

# TALKING BUILDINGS

...  
real-time IAQ monitoring









# Changing the industry.

Ongoing real-time monitoring provides an alternative to standard industry practice in which spaces are flushed out, tested, certified and unknowingly left to climb back up to hazardous levels.

## FLUSH-OUTS DON'T WORK

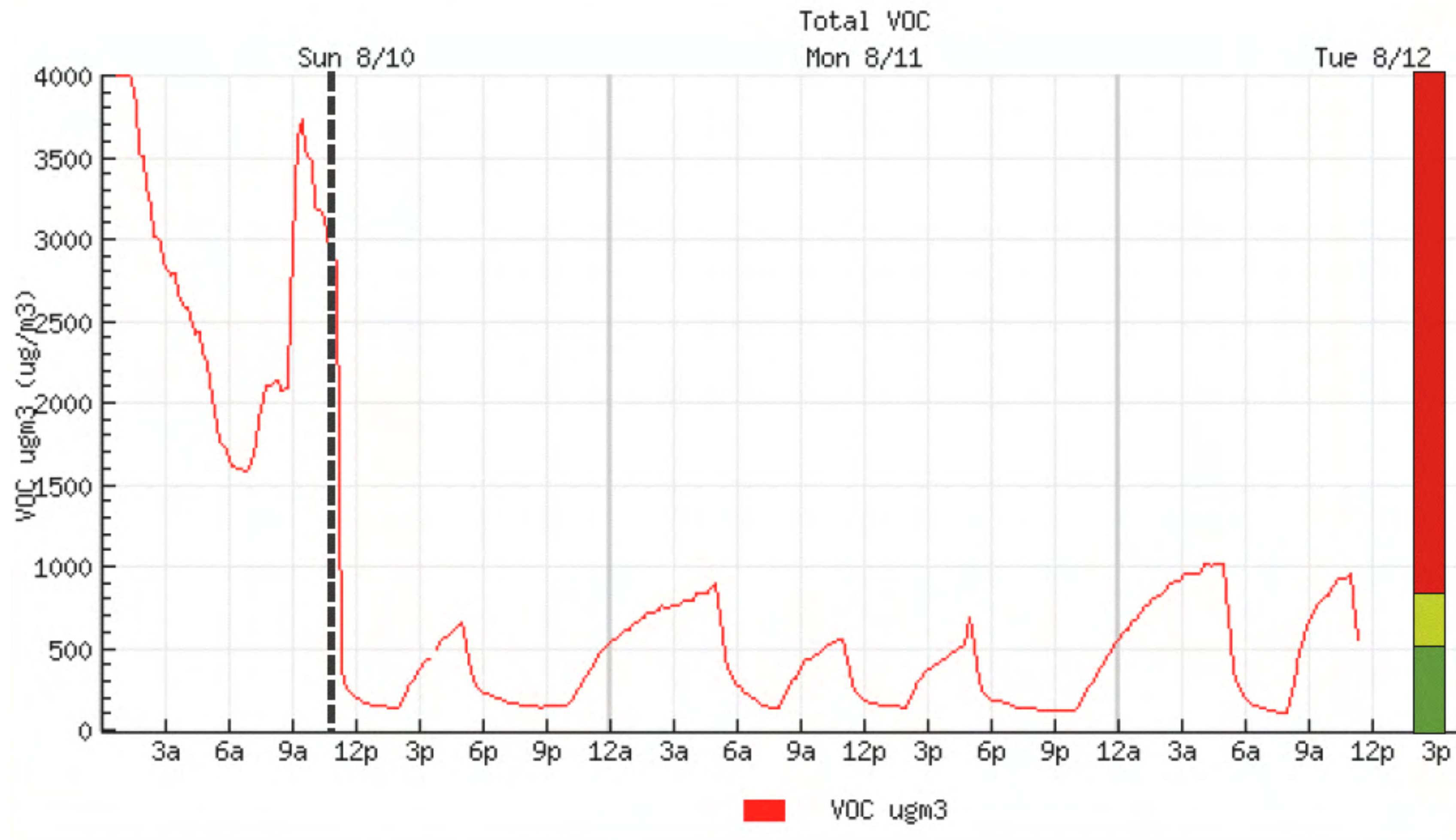
▲ BEYOND MEASUREMENT

CONSTRUCTION PHASE

FLUSH-OUT  
PHASE  
( passes test )

OCCUPANCY PHASE

▼ HEALTHY LIMIT



- Space renovated 14 months prior to testing.
- Intermittent ventilation system. TVOC ~ 150 when on.
- TVOC climbs to 1000 when off (2X over limit) within just a few hours.



Fresh Air and Filtration Units



**Qlear**  
healthy building data

QLEAR integrates the world's best hardware for managing indoor environmental quality.



Certification Grade Monitors



Outdoor Monitoring Stations





vs.



vs.



# All Monitors are not Equal

LOC 11111 11/08/2015 15:31:00



$\mu$	$\Sigma$	m
PM2.5	0.3	24.62
PM2.5	0.5	109.27
PM2.5	1.0	144.38
PM2.5	2.5	204.06
PM2.5	5.0	210.16
PM2.5	10.0	228.91

22.8 C  
50.7 %  
AUTO

CYCLES 0 / 999  
SAMPLE 00:00:49  
HOLD 00:05:00  
RECD 2607 / 3000

**COUNTING**

STOP

MIDHELD 3016-1AQ

91

origins

139

PM2.5  $\mu\text{g}/\text{m}^3$

AirAssure

TSI

# RESET™ *Indoor Air Quality (IAQ)*

## Monitoring Standards & Specifications:

Acceptable monitors must meet the following specifications. Monitors must have an annual certificate of recalibration.

---

### PM2.5:

Type: Near infrared Nephelometer

Range: 0-200ug/m<sup>3</sup>

### Relative Humidity (RH)

Type: Capacitive

Range: 10-90%

### Total Volatile Organic Compound (TVOC)

Type: Metal Oxide Semi-Conductor (MOS)

Range: 0 - 2.5mg/m<sup>3</sup> (0 - 1.22ppm)

### Temperature:

Type: Thermal Resistor (Thermistor)

Range: 10-40 Degrees C

### Carbon Dioxide (CO<sub>2</sub>)

Type: Non-dispersive infrared (NDIR)

Range: 0-3000 ppm

安邸AD

484

TVOC (ppb)

491

中度污染

TVOC (ppb)

527

中度污染

TVOC (ppb)

477

中度污染

TVOC (ppb)

origins

394

中度污染

TVOC (ppb)

origins

486

中度污染

TVOC (ppb)

origins

# Monitor Standards

Low-cost arrays don't work.



A lot of low-quality intelligence does not add up to high quality intelligence.



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GLUMAC engineers for a sustainable future™

Glumac

8

GOOD

INDOOR PM2.5  
(ug/m3)

2.5x

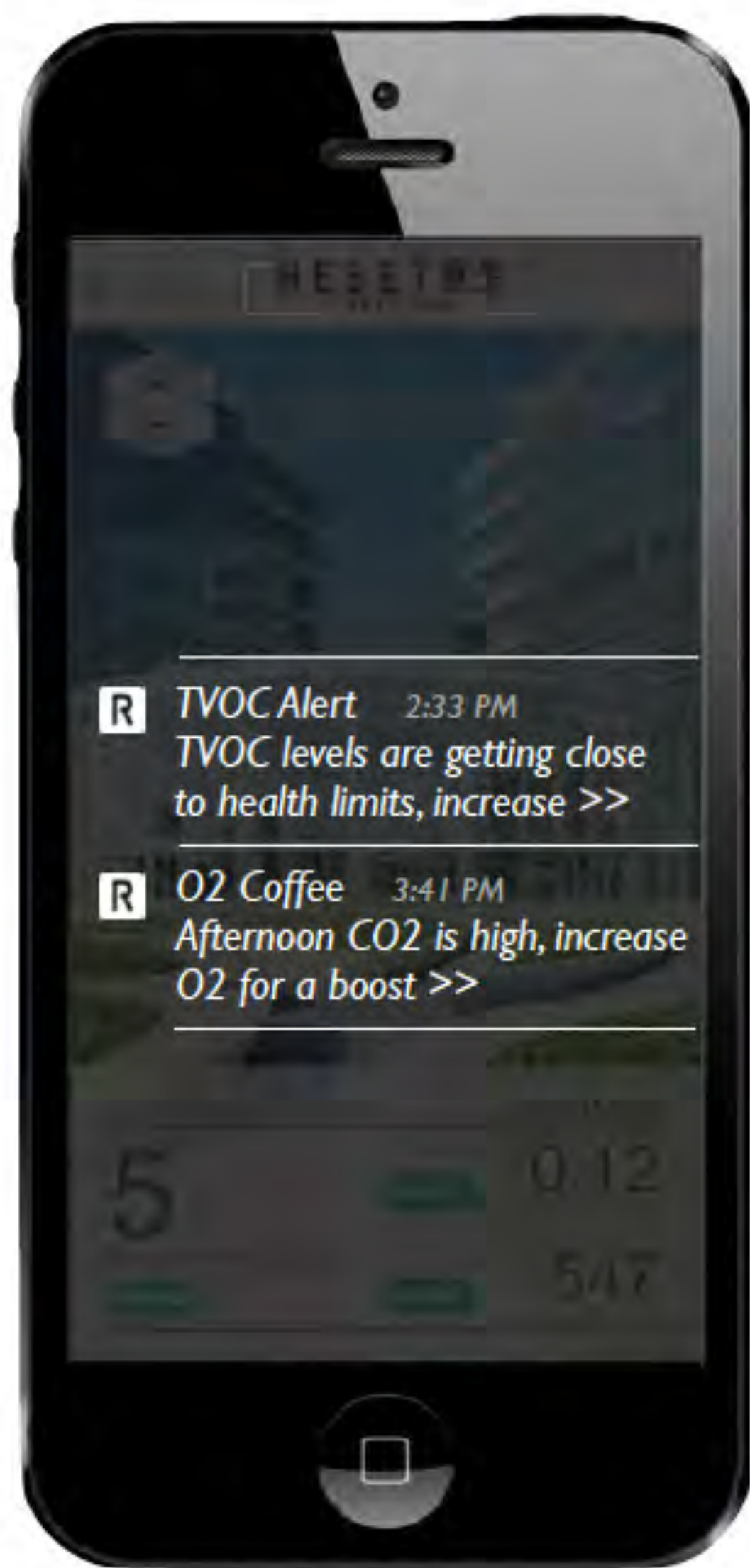
BETTER THAN  
OUTDOOR

20

OUTDOOR PM2.5  
(ug/m3)

VOC <0.12 (mg/m3) CO2 458 (ppmv) TEMP 24°C RH 64%

29 minutes ago



ENABLING BUILDINGS  
TO COMMUNICATE...

... ABOUT HOW THEY  
AFFECT US PERSONALLY.



