



Bridge Track Ventilation Panel



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Top Lesson Learned with Ventilation in PHIUS projects

- Academics
 - Prioritize health at start of project.
 - Double ventilation rates.
 - Life indoors is dynamic.
 - Smart systems: Leveraging latest technology.
- Manufacturer
 - Achieving PHIUS Ventilation characteristics
 - Principal
 - Ventilation System
 - Demand Control ventilation
- Field Verification
 - Testing and Balancing
 - Blower Door Testing
 - PHIUS Ventilation Requirement

Ventilation System Recommendation from Academics perspective

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Director of Business Development
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Top lessons recommended



1. Prioritize health at start of project.
2. Double ventilation rates.
3. Life indoors is dynamic.
4. Smart systems: Leveraging latest technology.

What do we know?



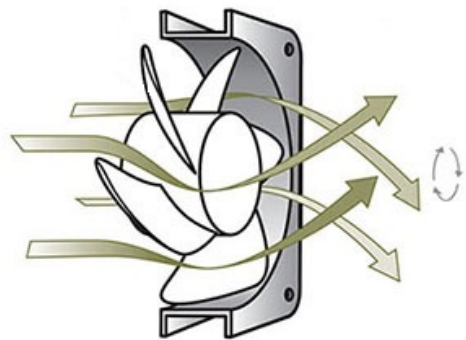
- We spend considerable time indoors.
- **Contaminants: Gases & Fine Particles**
 - Detrimental to health in high concentrations & exposure.
 - Fine particles include biological contaminants
 - Viruses, dust mites, mold spores, etc.
 - Particles from wildfires becoming a common occurrence.
- Pollutant levels indoors are 2 to 5 times higher than outdoor concentrations (U.S. EPA).
- **Solutions: Ventilation (dilution of contaminants) and Filtration (removal of particles).**

