



PITTSBURGH 2030 DISTRICT

DRIVING BUILDING PERFORMANCE AND ECONOMIC VITALITY

***PITTSBURGH 2030 DISTRICT IAQ PILOT OVERVIEW FOR THE
FEDERAL INTERAGENCY COMMITTEE ON INDOOR AIR QUALITY***

JUNE 8, 2016





THANK YOU.



PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND



ANNA J. SIEFKEN, LEED AP BD+C

VP OF STRATEGIC ENGAGEMENT &
PITTSBURGH 2030 DISTRICT DIRECTOR,
GREEN BUILDING ALLIANCE (GBA)

ANNAS@GBAPGH.ORG

412.773.6013



MELISSA BILEC, PHD, LEED AP

ASSOCIATE PROFESSOR, DEPARTMENT OF CIVIL
AND ENVIRONMENTAL ENGINEERING
DEPUTY DIRECTOR, MASCARO CENTER
FOR SUSTAINABLE INNOVATION,
UNIVERSITY OF PITTSBURGH

MBILEC@PITT.EDU, 412.648.8075



Mascaro Center
for Sustainable Innovation

GREEN BUILDING ALLIANCE



Vision: The places where we live, work, learn, and play will be healthy and high performing.



GREEN BUILDING ALLIANCE

INSPIRE

PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND



PROVE

**Policy &
Advocacy**

**Educational
Programs**

Learning
events, tours,
networking,
community,
case studies,
& resources.

EQUIP

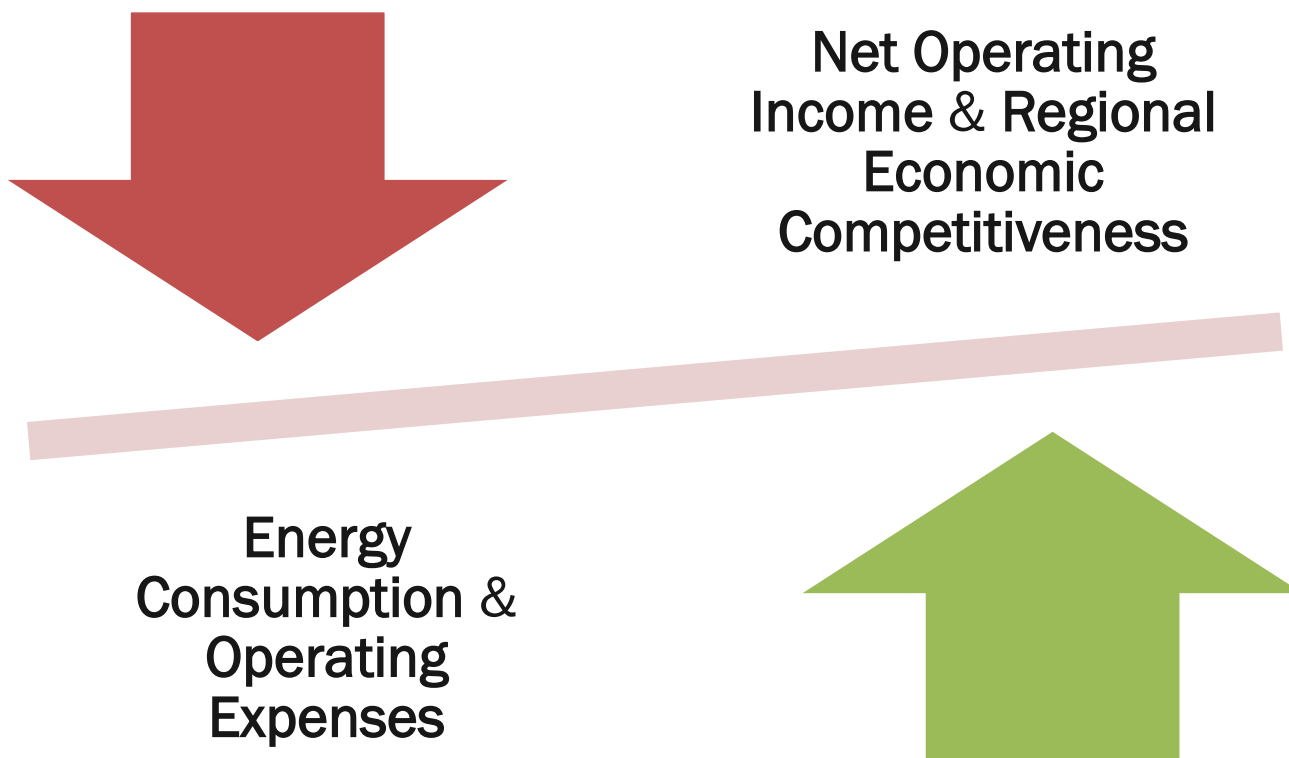
**Technical
Assistance**



WHAT DID PITTSBURGH NEED?



PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND





PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND

PITTSBURGH 2030 DISTRICT



A COLLABORATIVE, NATIONALLY-RECOGNIZED, LOCALLY-DRIVEN VOLUNTARY COMMUNITY OF BUILDINGS IN DOWNTOWN PITTSBURGH AND OAKLAND THAT ARE WORKING TOWARDS HIGH PERFORMANCE.

HIGH PERFORMANCE BUILDINGS HAVE PROVEN TRACK RECORDS:

- **BUSINESS AND PROPERTY PROFITABILITY**
- **ASSET VALUE INCREASES**
- **ENVIRONMENTAL IMPROVEMENTS**
- **OCCUPANT HEALTH**

THE PITTSBURGH 2030 DISTRICT GOALS ARE INSPIRED BY THOSE SET NATIONALLY BY *ARCHITECTURE 2030* AND ITS 2030 CHALLENGE.