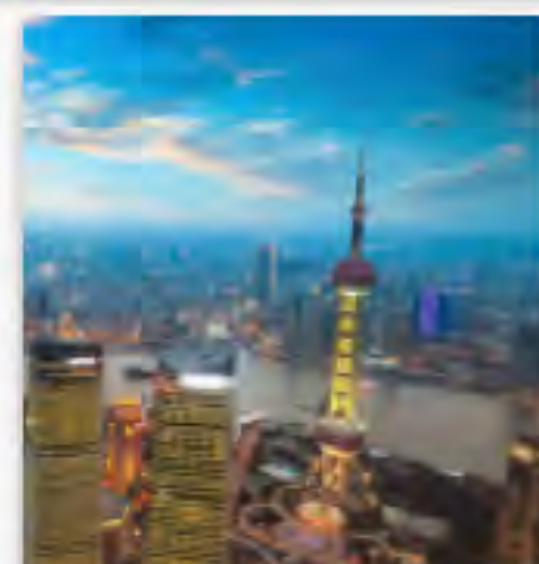
Beijing



Shijiazhuang



Tangshan



Shanghai



Wuxi



Suzhou



Hefei



Zhengzhou



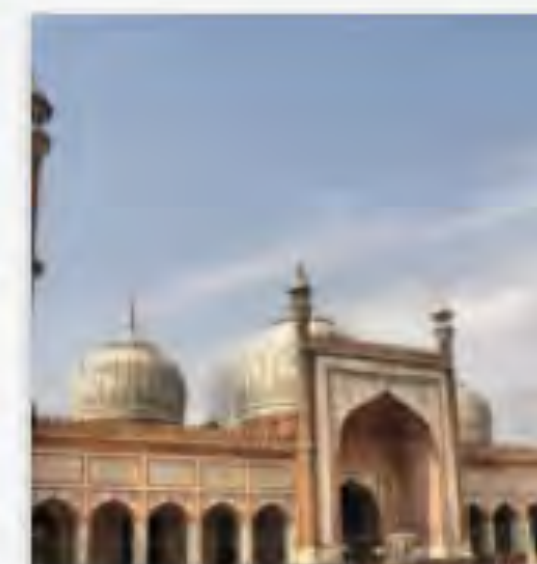
Guangzhou



Shenzhen



Chengdu



Newdelhi



Toronto



Chicago



Orlando

Feedback





TISHMAN SPEYER

Tishman Speyer - The Springs CBD  
尚浦中心

PM 2.5

Last Updated about 1 hour ago

Shanghai

PM 2.5

34

µg/m³

GOOD INDOOR

MODERATE OUTDOOR

BETTER THAN OUTDOOR

62 µg/m³

1.8 x

TVOC

GOOD 0.2 mg/m³

CARBON DIOXIDE

GOOD 350 ppm

TEMPERATURE

20 °C

HUMIDITY

56.52 %RH



Feedback



# RESET™ *Indoor Air Quality (IAQ)*

## Certification Standards:

Certification Standards for IAQ monitoring meet or exceed international best practices.

	PM2.5	TVOC	CO <sub>2</sub>	RELATIVE HUMIDITY	TEMPERATURE
UNIT OF MEASURE	µg/m <sup>3</sup>	mg/m <sup>3</sup>	ppm	%	°C
MINIMUM TARGET	35	≤0.5	≤800	Measured	Measured
HIGH-PERFORMANCE TARGETS	10	≤0.4	≤600	Measured	Measured

RESET requires monitoring for 5 related data points. These 5 data points are necessary to help identify issues locally and remotely, as well as build operational intelligence.

Levels must be maintained 100% of the time during hours of occupancy, calculated on a monthly basis.

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Glumac

Location Average

Shanghai Last Updated 23 minutes ago

PM 2.5

9

µg/m³

GOOD INDOOR  
GOOD OUTDOOR 20 µg/m³  
BETTER THAN OUTDOOR 2.2 x

TVOC GOOD 0.06 mg/m³

CARBON DIOXIDE GOOD 458 ppm

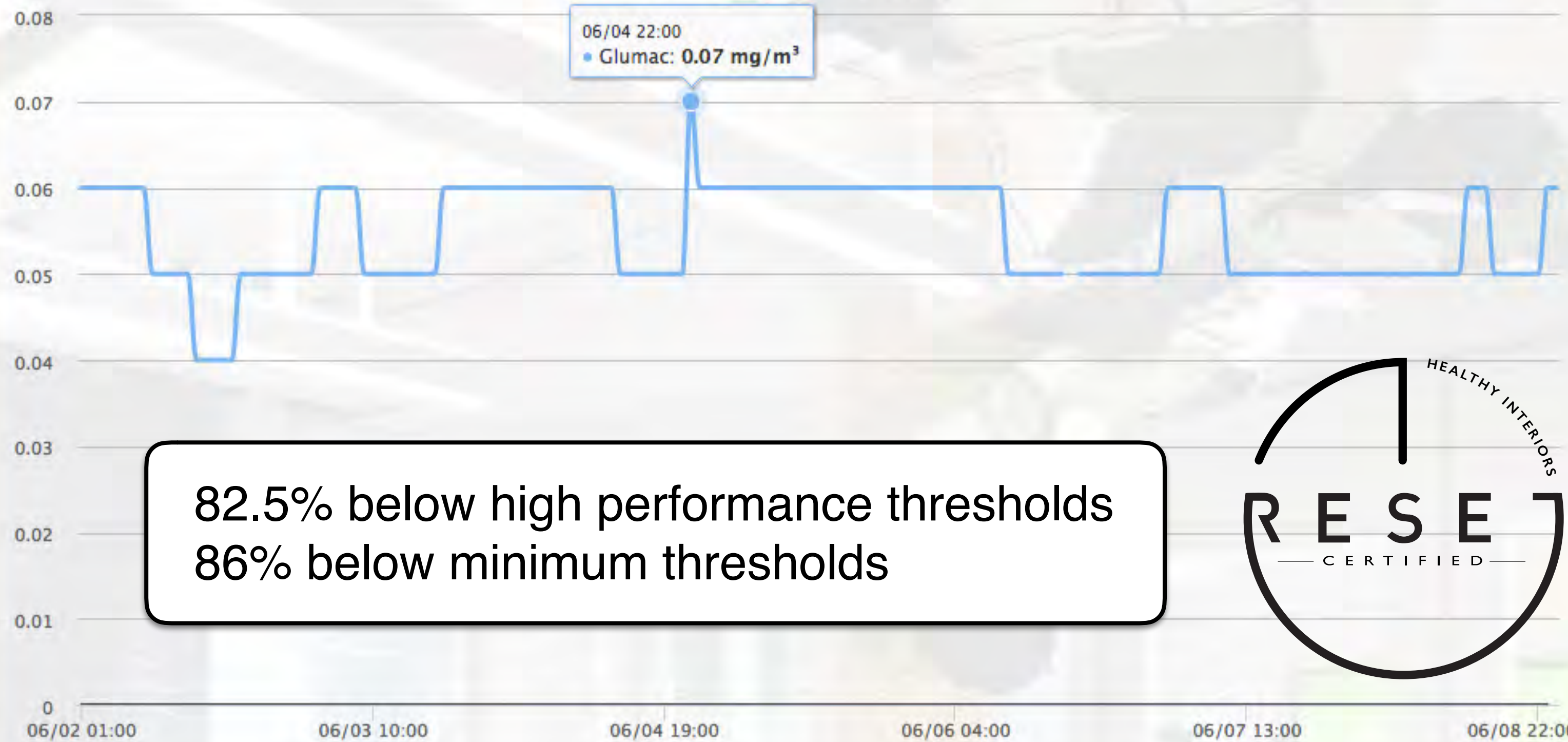
TEMPERATURE 25 °C

HUMIDITY 63.63 %RH

Total VOC Last 7 Day

Toggle Legend X

Total VOC Data Graph



82.5% below high performance thresholds  
86% below minimum thresholds



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**GOOD**  
INDOOR PM2.5  
(ug/m3)