Energy for Healthy Indoor Air

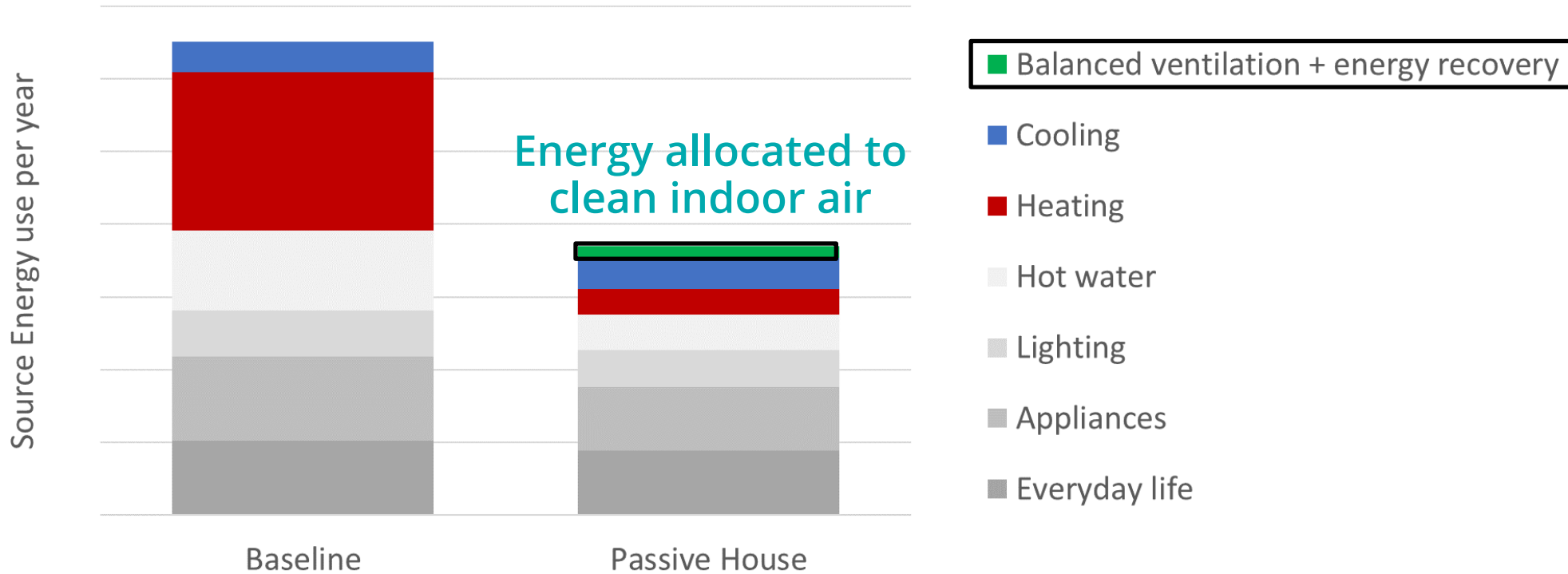


Energy is needed to create a healthy indoor environment:

- Moving air through filters.
- Replacing indoor air with outside fresh air.
- Conditioning outside fresh air.
 - Energy reduced when fresh air is conditioned with indoor air (ERV/HRV).



Building Energy Management



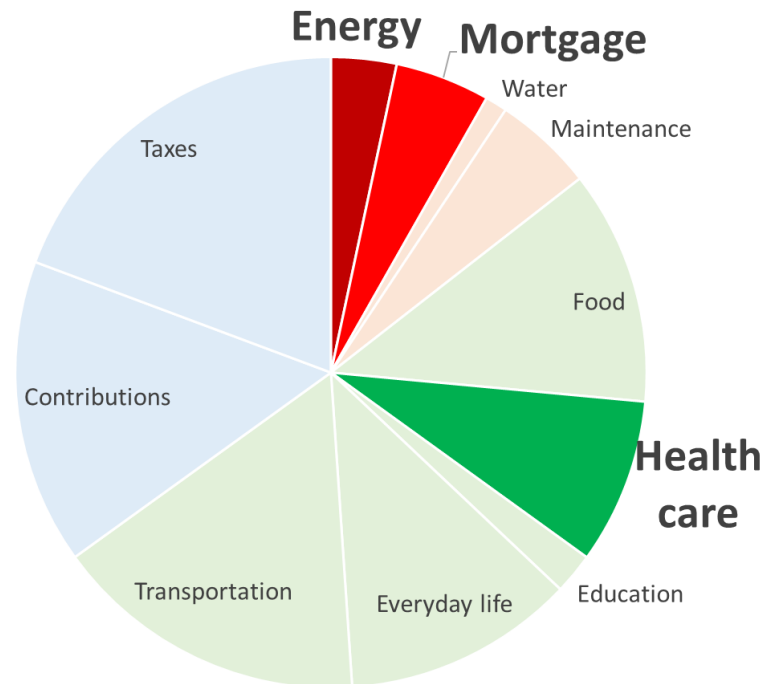
Optimized PHIUS standard reduced initial and operational energy costs (net present value):

- Increasing affordability.
- Reducing greenhouse gas emissions.

Household Budget



Healthcare is also an important portion of our budget.



Disease prevention:

Healthy indoor air: Feel better, sleep better, live better.

Opportunity to reduce healthcare costs.



Low Ventilation Rates

Low ventilation rates are detrimental to health, cognition, quality of sleep, and productivity.

Increase in sick days
Increase in doctor's visits.



Major impact in household budget

Detrimental effects quantified by numerous studies.



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UPSTATE
MEDICAL UNIVERSITY



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Denmark

Current standards minimums (15-20 CFM/person) may create an unhealthy indoor environment.

Move beyond minimum standards.

Let's Measure Pollutants Instead



Technology evolving to measure pollutants accurately and affordably.

- Carbon dioxide
- Volatile organic compounds (VOCs)
- Fine particles (PM10, PM2.5, PM1...etc.)
- Radon, carbon monoxide, etc.