PITTSBURGH 2030 DISTRICT GOALS

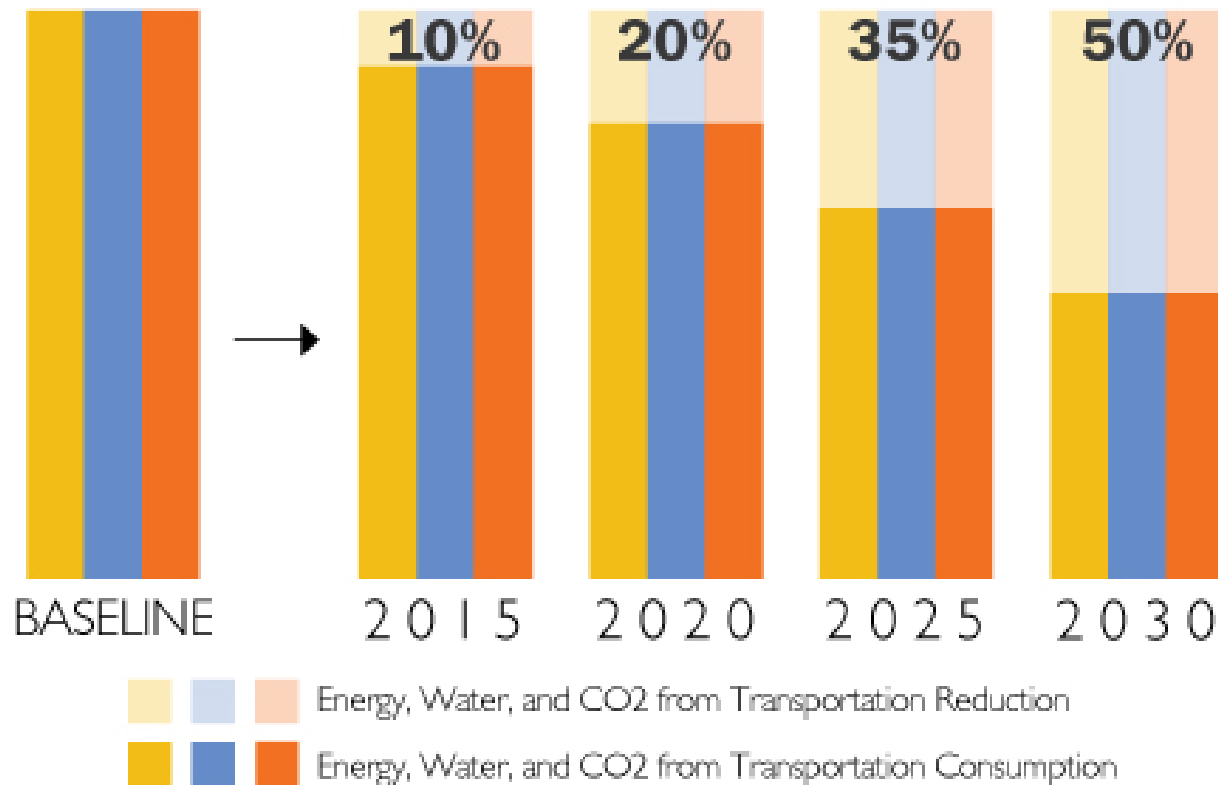


- **ENERGY USE:** A MINIMUM 10% REDUCTION BELOW THE NATIONAL AVERAGE BY 2015, WITH INCREMENTAL TARGETS REACHING A 50% REDUCTION BY 2030.
- **WATER USE:** A MINIMUM 10% REDUCTION BELOW THE DISTRICT AVERAGE BY 2015, WITH INCREMENTAL TARGETS REACHING A 50% REDUCTION BY 2030.
- **TRANSPORTATION CO² EMISSIONS:** A MINIMUM 10% REDUCTION BELOW THE DISTRICT AVERAGE BY 2015, WITH INCREMENTAL TARGETS REACHING A 50% REDUCTION BY 2030.
- **INDOOR AIR QUALITY:** *TO BE DETERMINED LOCALLY.*

2030 CHALLENGE

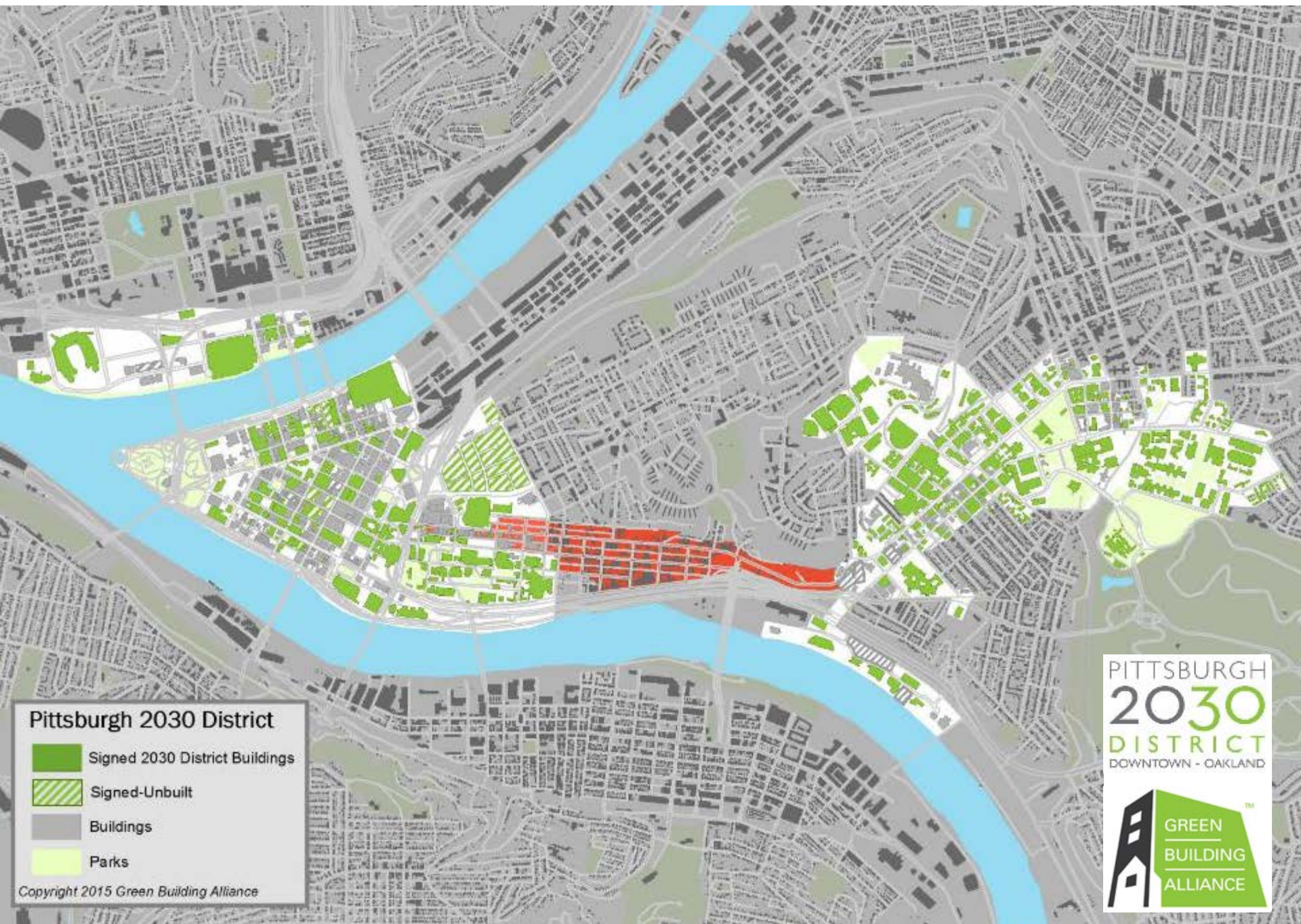


EXISTING BUILDING TARGETS



The 2030 Challenge for Planning: Existing Buildings

Source: © 2011 | 2030, Inc. / Architecture 2030. All Rights Reserved.