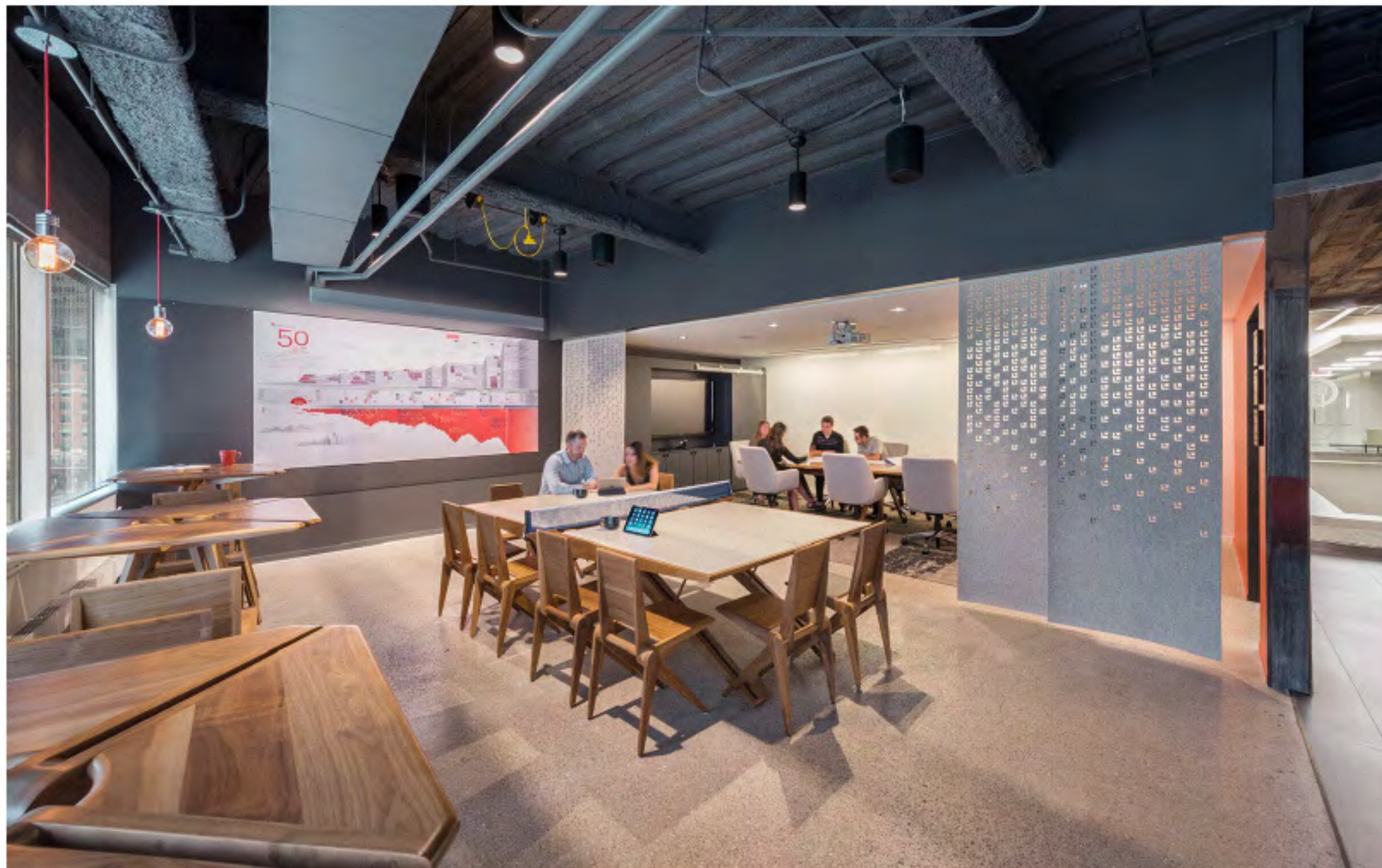
1.1x  
BETTER THAN  
OUTDOOR

11  
OUTDOOR PM2.5  
(ug/m3)

VOC <0.12 (mg/m3) CO2 545 (ppmv) TEMP 25°C RH 53%

an hour ago

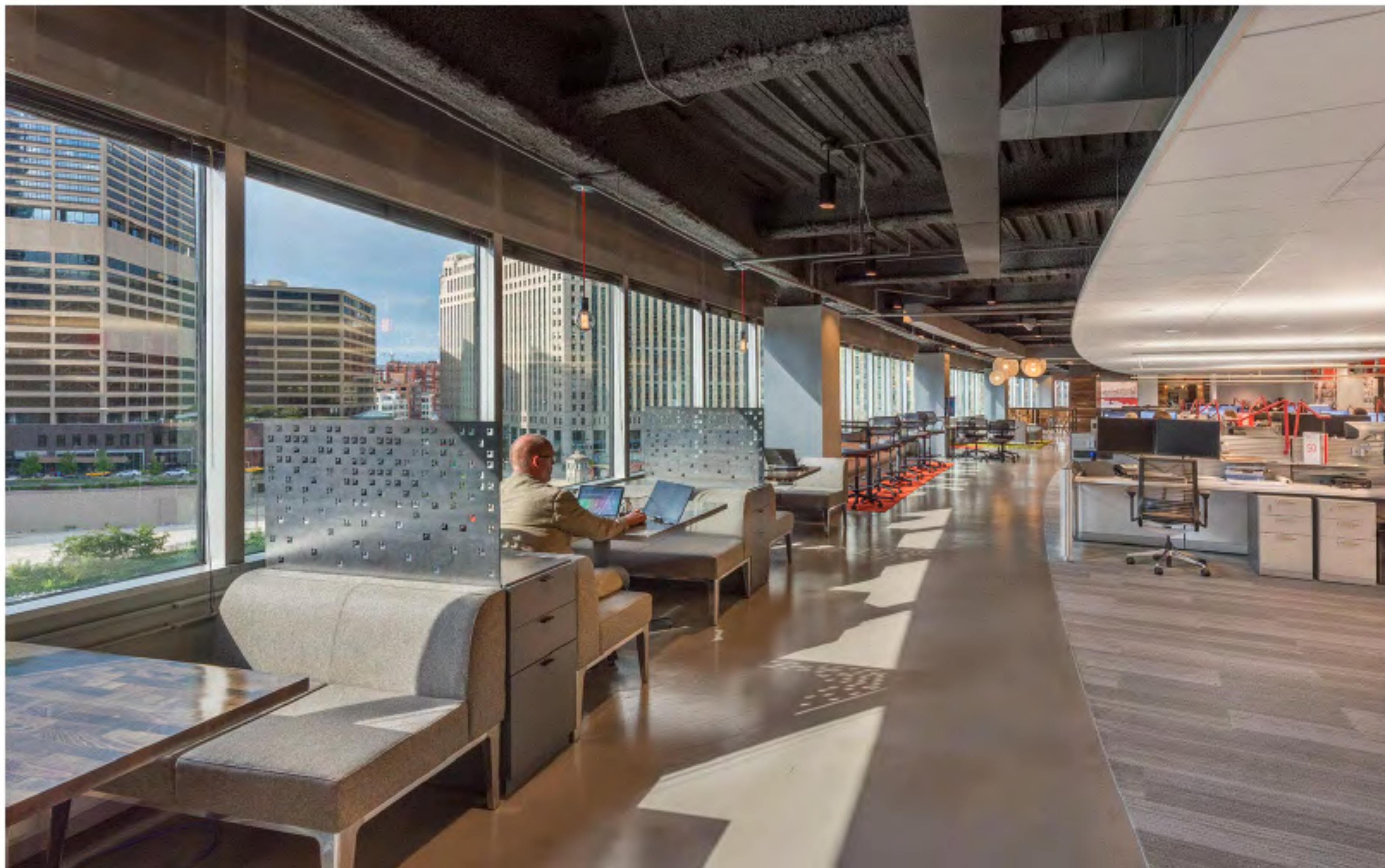


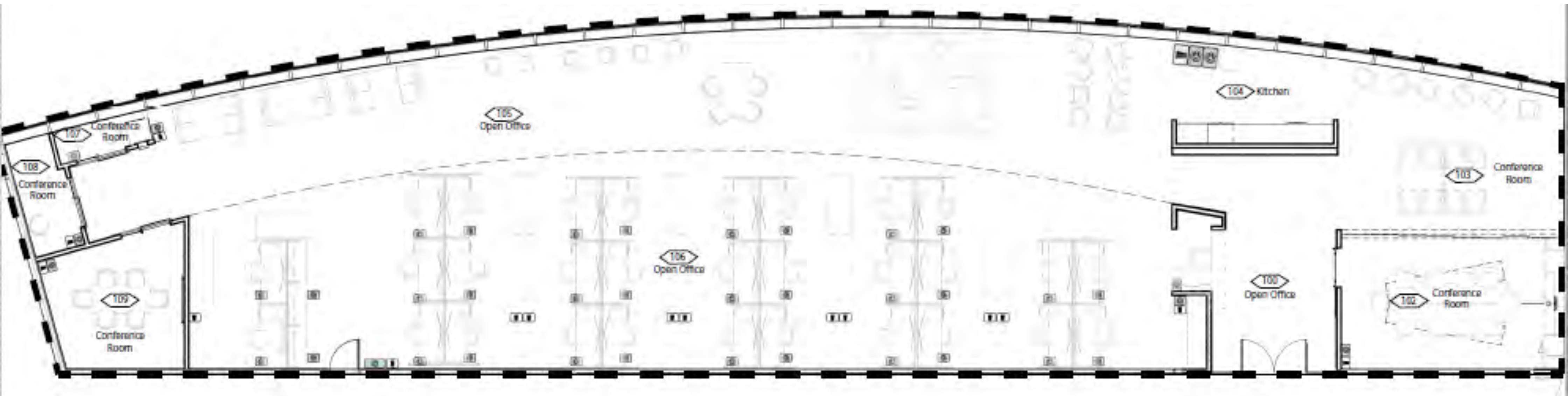


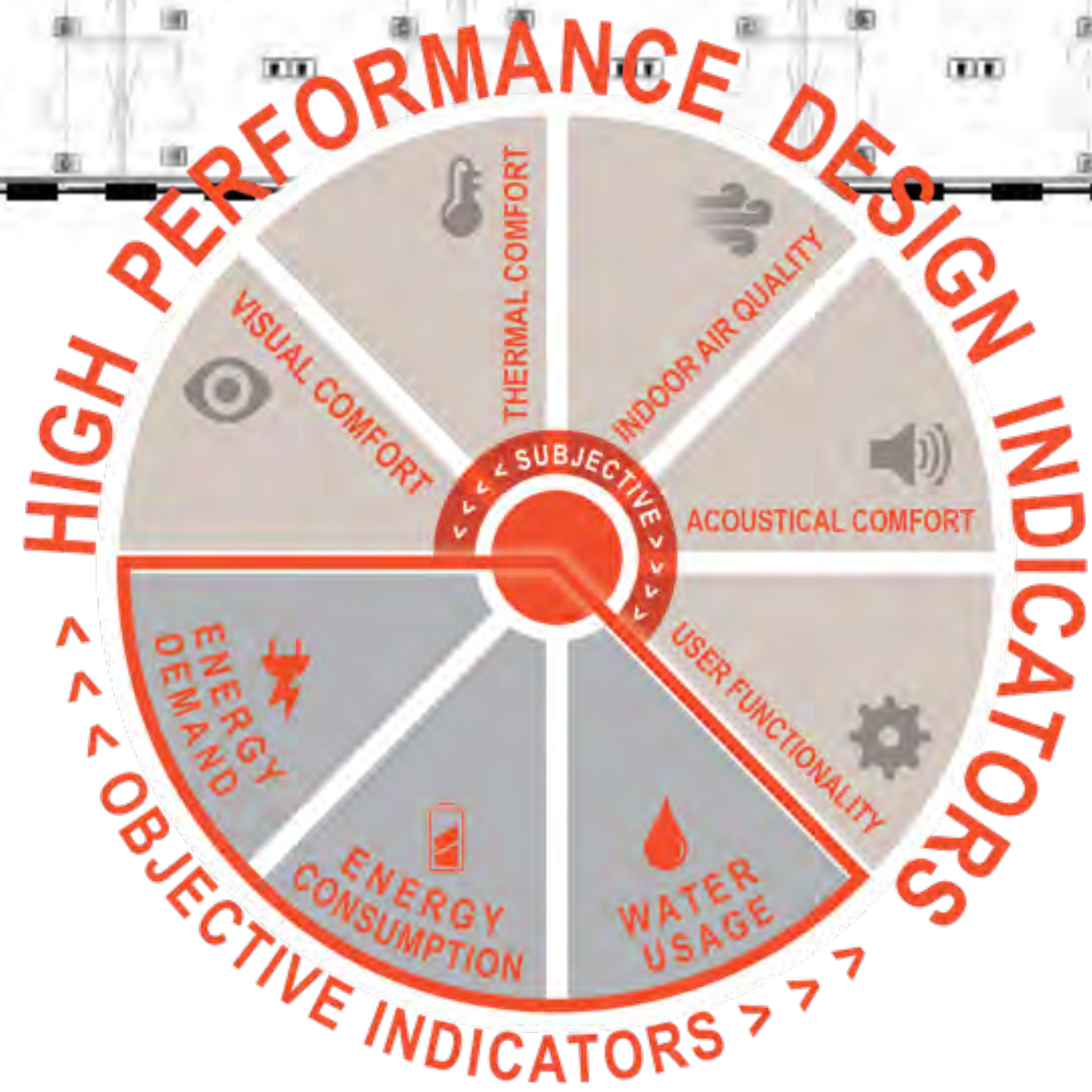
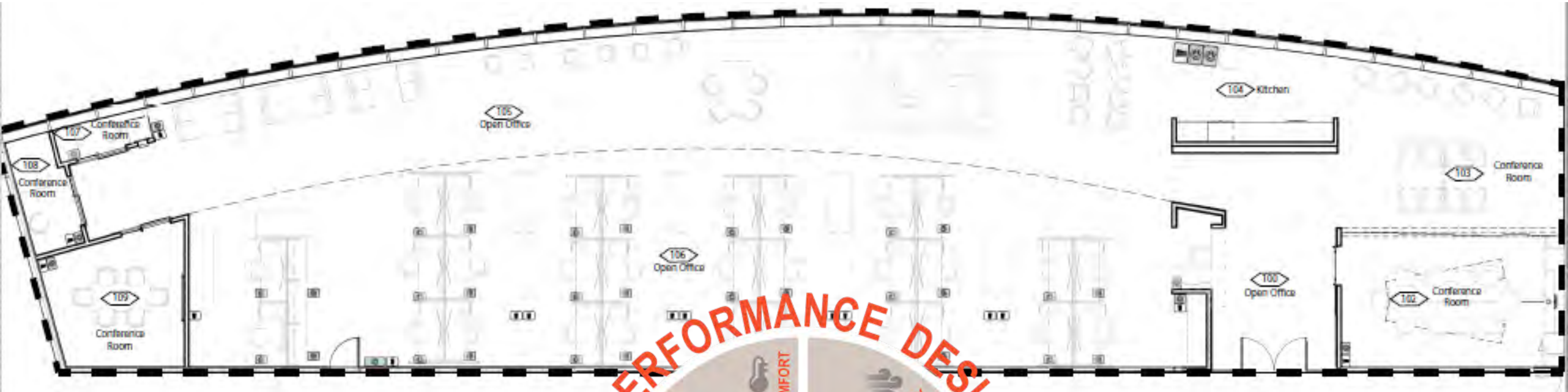