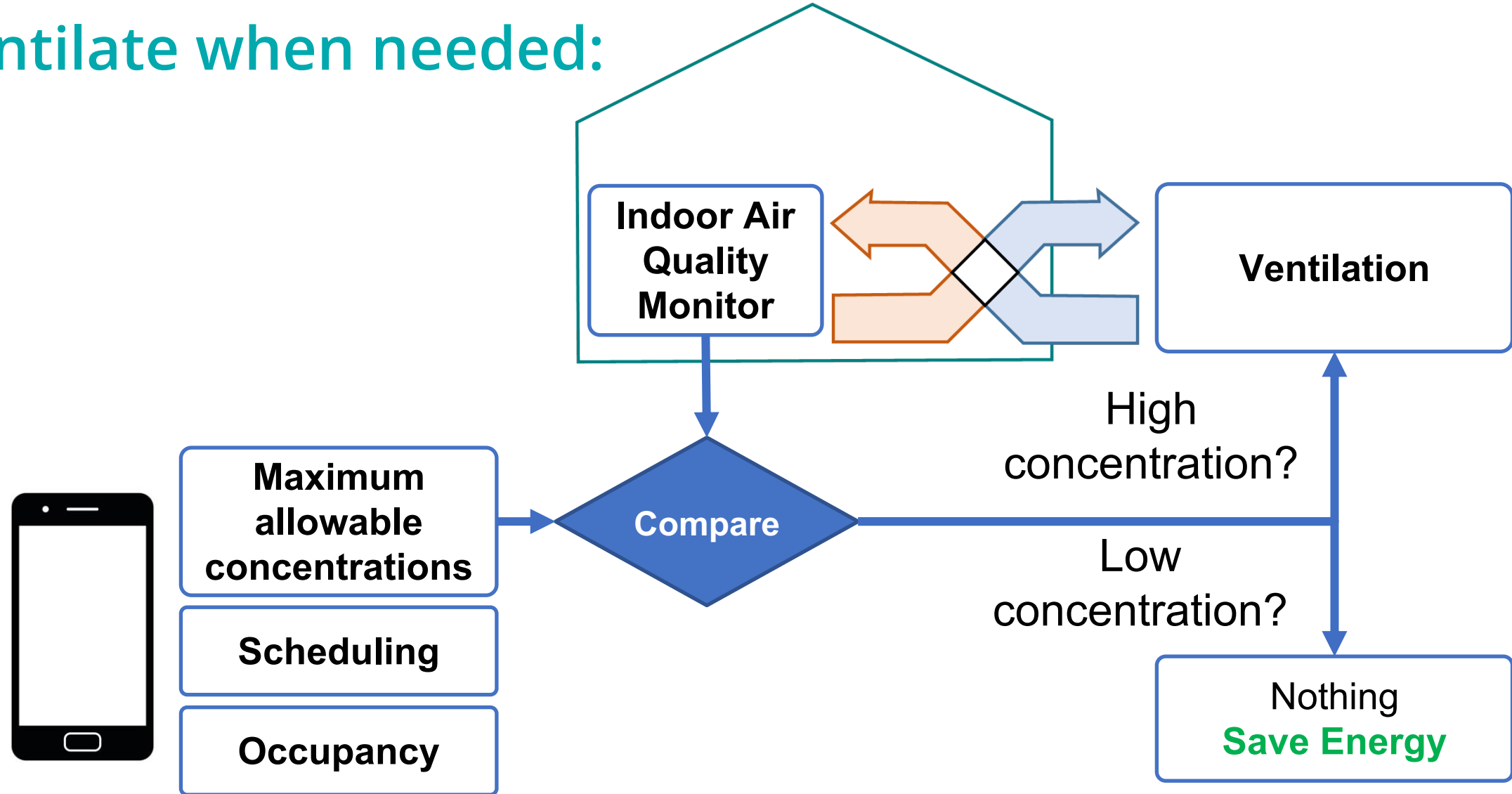
Leverage technology to achieve healthy indoors

- IAQ monitors detect the pollutants we can't.

Smart Ventilation System



Ventilate when needed:



Life at Home is Dynamic

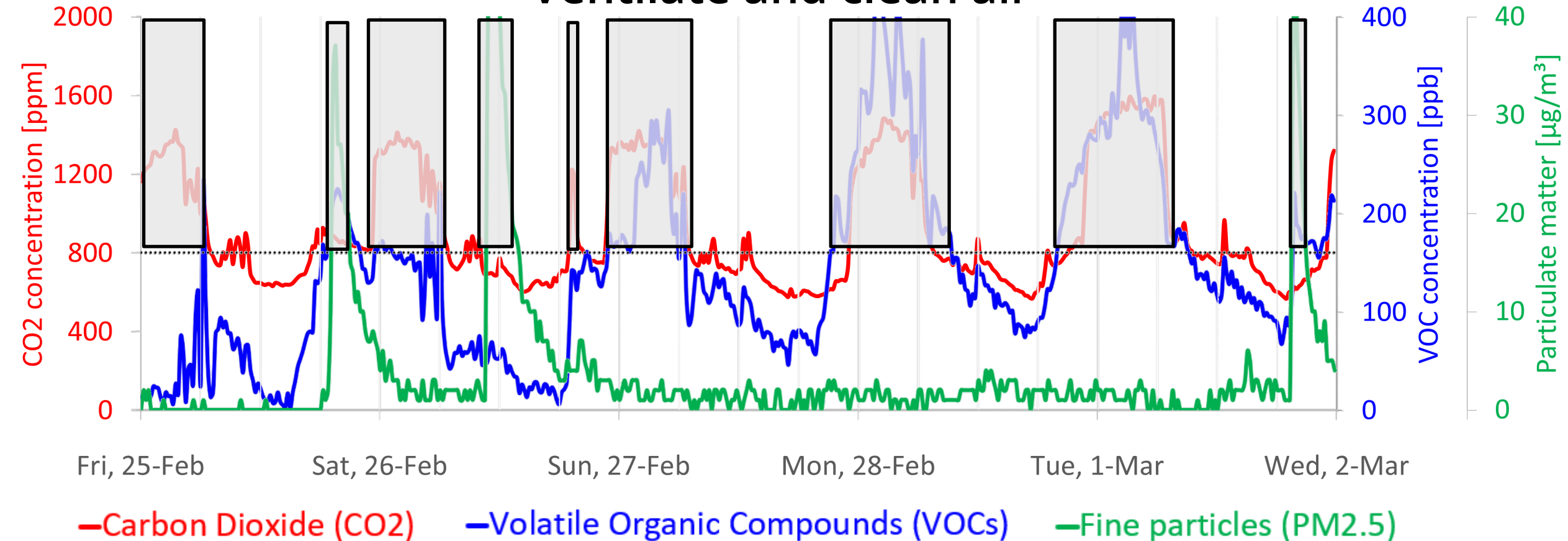


Life at home is Dynamic



Young couple, 2,200 sq.ft home (BSL). IAQ monitor in bedroom.

Ventilate and clean air



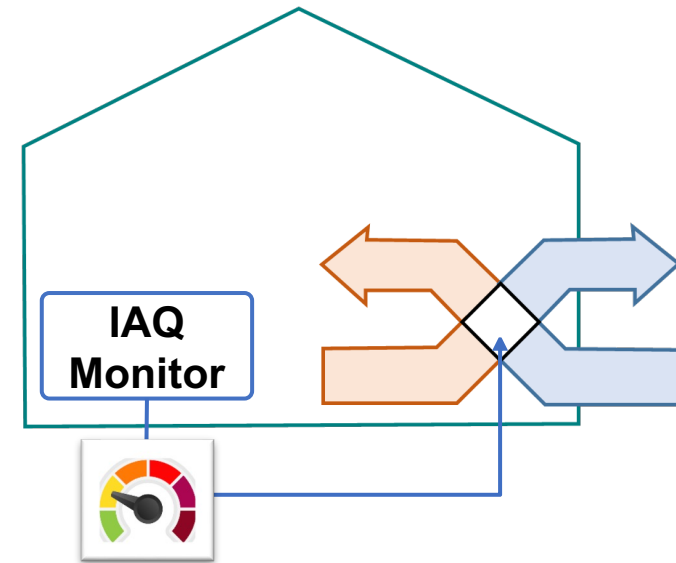
Achieving a Healthy Environment



Prioritizing health while reducing carbon emissions:

Use smart ventilation systems:

- Measure pollutants:
 - Carbon dioxide
 - Volatile organic compounds
 - Fine particles (at least PM2.5)
- Compare with IAQ guidelines.
- Ventilate when needed.
 - Variable speed fan.
- Save energy otherwise.