Pittsburgh 2030 District

-  Signed 2030 District Buildings
-  Signed-Unbuilt
-  Buildings
-  Parks

Copyright 2015 Green Building Alliance

PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND



PITTSBURGH 2030 DISTRICT COMMITMENTS



PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND

438 properties

68,210,816 ft²

69% of the

PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND

12 DISTRICTS INTERNATIONALLY



LOS ANGELES
2030
DISTRICT®

SEATTLE
2030
DISTRICT®

GRAND RAPIDS
2030
DISTRICT®

SAN ANTONIO
2030
DISTRICT

CLEVELAND
2030
DISTRICT®

PITTSBURGH
2030
DISTRICT®
DOWNTOWN · OAKLAND

DENVER
2030
DISTRICT®

STAMFORD
2030
DISTRICT®

ALBUQUERQUE
2030
DISTRICT®

SAN FRANCISCO
2030
DISTRICT®

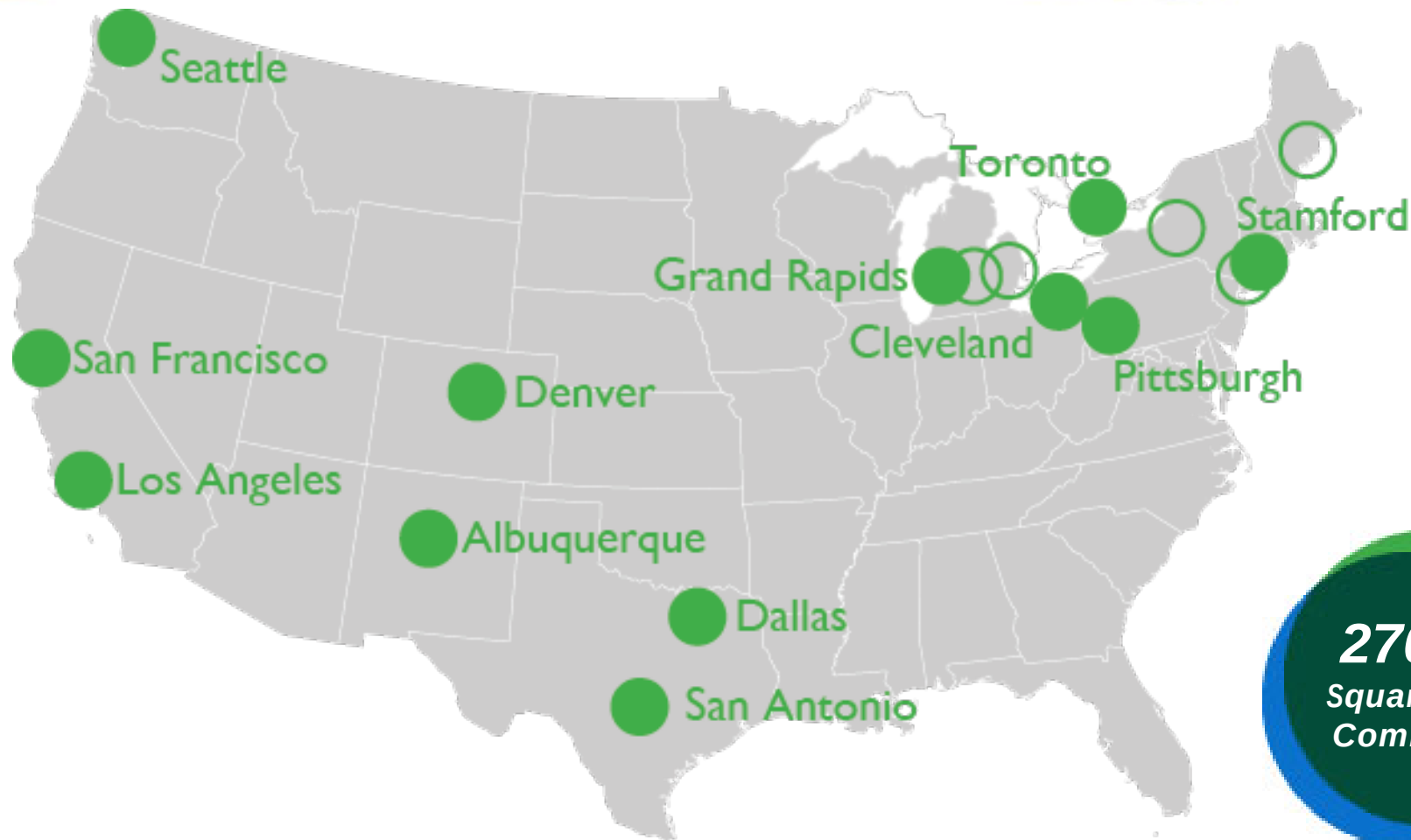
DALLAS
2030
DISTRICT®

TORONTO
2030
DISTRICT®

Established Districts

- 1087 Buildings
- 311 Property Partners

A GROWING NETWORK



270 M
Square Feet
Committed

● Established 2030 District ○ Emerging 2030 District

2015 – MEASURED REDUCTION RESULTS



Energy = ↓ **12.5%**

Water = ↓ **10.3%**

Transportation

Emissions = ↓ **24.2%**

Indoor Air Quality = ***Pilot complete.***



WHAT IS HAPPENING WITH INDOOR AIR QUALITY?

MELISSA BILEC, PhD, LEED AP

ASSOCIATE PROFESSOR, DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
DEPUTY DIRECTOR, MASCARO CENTER FOR SUSTAINABLE INNOVATION
UNIVERSITY OF PITTSBURGH

BILL COLLINGE, PhD

POST-DOCTORAL ASSOCIATE, DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

HAROLD RICKENBACKER

GRADUATE STUDENT, DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

VACLAV HASIK

GRADUATE STUDENT, DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING



WHY?