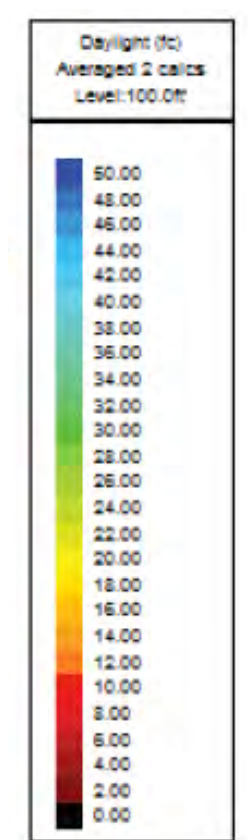
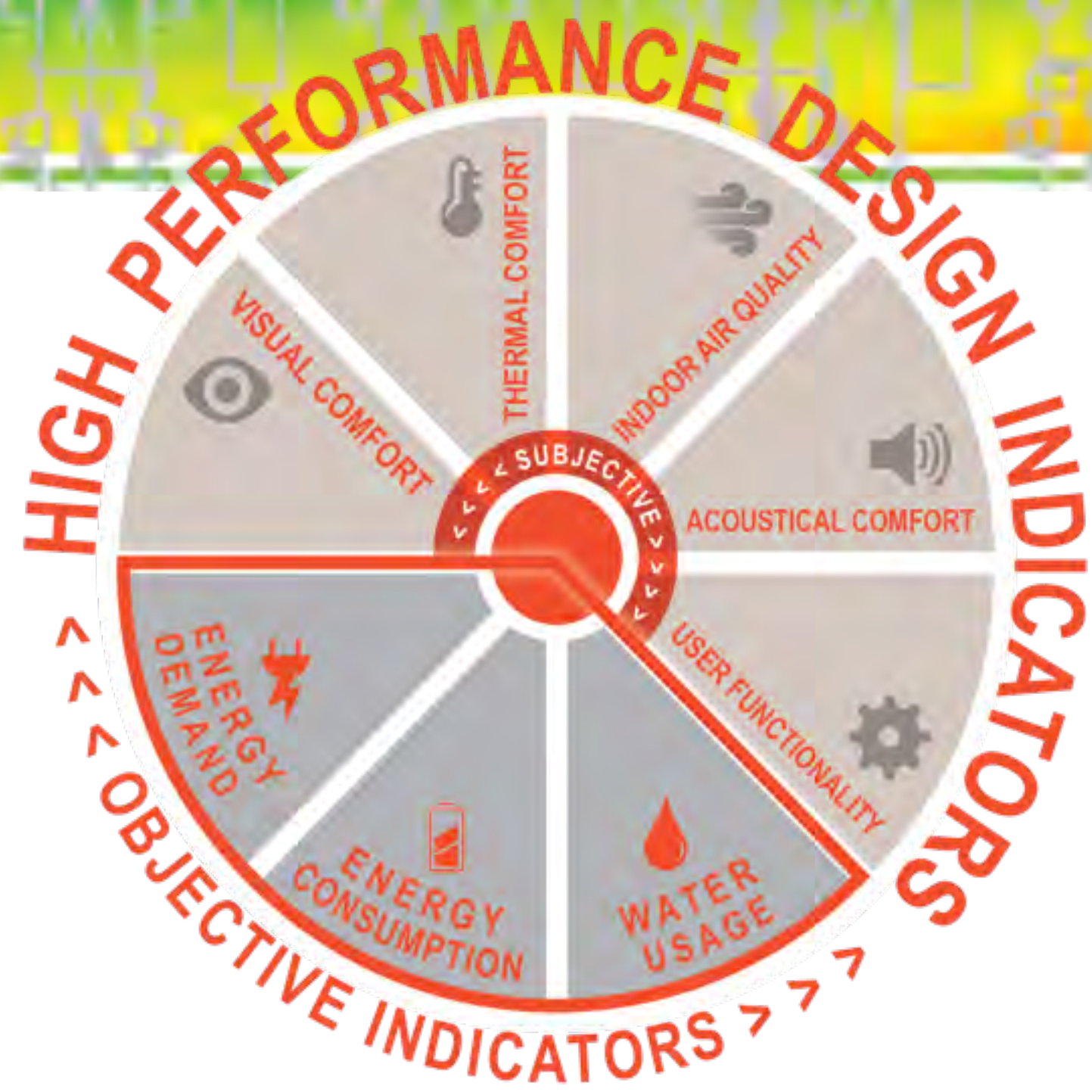
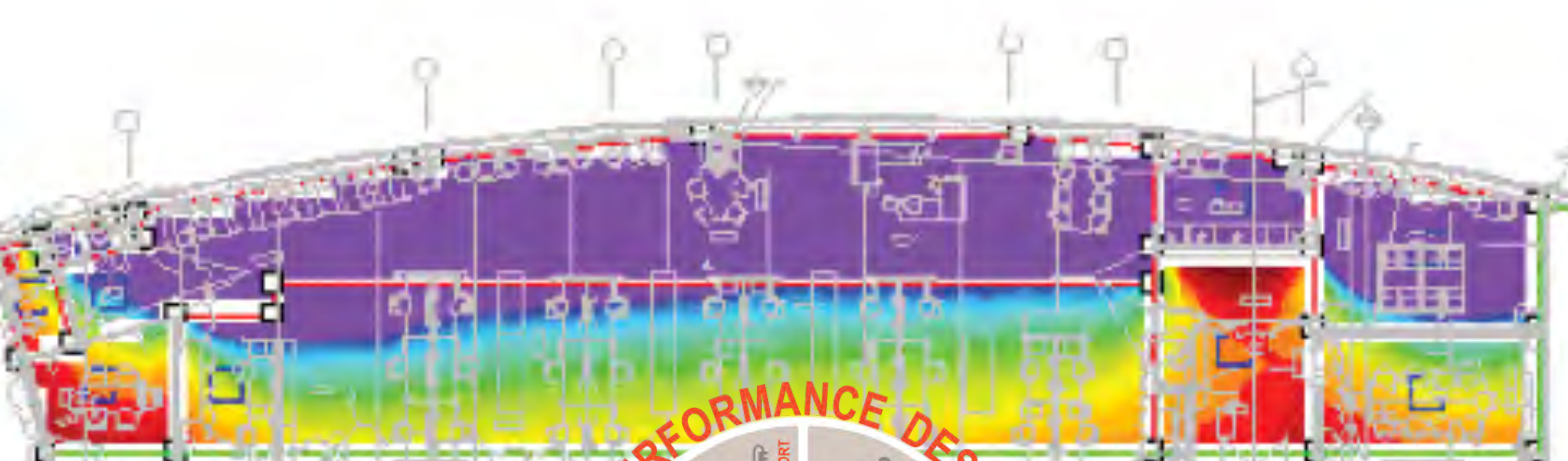


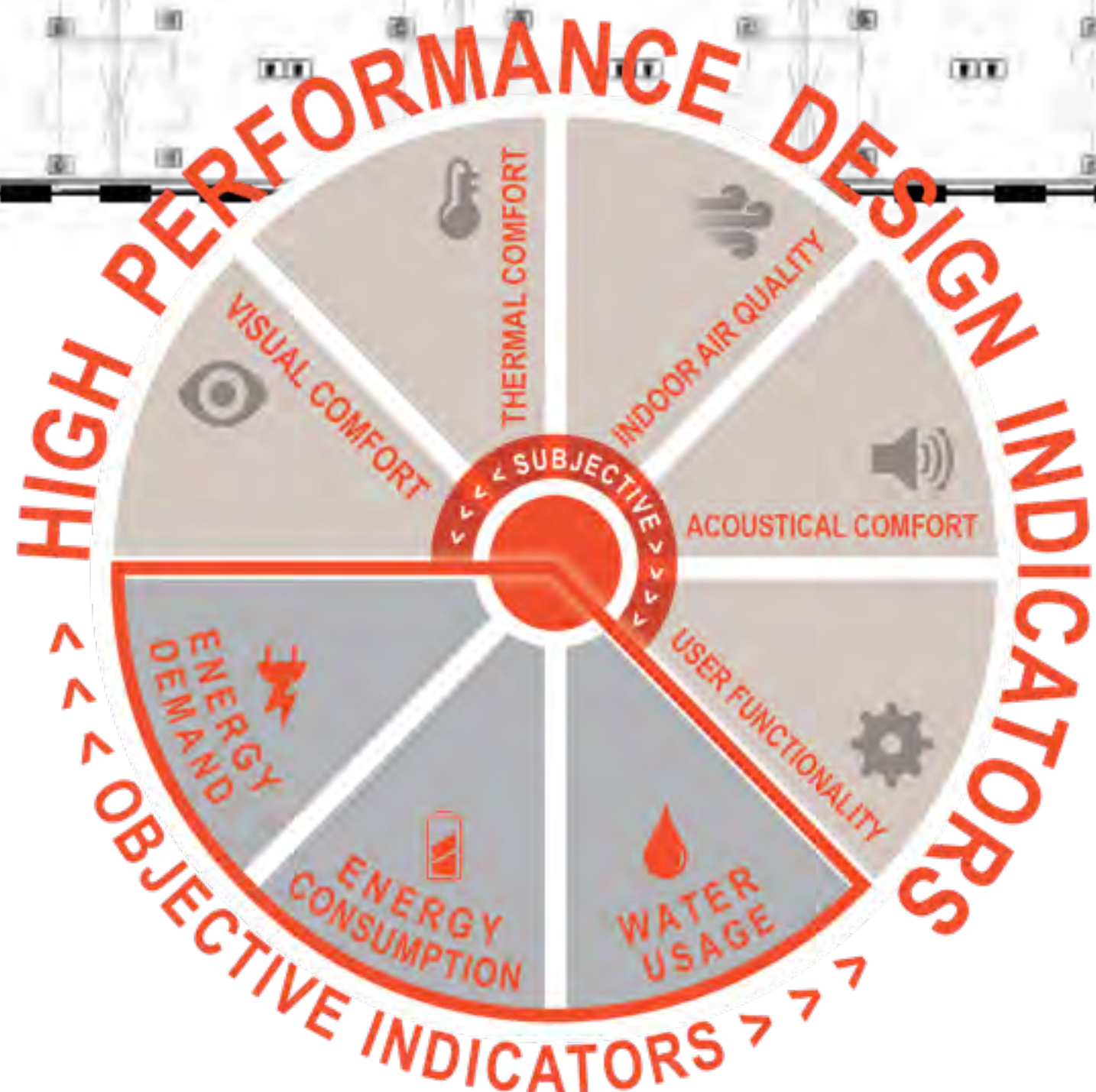
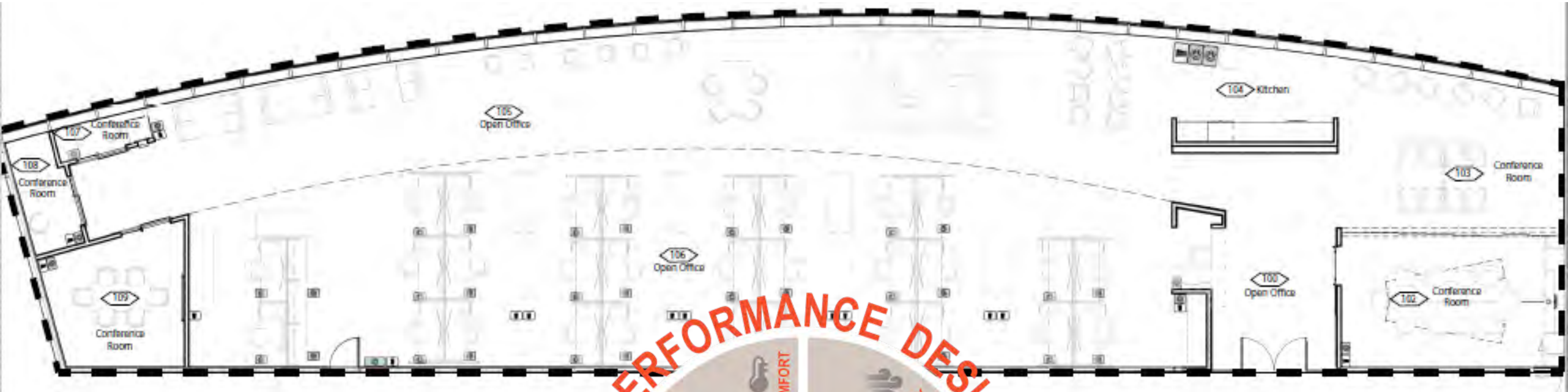