Achieving a Healthy Environment

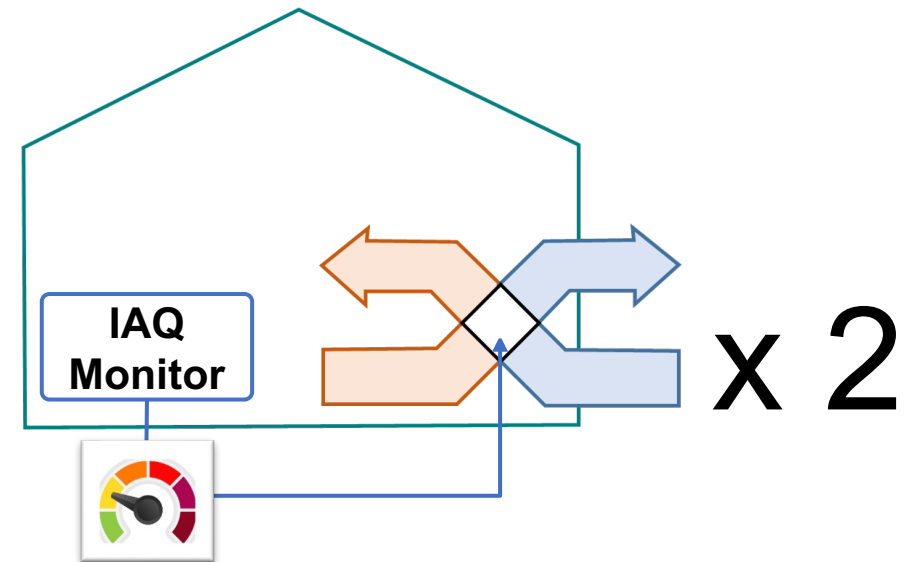


Prioritizing health while reducing carbon emissions:

Use smart ventilation systems

Double ventilation rates.

- Move beyond minimums.
- 40 CFM per person.
- **Benefits quantified by numerous studies (compared to 20 CFM/person).**
 - Productivity increases by 8%.
 - Cognition increases by 25%.
 - Better sleep, better health



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Achieving a Healthy Environment



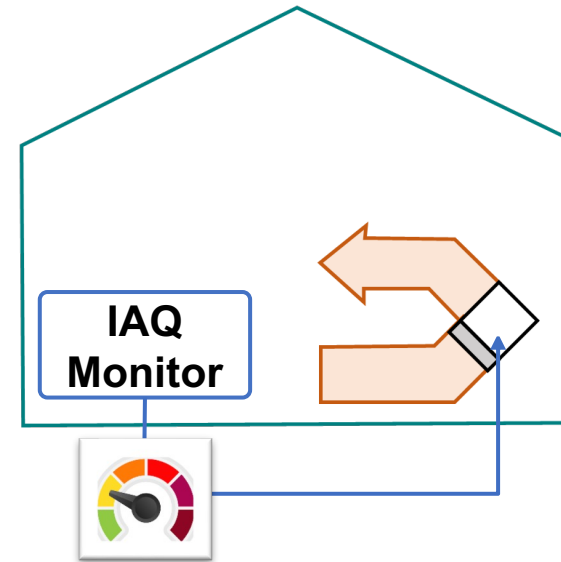
Prioritizing health while reducing carbon emissions:

Use smart ventilation systems

Double ventilation rates.

Fan recirculation & MERV 13 filters

- Mix high/low concentration zones.
- Low CO₂ & VOCs, high PMs.
 - Remove fine particles with filter.
- No conditioning needed.
 - Dampers closed.



Achieving a Healthy Environment



Prioritizing health while reducing carbon emissions:

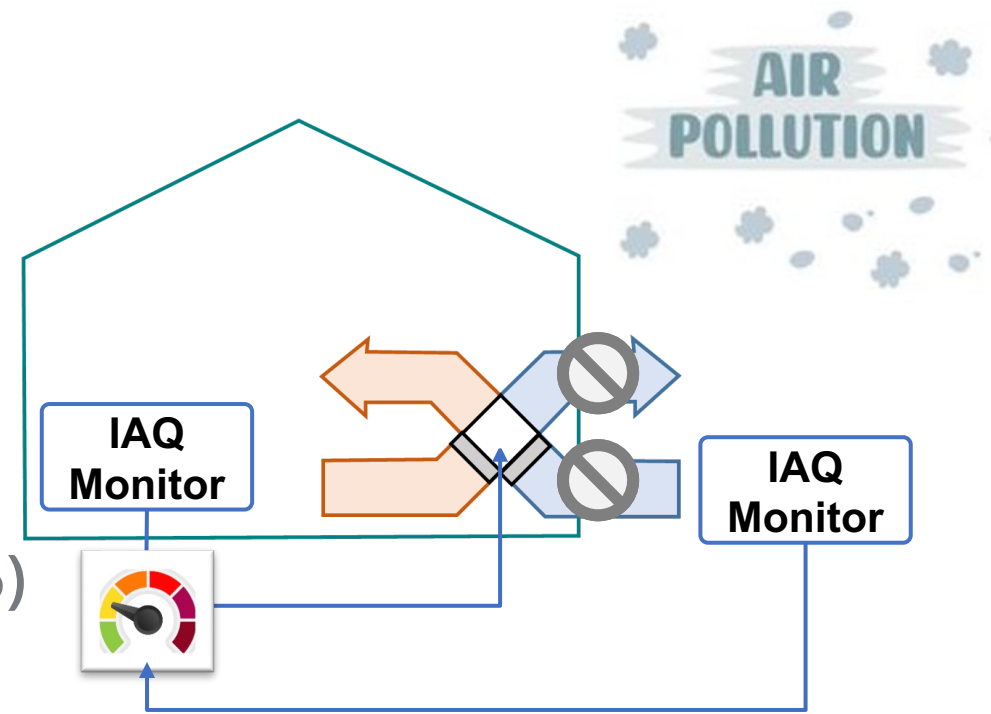
Use smart ventilation systems

Double ventilation rates.

Fan recirculation & MERV 13 filters

Concerns on outside pollution?

- Increase to MERV 13 filter outside.
- IAQ monitor in fresh air inlet (VOCs, PM2.5)
 - Close dampers when high concentrations.



Thank you!

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Director of Business Development
Build Equinox



Achieving PHIUS Ventilation characteristics



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Principle

“Passive building comprises a set of design principles used to attain a quantifiable and rigorous level of **energy efficiency** within a specific quantifiable **comfort** level.”

[Passive House Institute US](#)