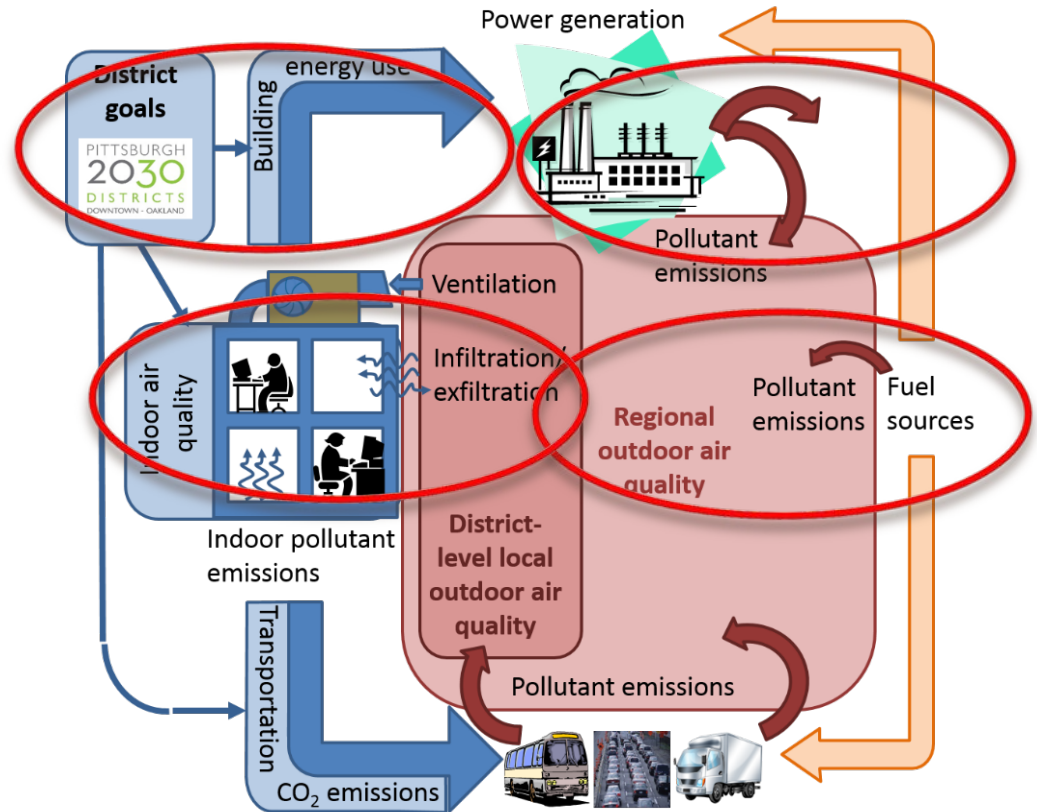
www.worldwatch-europe.org

We spend 90% of our time inside buildings.



INDOOR AIR QUALITY & 2030 DISTRICTS

The vision of this work is centered on answering the question:
How can the 2030 district impact indoor air quality?



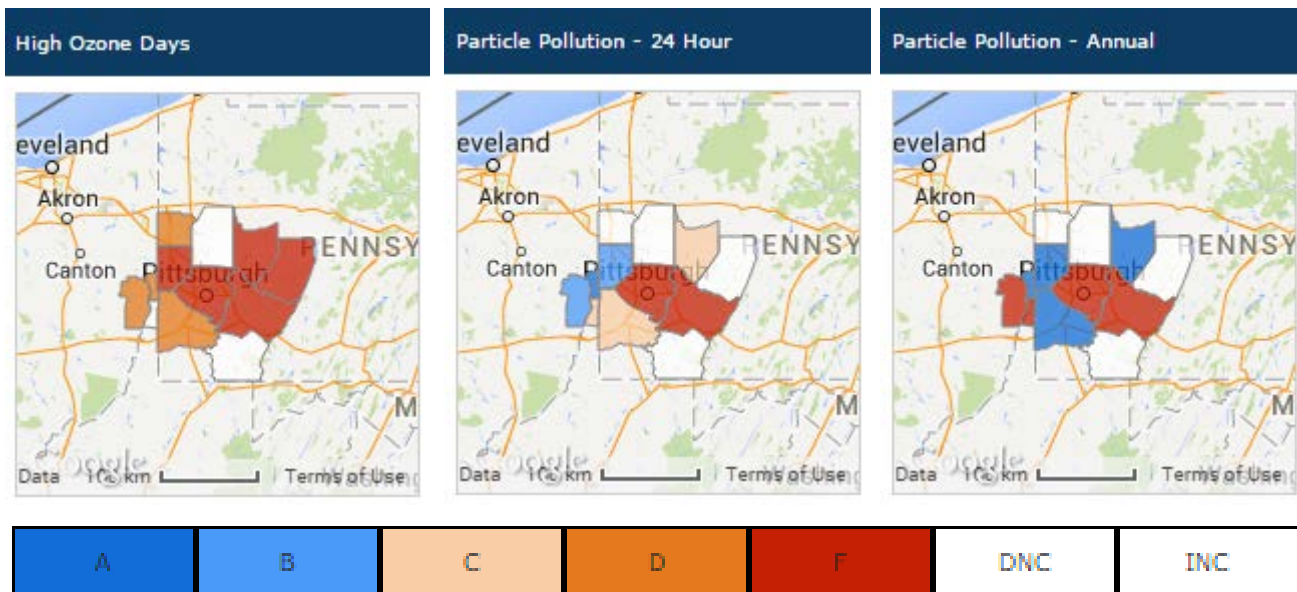


INDOOR AIR QUALITY & 2030 DISTRICTS

- PITTSBURGH IS RANKED:
 - 21ST FOR HIGH OZONE DAYS OUT OF 277 METROPOLITAN AREAS
 - 6TH FOR 24-HOUR PARTICLE POLLUTION OUT OF 277 METROPOLITAN AREAS
 - 6TH FOR ANNUAL PARTICLE POLLUTION OUT OF 277 METROPOLITAN AREAS

(STATE OF THE AIR 2014, AMERICAN LUNG ASSOCIATION)

How much
indoor
pollution in the
2030 district
comes from
outdoors?