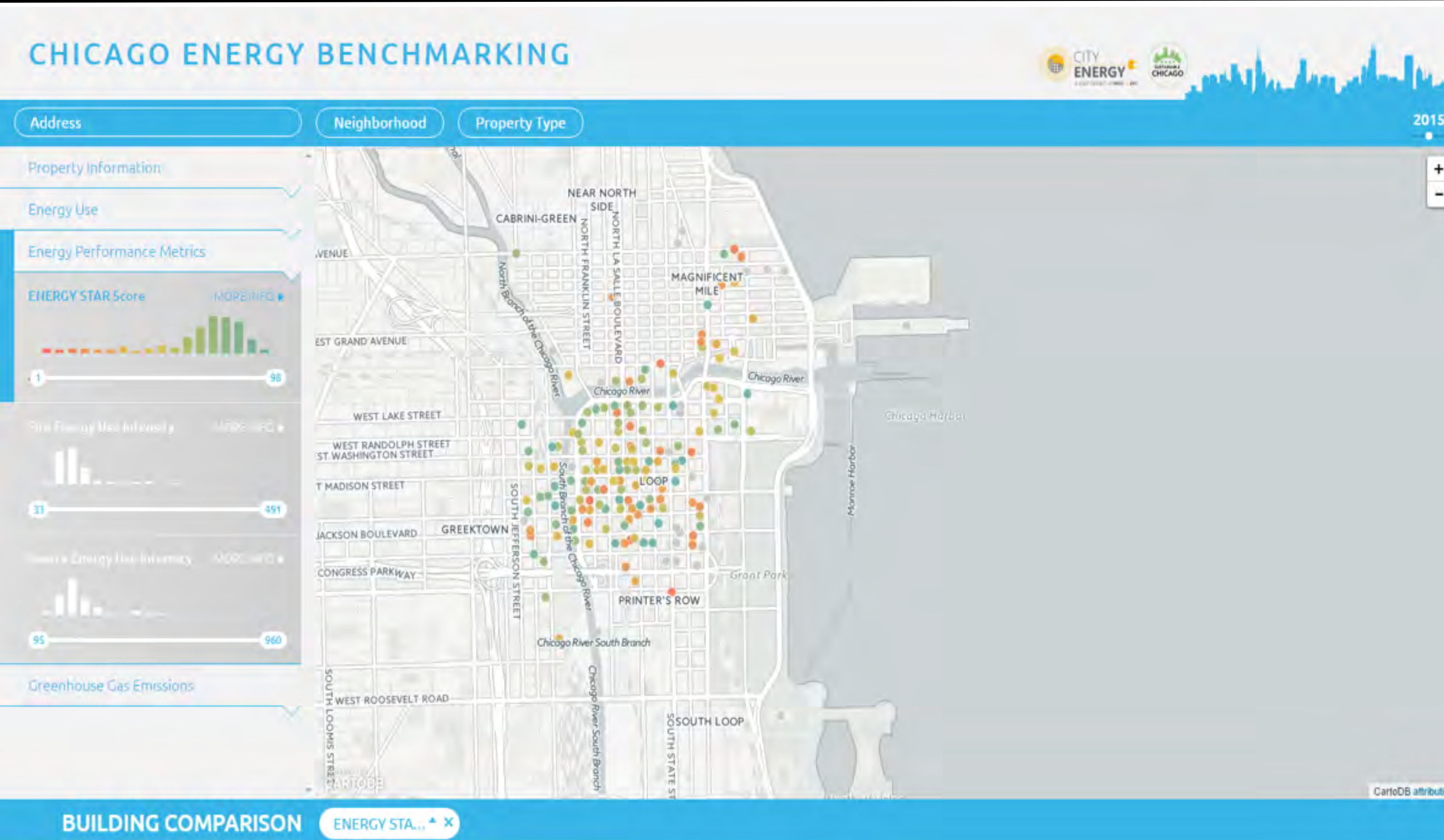






# Transparency in Data

## Mandatory Energy Benchmarking Ordinances



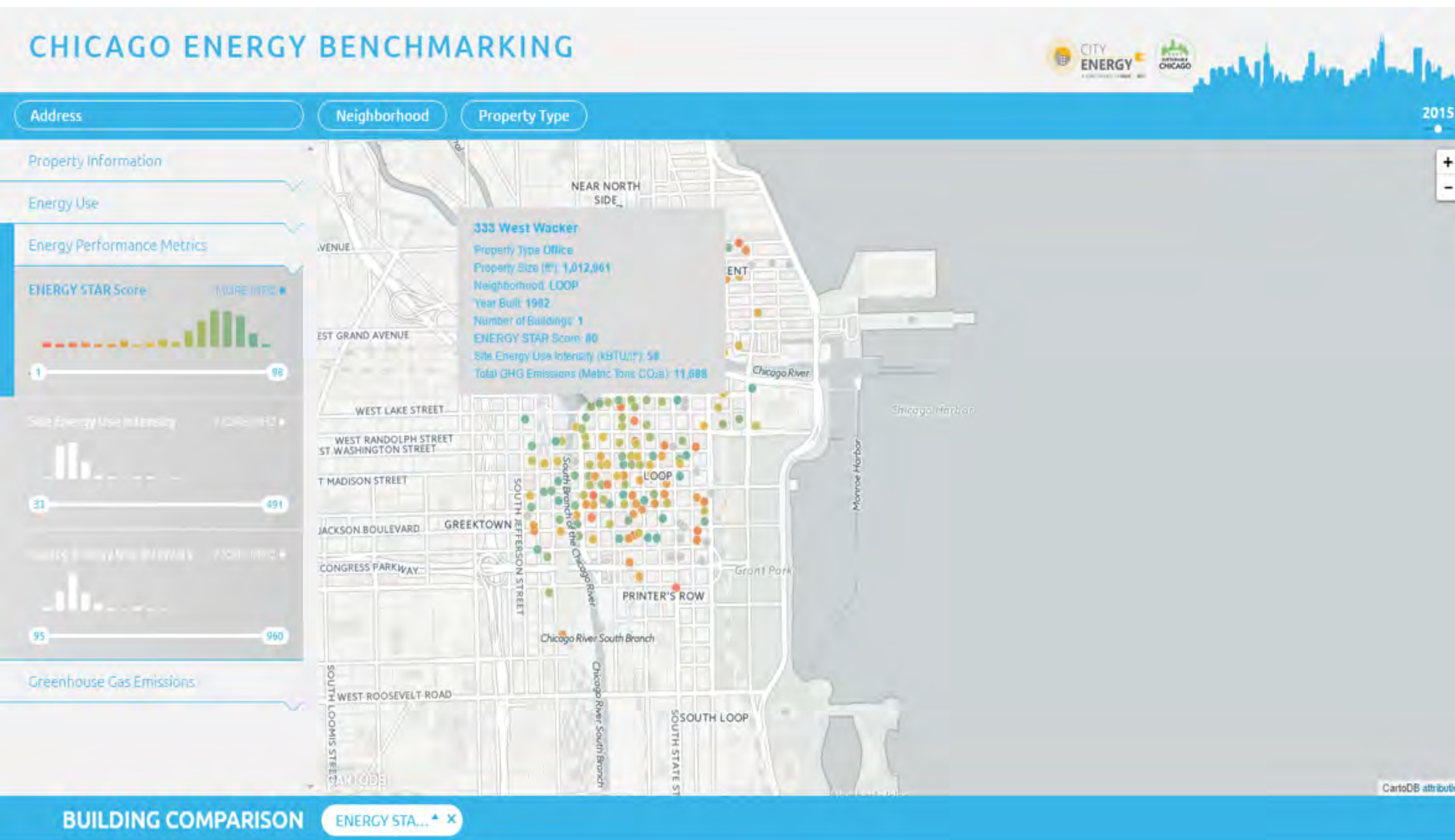
↓ Energy

↑ Transparency

↑ Competitiveness

# Transparency in Data

## Energy Performance & Data Visualization



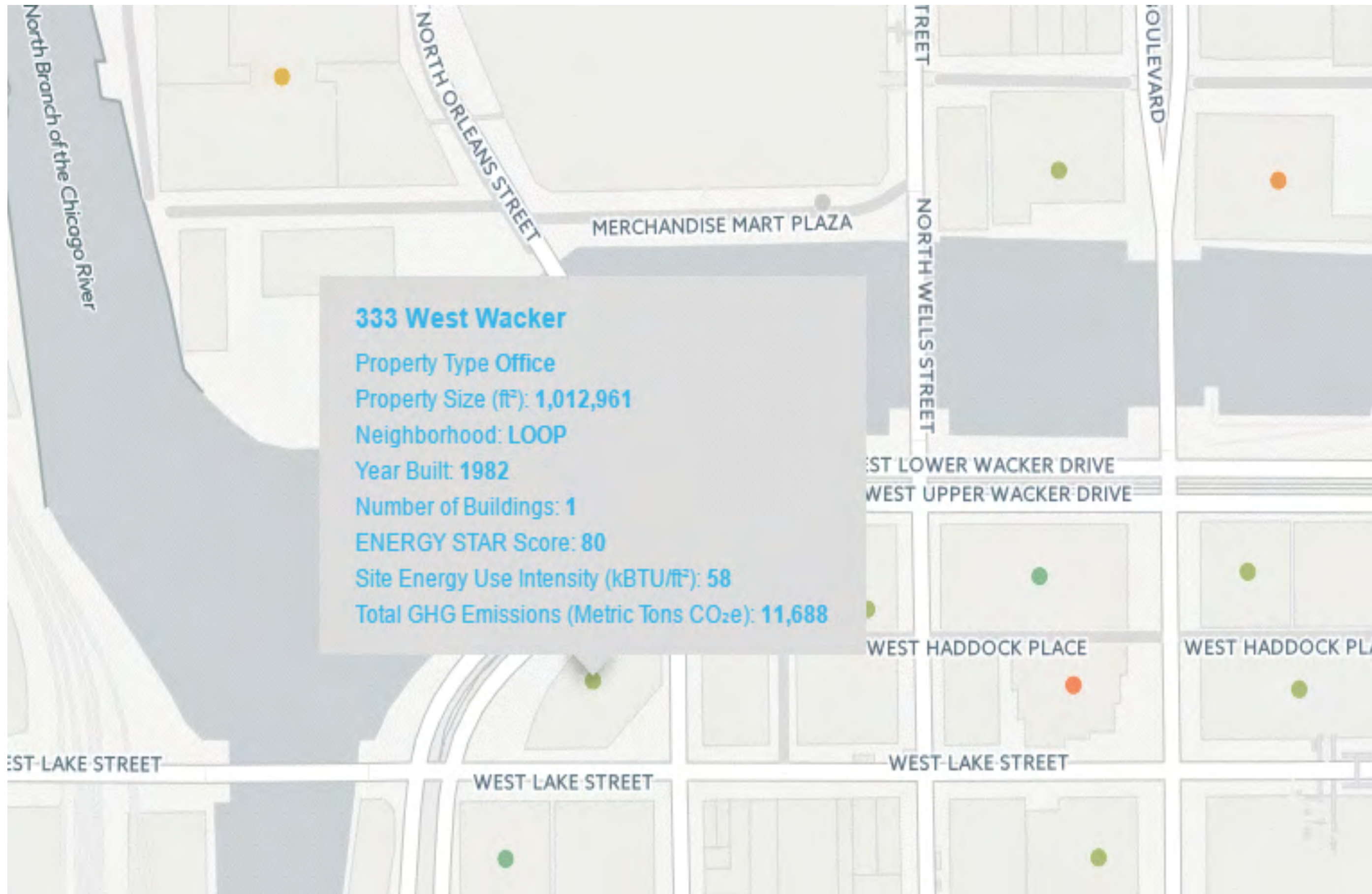
↓ Energy

↑ Transparency

↑ Competitiveness

# Transparency in Data

## New Level of Visibility



↓ Energy

↑ Transparency

↑ Competitiveness



**24** PARTICIPANTS

**6** DAYS **OVER** **2 WEEKS**

## 2 TESTS

**1** **Multivariable test for building types:**

Conventional	Green	Enhanced Green
i.e., Typical Office	Low VOC	Low VOC and High Ventilation

**2** **Single-variable test for carbon dioxide:**

Low CO<sub>2</sub>    Moderate CO<sub>2</sub>    High CO<sub>2</sub>



The Total Indoor Environmental Quality Lab is housed at Syracuse Center of Excellence. The lab was used to simulate conditions observed in different office environments.



PARTICIPANTS EXPERIENCED