Betances V, The Bronx NY

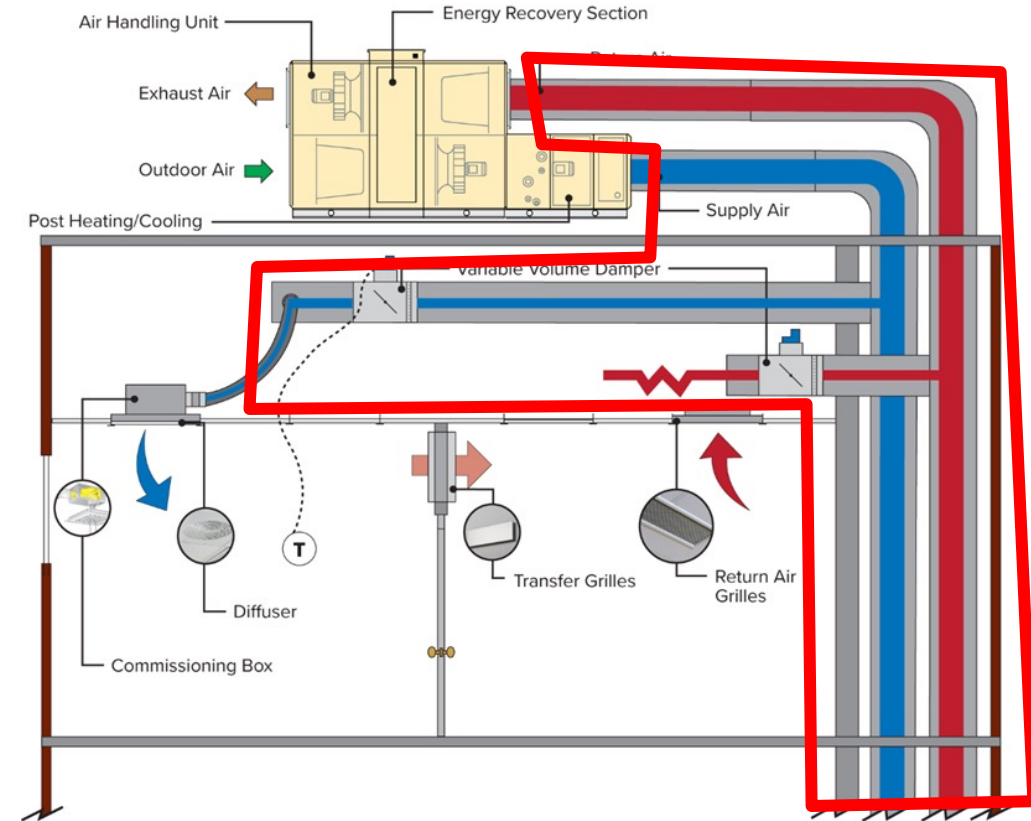
Ventilation System

- Design efficient duct systems

- Supply and return
- Low pressure drop
 - Larger ducts
 - Shorter duct runs
 - Directed air flow
 - Pay attention to fittings!
- Low leakage
 - Design, test and remediate

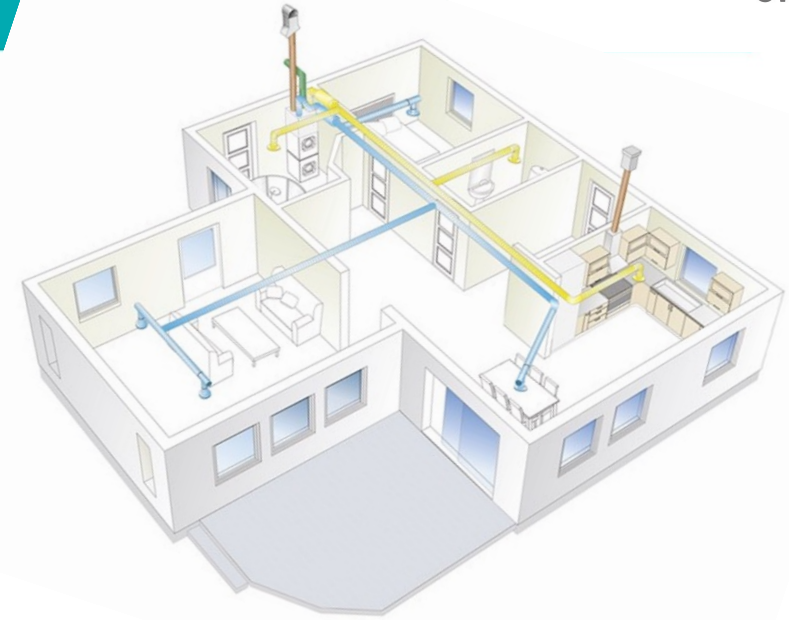
- Select AHU for efficient ventilation

- Low electrical consumption
- Low casing leakage
- Match low pressure duct requirements



Ventilation System

- Heat exchanger provides first stage of heating and cooling
- Temperature of air leaving air handler is inherently more comfortable and therefore less expensive to heat or cool
- 2nd stage cooling and heating with smaller mechanical cooling and heating devices downstream
 - Post-heating/post-cooling
 - In-zone H/C units



Air distribution

- Demand-control enhances energy-savings and control
- High-performance air outlets provide good thermal mixing at all flows
- Transfer grilles reduce pressure drop associated with ductwork

Demand Control



When conditions change,
Demand Control:

- improves comfort
- adjusts energy consumption

Benefits of periodically increasing airflow



COMFORT & AIR QUALITY

Extra fresh air



AIR QUALITY

Dilution of CO₂ / contaminants



COMFORT & RESILIENCE

Faster removal of excess moisture



COMFORT

Extra heating



COMFORT

Extra cooling



ENERGY SAVINGS

Maximum free-cooling

Reasons to periodically decrease airflow



Occupancy

*Reduced
minimum airflow
requirement*



IEQ

*periods of low
CO₂ / VOC*



Operating Cost Savings

*Reduced
minimum airflow
requirement*



First Cost Savings

*Equipment
downsizing
Fewer Other
Passive
Measures*

Demand Control Equipment

Air Handling Unit (ERV) – integration
for comfort

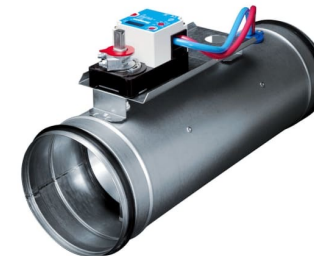
- Selected to provide extra air flow on demand
 - +30%, considering diversity
 - delivers more heating & cooling
- Controls, to provide
 - Airflow balance between Supply and Exhaust Air
 - Boost mode setting
 - Free cooling
 - Supply Air temperature / humidity / pressure measurement
 - Standalone capability (multifamily projects)



Demand Control Equipment

Control Dampers – integration for comfort

- Provide local (zone) control
 - Boost mode comfort
 - Occupied mode safety
 - Unoccupied mode energy savings
 - Free cooling response
 - Dehumidification mode response
- Standalone capability
 - To support multifamily projects



Things I Wish I Knew Before Starting My First PHIUS Project Ventilation

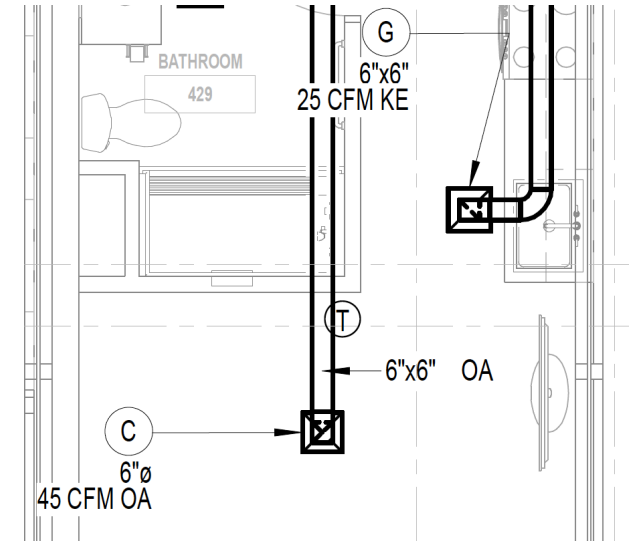


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Verification

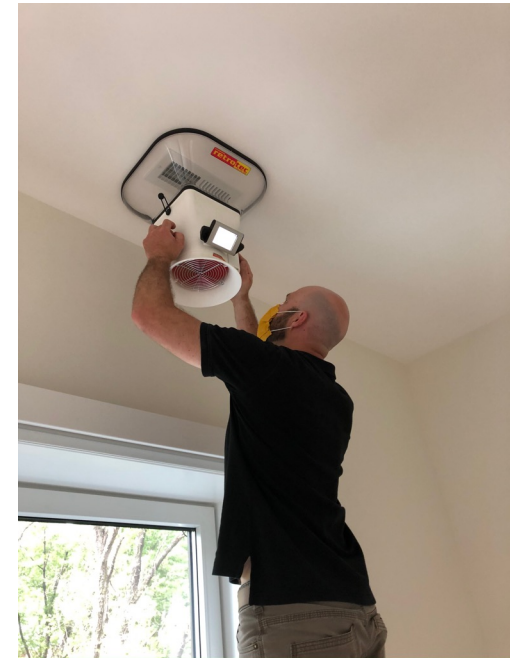
Testing & Balancing (TAB)

- ✓ Design
- ✓ Pretesting
- ✓ Branch Dampers



Phius Ventilation Requirements

- ✓ Total supply and exhaust at the ERV must be at least the design rate and within 10% of each other
- ✓ Each supply and exhaust diffuser must be within +/- 20% or 5 cfm of the design
- ✓ bathroom exhaust: ≥ 20 cfm continuous or 50 cfm intermittent



Blower Door Testing

- ✓ Durability threshold – .06 CFM/sq ft shell
 - Non-threatening leakage
- ✓ WUFI threshold
- ✓ Motorized dampers – operation schedule
- ✓ Leakage at outdoor units