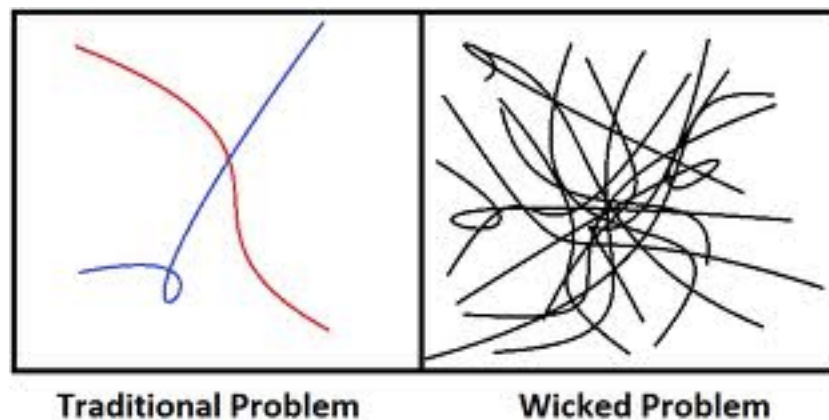


Goals

- Establish baseline IAQ in 2030 District buildings
- Evaluate direct & indirect impacts of energy reductions on IAQ
 - Direct = changes to building characteristics (e.g. ventilation, materials)
 - Indirect = life-cycle energy impacts on regional outdoor air quality
- Develop goals and strategies for improvements in IAQ metrics

HOW DO WE EVEN BEGIN TO TACKLE THIS STUDY?

- MULTIPLE VARIABLES
 - BUILDING TYPES
 - HVAC SYSTEMS
 - SEASONAL IMPACTS
 - MULTI-YEAR STUDY
 - BUILDING USE
- PILOT BUILDINGS





HOW...TESTING PROTOCOL

- MODELED AFTER THE EPA'S BUILDING ASSESSMENT SURVEY AND EVALUATION (BASE)
- STEP 1: BUILDING AND SITE VISIT
- STEP 2: SELECT STUDY AREA AND MONITORING LOCATION
- STEP 3: BUILDING CHARACTERIZATION AND SAMPLING
- STEP 4: DATA MANAGEMENT AND ANALYSIS
- STEP 5: ADMINISTER OCCUPANCY SURVEY?



PILOT TESTING-HOW & WHAT



MCSI IAQ Cart

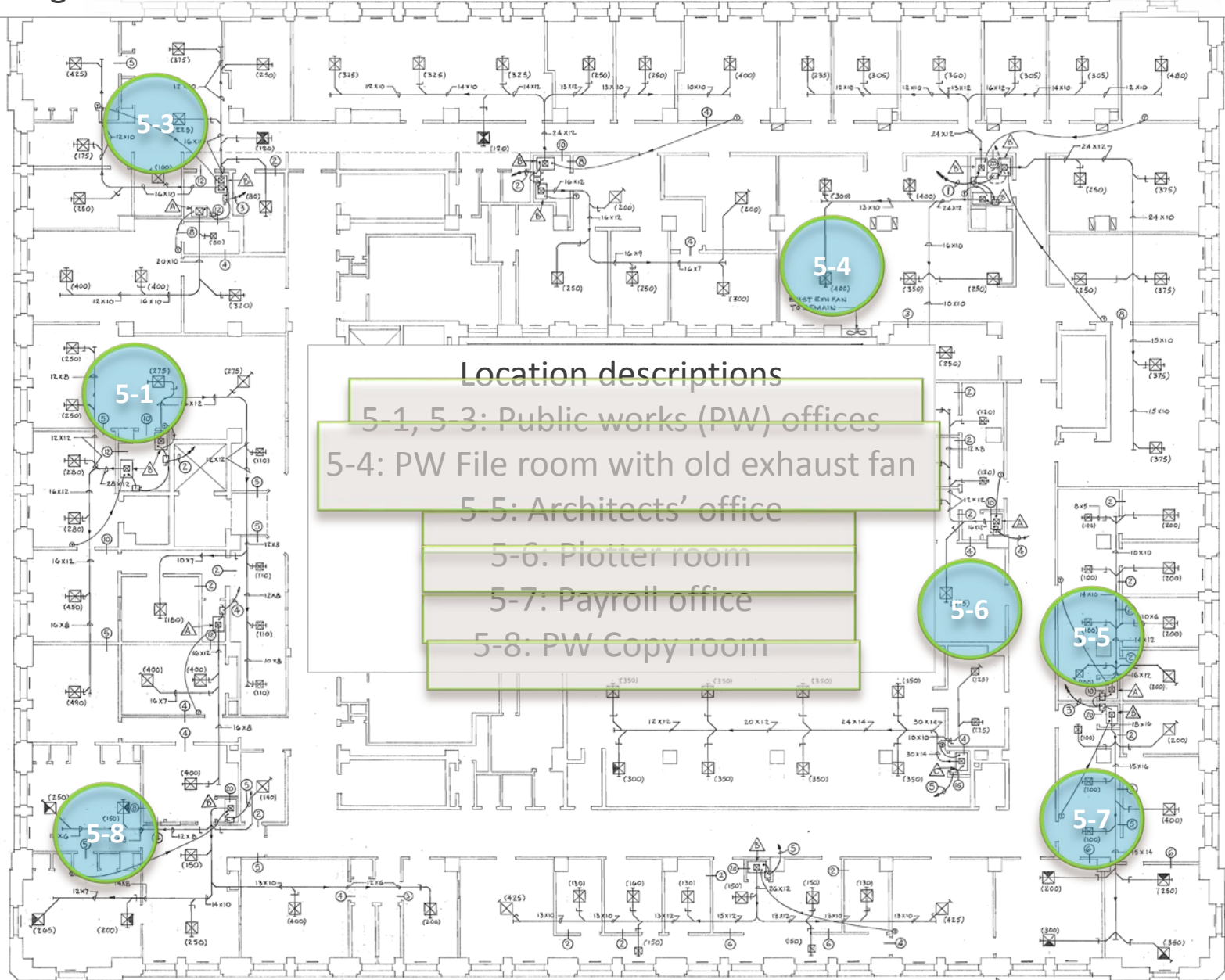
Particles

- 0.3 - 0.5 μm
- 0.5 - 1.0 μm
- 1.0 - 2.5 μm
- 2.5 - 10.0 μm
- > 10.0 μm

- Total VOC's
- Carbon Dioxide
- Ozone
- Carbon Monoxide
- Temperature
- Relative Humidity