**SIGNIFICANTLY BETTER COGNITIVE FUNCTION**

**FEWER HEALTH SYMPTOMS**

**BETTER PERCEIVED INDOOR ENVIRONMENTAL QUALITY**

**BASED ON THE FOLLOWING COGNITIVE FUNCTION DOMAINS**

- Basic activity level
- Applied activity level
- Focused activity level
- Task orientation
- Crisis response
- Information seeking
- Information usage
- Breadth of approach
- Strategy

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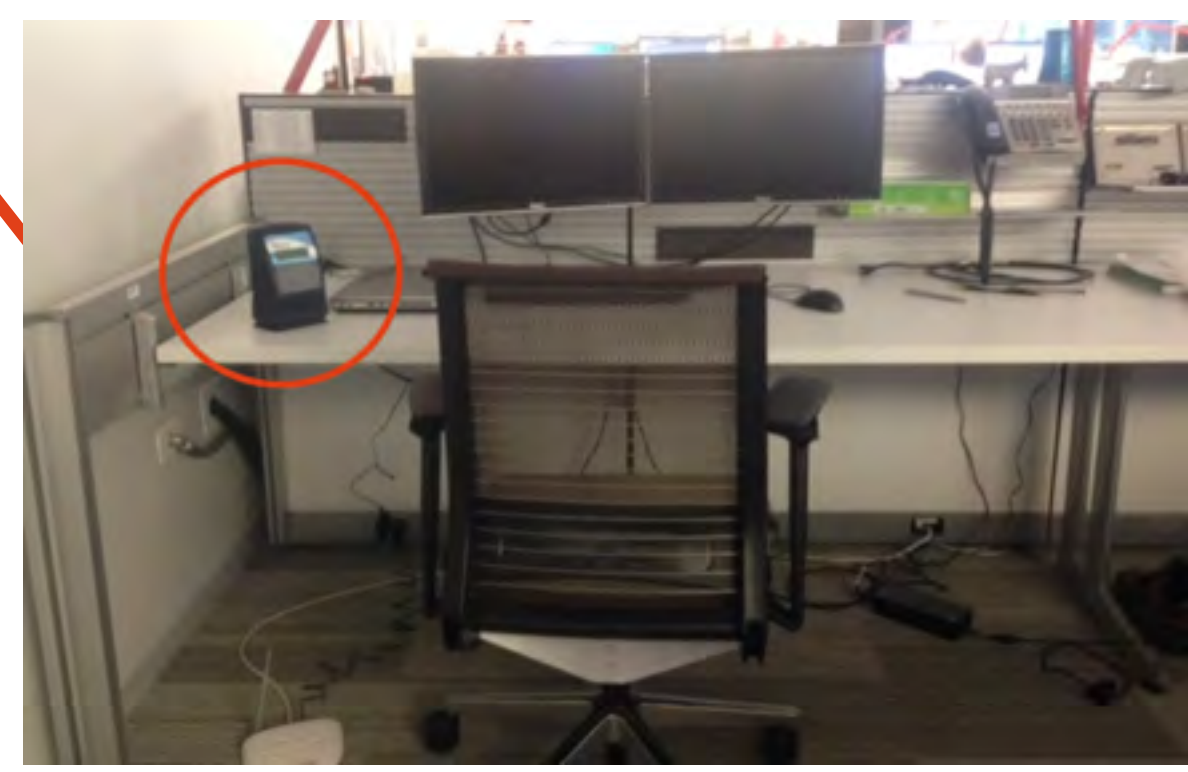
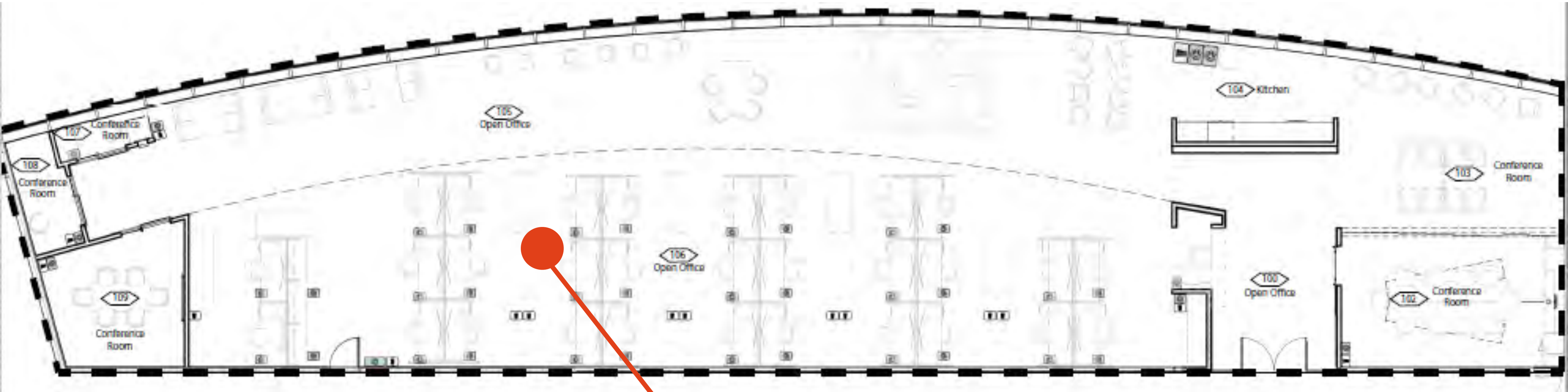
**GOOD**  
INDOOR PM2.5  
(ug/m3)

1.1x  
BETTER THAN  
OUTDOOR

11  
OUTDOOR PM2.5  
(ug/m3)

VOC <0.12 (mg/m3) CO2 545 (ppmv) TEMP 25°C RH 53%

an hour ago





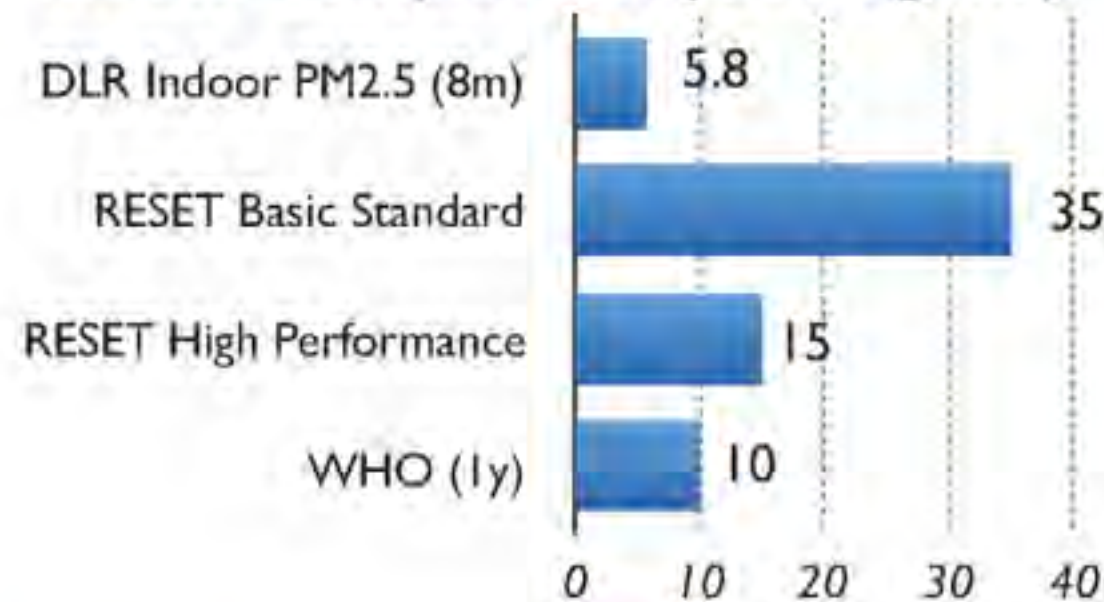
# IAQ DATA ANALYSIS: 8 MONTH AVERAGE

Location / Identifier	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	8 Months Average
Outdoor	PM2.5 (ug/m3)	7.4	6.2	8.4	9.6	8.9	11.6	12.8	6.9	9.0
Indoor (32295)	PM2.5 (ug/m3)	5.5	6.2	6.3	6.8	6.3	4.9	5.3	5.4	5.8
	CO2 (ppm)	758	737	609	641	680	886	803	792	738
	TVOC (ug/m3)	86	75	37	35	33	35	32	30	45

