounting assembly, power wiring, installation and other consumables
	UV AHU Solution (15TR)	• Includes UV lamps and lamps mounting assembly, power wiring, installation and other consumables

MSERV Product Offerings (Others)

Item	Specifications
HVAC Starter (AHU)	• Overall assessment of HVAC system, measurement of indoor air quality, and bacteria sampling
HVAC Starter (FCU)	• Overall assessment of HVAC system, measurement of indoor air quality, and bacteria sampling
HVAC Starter (Chiller)	• Overall assessment of HVAC system, measurement of indoor air quality, and bacteria sampling
Indoor Air Quality Monitoring System	• Multi-sensors for CO2. TEMP, RH. PM & VOC), including installation, programming and commissioning
Air Filters	• Based on design and application
Cleaning and Maintenance	• Split Type Units (inverter and non-inverter) • Chilled Water FCU (5-10TR) • Chilled Water AHU (20-35TR) • Chilled Water AHU (40-70TR)

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End of Presentation