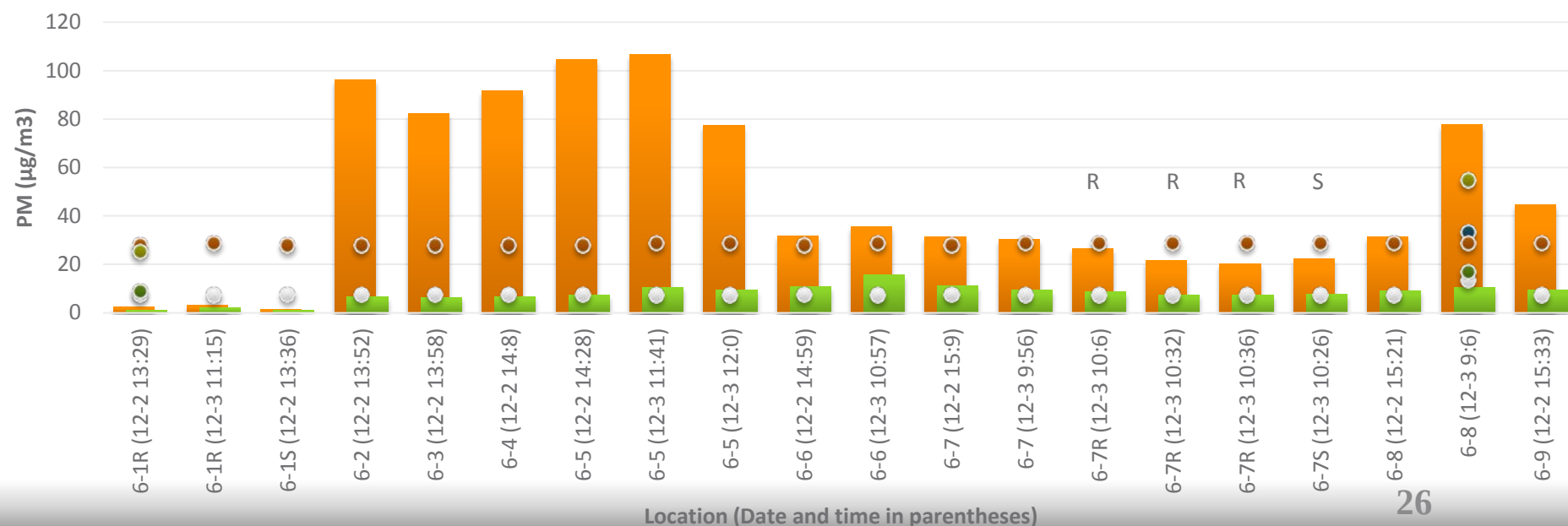
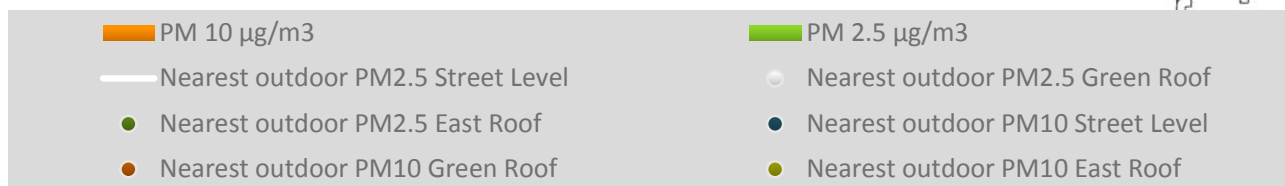
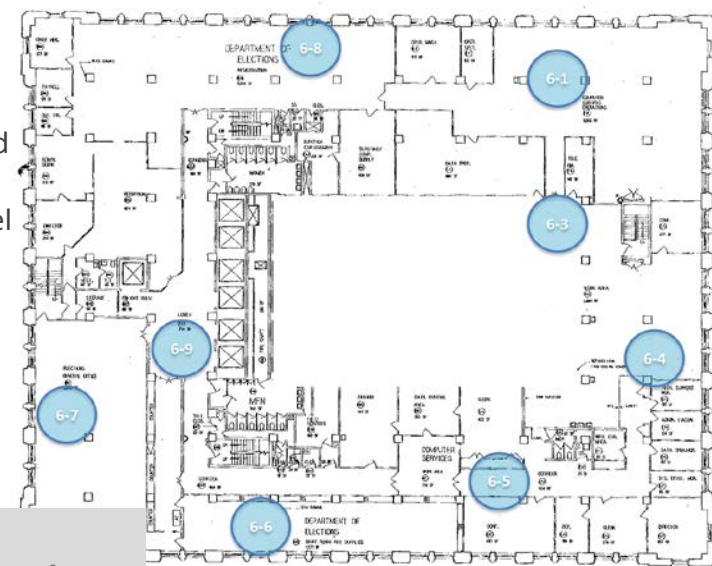
Current IAQ Testing Equipment
and variables – with more coming



HVAC System: Ducted forced-air cooling (multiple AHUs) with radiator heating.
No direct outdoor air supply.

Particulate Matter (10 & 2.5)

- **Low PM in data center (6-1) – constant recirculation with good filtration**
- Higher PM₁₀ in Computer Services area (6-3, 6-4, 6-5) – convection units, carpet, ceiling fan use, and higher occupancy than other areas; little to no filtration
- Location 6-8 was drafty, and PM values were near outdoor levels, suggesting outside air infiltration
- Supply air (S) and return air (R) samples at the AHU tested had nearly identical level
- “Nearest outdoor” is the closest outdoor sample in time, to the labeled indoor sample
- Averages
- Preliminary results





RECOMMENDATIONS

- **MONITORING**
 - Inexpensive PM monitors are available, such as the Speck and Dylos units. Consider installing PM monitors, particularly in areas where high PM was identified. Medium to long term tracking of PM levels can provide feedback on maintenance measures such as cleaning and filtration.
- **CLEANING**
 - It was noted that cleaning is infrequent, and some surfaces were notably dusty. More frequent cleaning could lead to lower levels of dust re-suspension (larger PM sizes) during occupant activities.
 - Dust and sanitize furniture and floors regularly. Use low VOC emitting supplies. A list of green products are available on the EPA website under Environmental Preferable Purchasing (EPP). (See appendix)
 - Carpeting should be cleaned using HEPA vacuums to avoid spreading fine dust particles which are not captured by conventional vacuums.
- **AIR FILTRATION**
 - For spaces equipped with AHUs and convection units, use the best available filters and check regularly for filter cleanliness. For AHUs observed on the 5th and 6th floors, it may be possible to install MERV 13 filters, which can significantly reduce PM down to 2.5 μm and below.
 - If filters are cleaned and upgraded, consider running AHUs and convection units in “fan only” mode when heating or cooling is not required, or for AHUs in radiator areas, when cooling is not required.
 - Change filters regularly, at least seasonally, with monthly changes if needed.