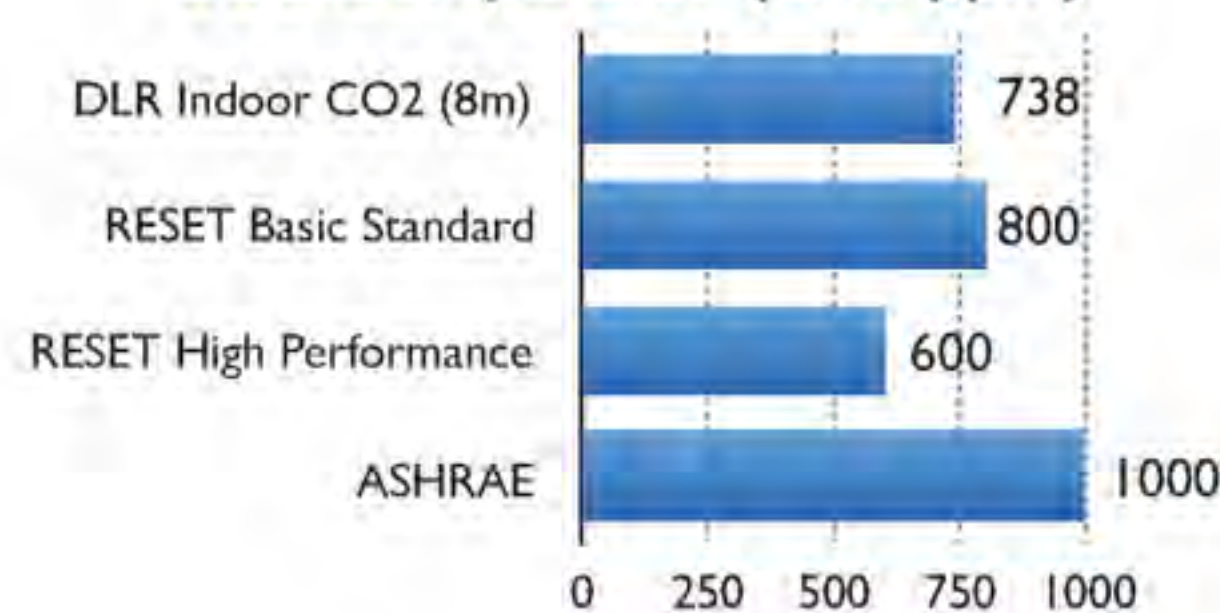
**Note:**

- The data only calculate working hours from 9:00-18:00pm, does not include American holidays (1-3 January, 28-30 May, 2-4 July) and weekend (Saturday and Sunday).
- PM2.5 protection factor =  $1 - (\text{Indoor PM2.5} / \text{Outdoor PM2.5}) = 1 - (5.8/9) = 35.6\%$ .

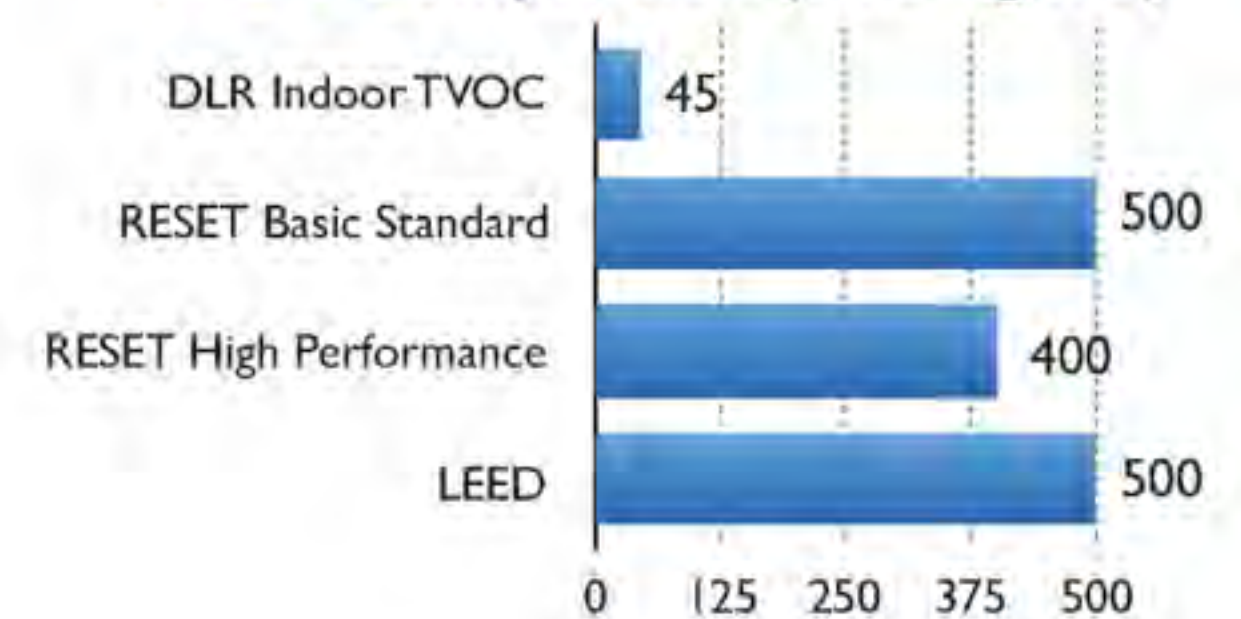
### PM2.5 Comparison (unit: ug/m3)



### CO2 Comparison (unit: ppm)



### TVOC Comparison (unit: ug/m3)



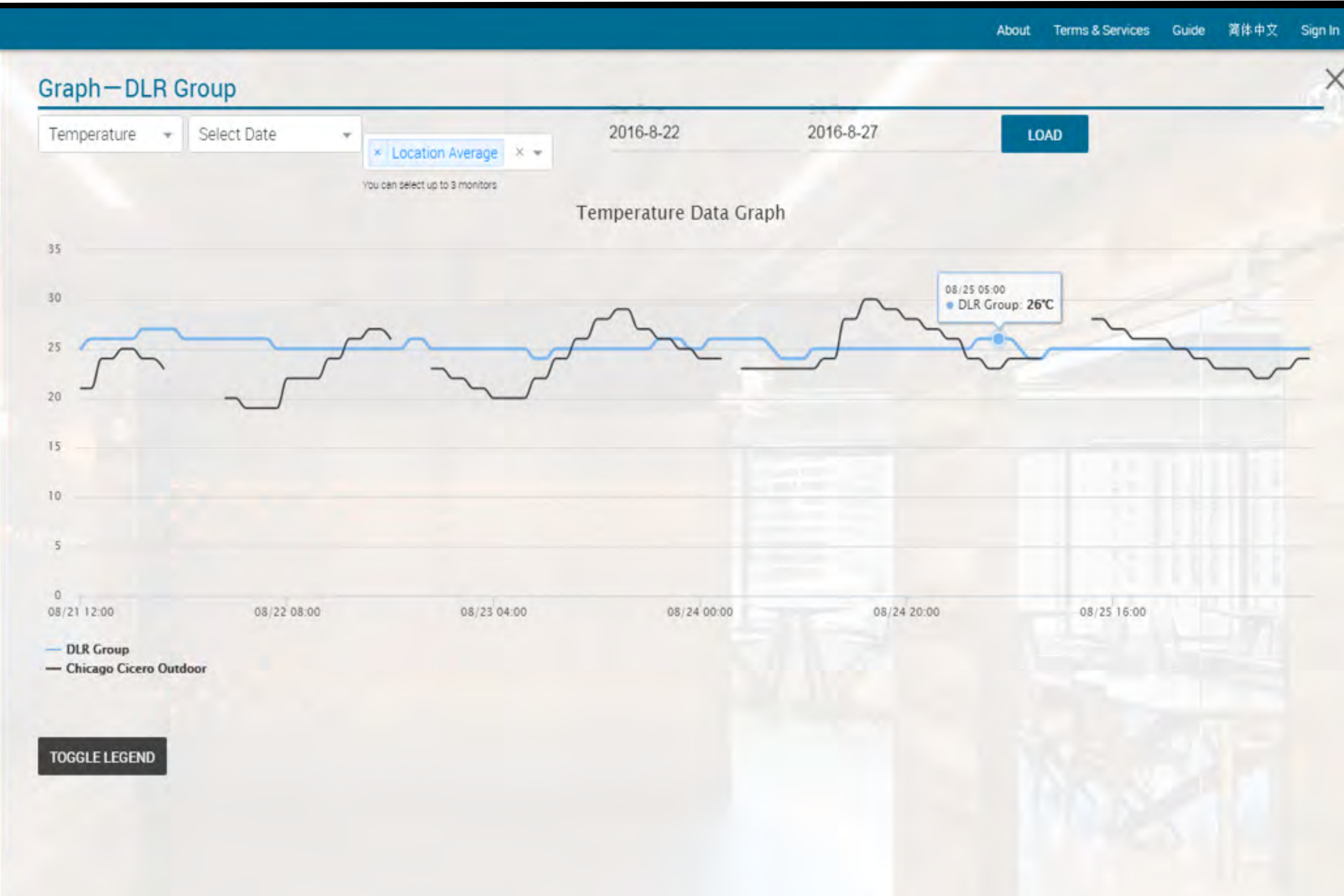
## CONCLUSION

- DLR Indoor PM.5 8 Month Average **MEETS** RESET High Performance Standard (15ug/m3).
- DLR Indoor CO2 8 Month Average **MEETS** RESET Basic Standard (800ppm).
- DLR Indoor TVOC 8 Month Average **MEETS** and **9 times better** than RESET High Performance Standard (400ug/m3).