But this is for *one building!*
Now what?



From Andrew Rush/PPG

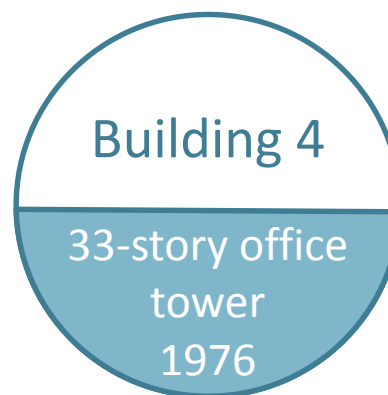


BUILDING-SPECIFIC IAQ (PM) RESULTS

COMPARING BUILDINGS

THE CHALLENGERS

THE INCUMBENT



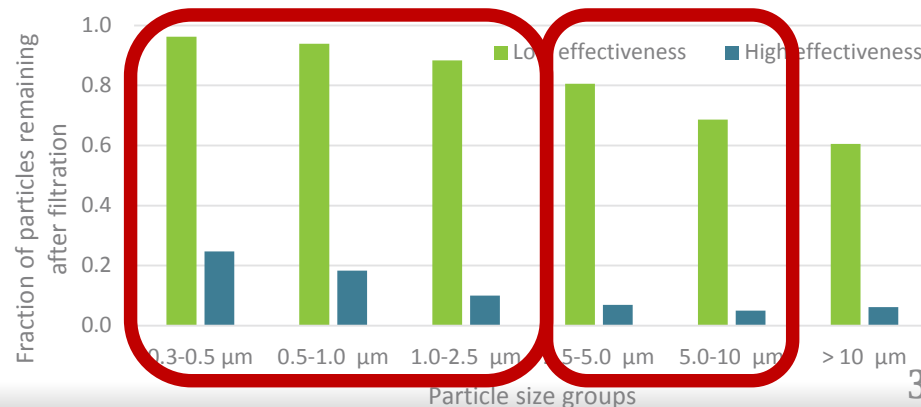
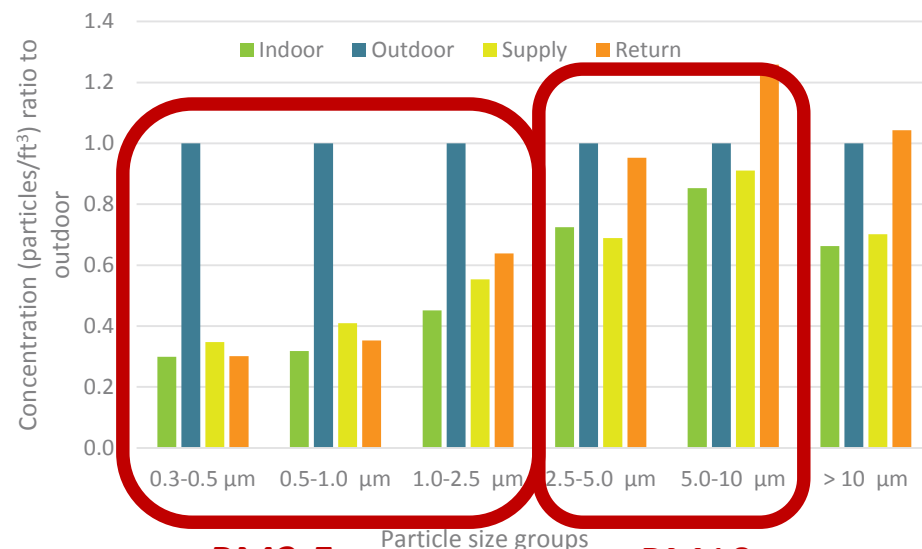
SO HOW ARE OUR BUILDINGS DOING?

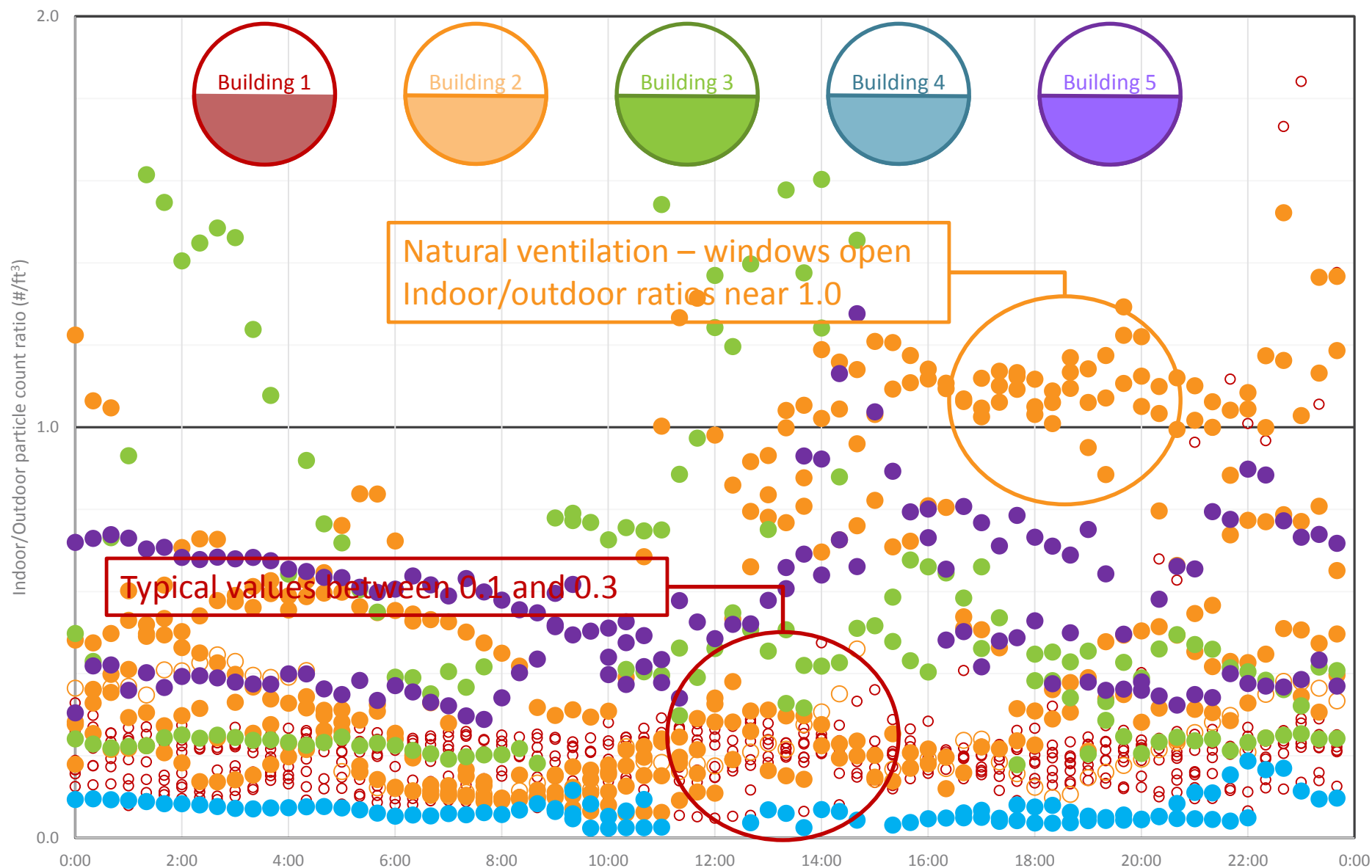
• EARLY FINDINGS – AGGREGATED PM

- Consistent with previous studies
- Smaller particles mainly from outdoors
- Larger particles from a mixture of indoor and outdoor sources
- A wide variety of filtration effectiveness exists between buildings, from very limited to MERV-14 (very good)



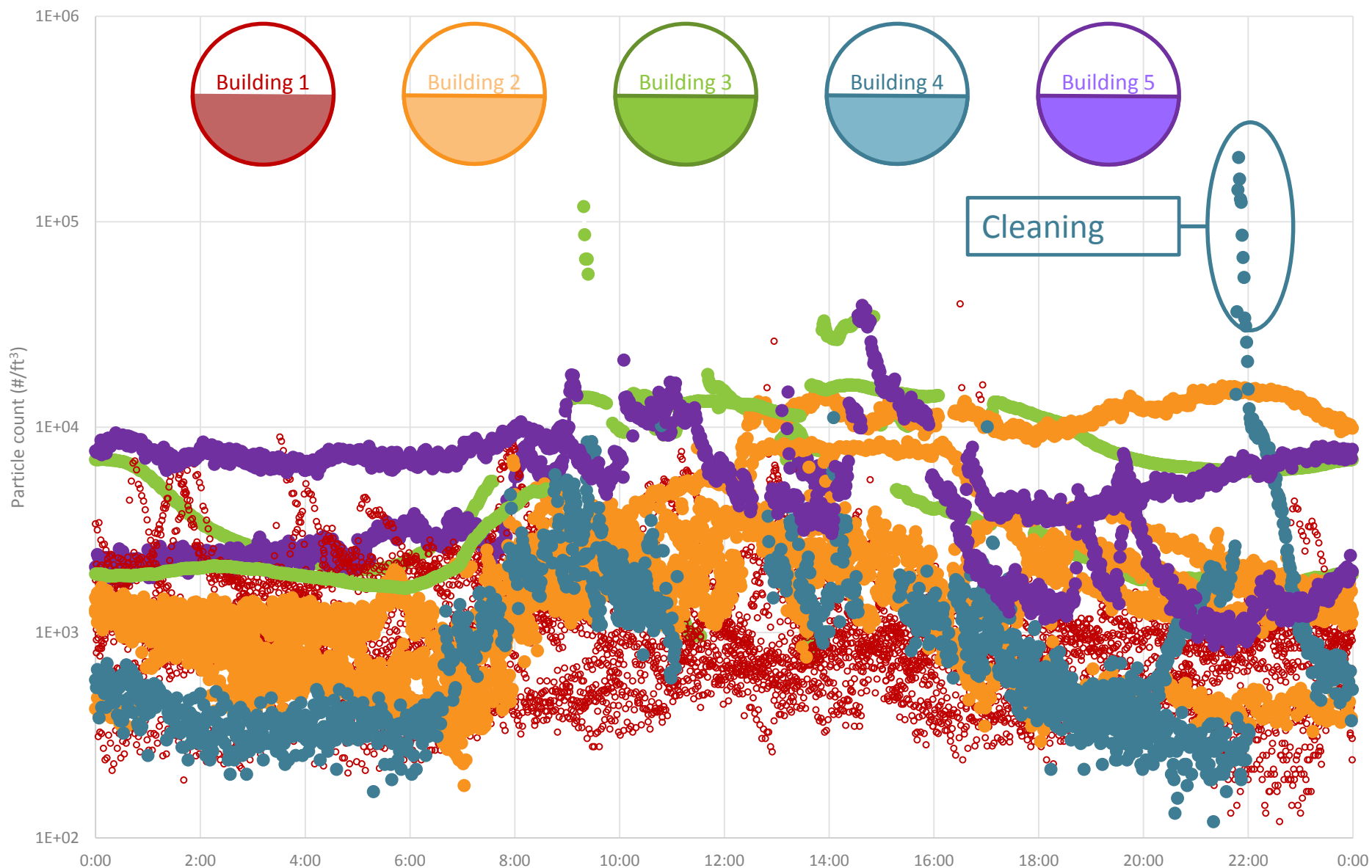
- It's not just the filters in the HVAC, it's also the envelope!



Indoor to outdoor ratios for PM between 0.3 and 0.5 μm – Outdoor sources



Indoor counts for PM between 1.0 and 2.5 μm – Indoor and outdoor sources



MOVING FORWARD

OUR AIM (AT THIS POINT) IS TO
CREATE A COLLABORATIVE AND
QUANTITATIVE MODEL THAT
HELPS THE 2030 BUILDINGS AND
OCCUPANTS





PITTSBURGH
2030
DISTRICT
DOWNTOWN - OAKLAND

QUESTIONS?



ANNA J. SIEFKEN, LEED AP BD+C

**VP OF STRATEGIC ENGAGEMENT &
PITTSBURGH 2030 DISTRICT DIRECTOR,
GREEN BUILDING ALLIANCE (GBA)**

ANNAS@GBAPGH.ORG

412.773.6013

MELISSA BILEC, PHD, LEED AP

ASSOCIATE PROFESSOR, DEPARTMENT OF CIVIL

AND ENVIRONMENTAL ENGINEERING

DEPUTY DIRECTOR, MASCARO CENTER

FOR SUSTAINABLE INNOVATION,

UNIVERSITY OF PITTSBURGH

MBILEC@PITT.EDU, 412.648.8075