# Indoor Air Quality

Building Data  $\leftarrow$   $\rightarrow$  Actionable Intelligence



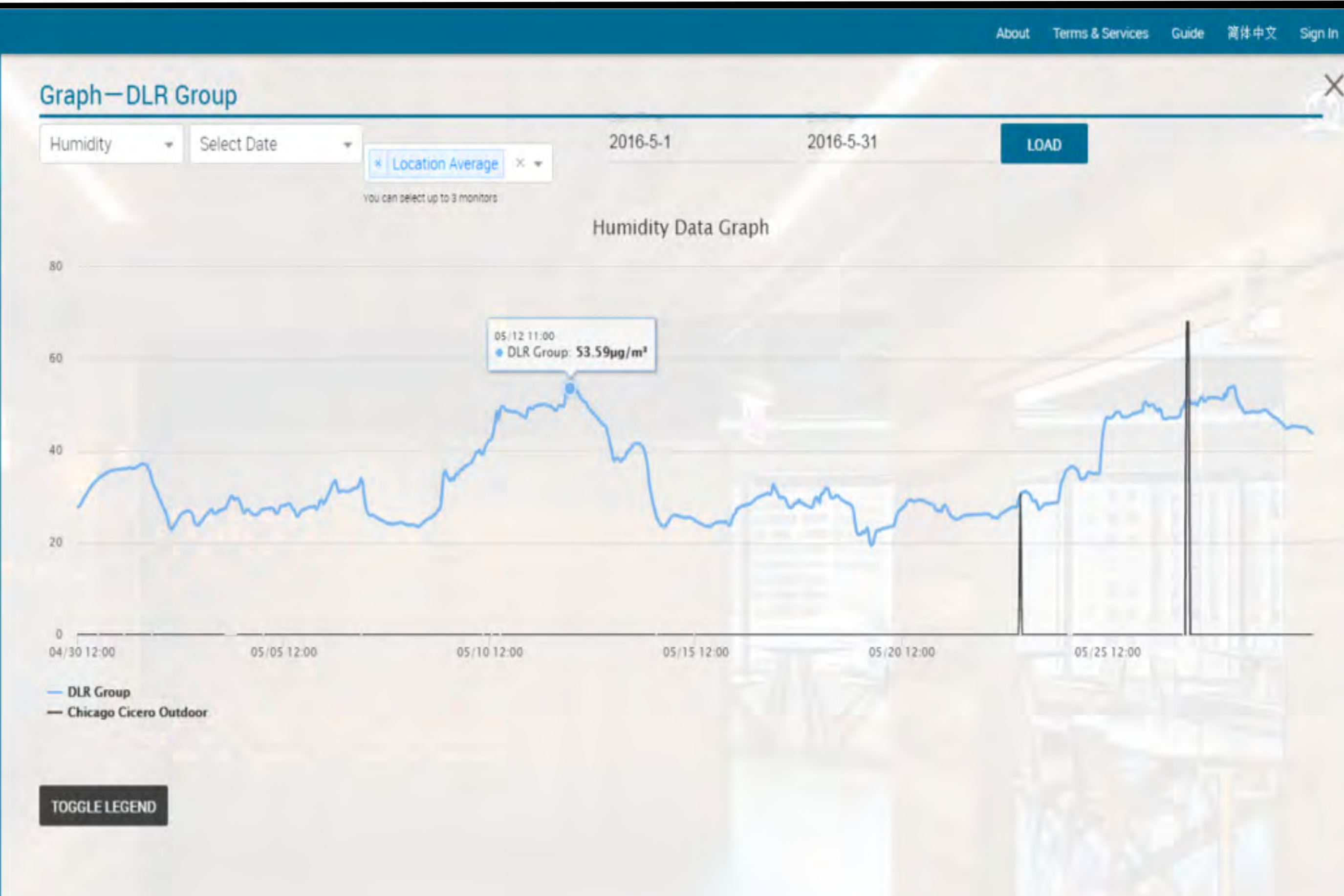
↑ Temperature

↓ Comfort

↓ Productivity

# Indoor Air Quality

Building Data  $\leftarrow \rightarrow$  Actionable Intelligence



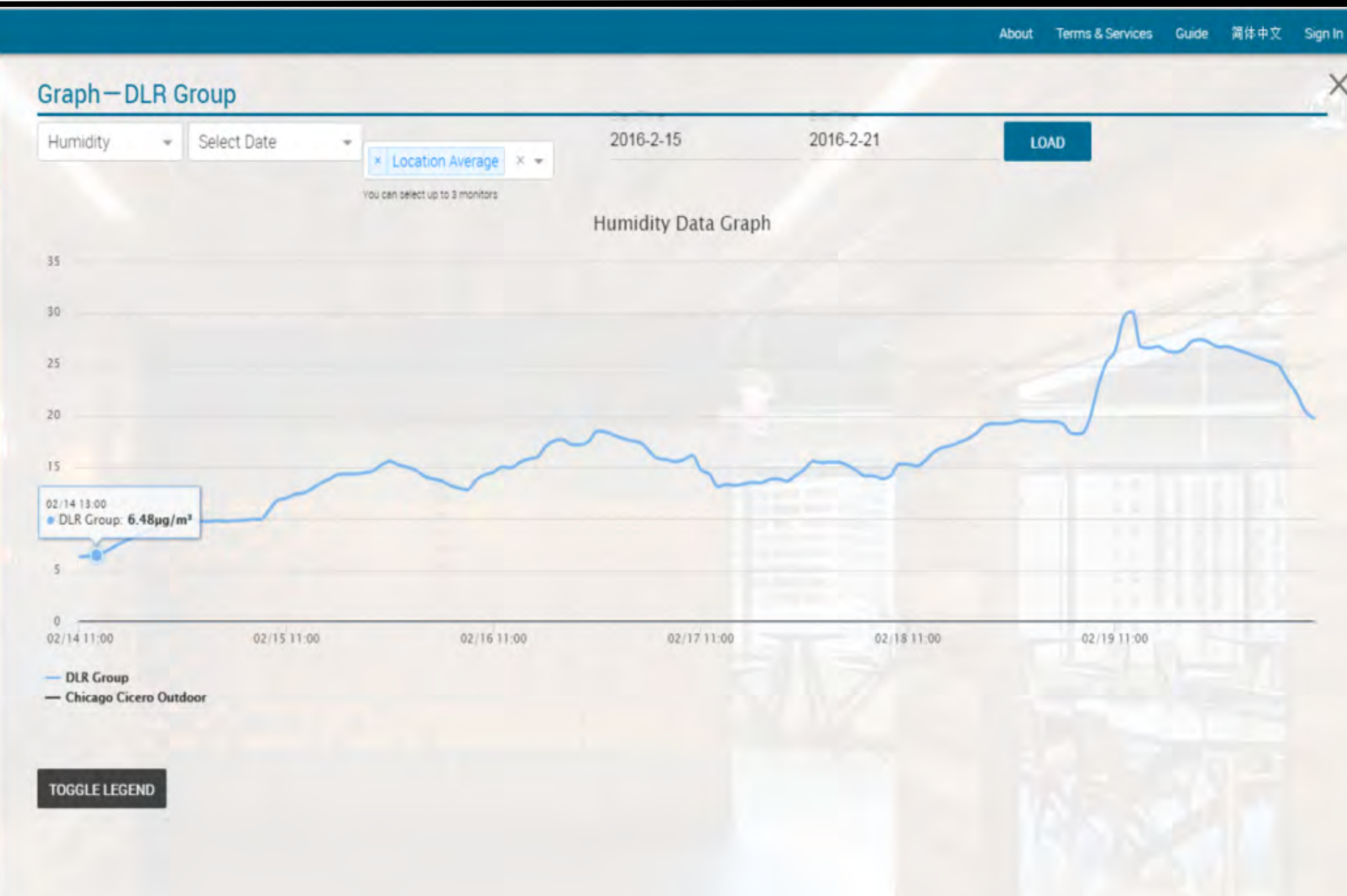
↑ Humidity

↓ Comfort

↓ Productivity

# Indoor Air Quality

Building Data  $\leftarrow \rightarrow$  Actionable Intelligence



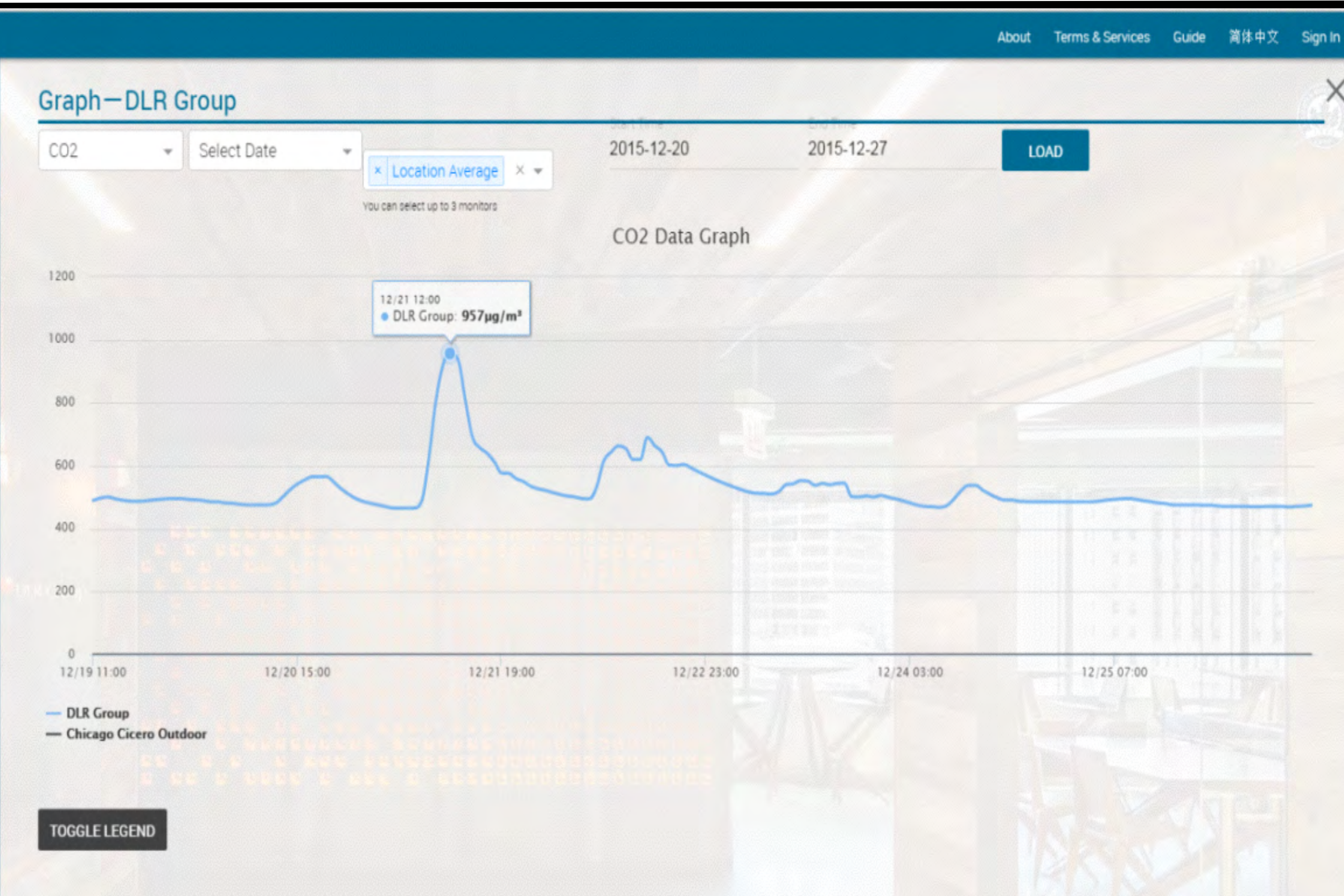
↓ Humidity

↓ Comfort

↓ Productivity

# Indoor Air Quality

Building Data  $\leftarrow \rightarrow$  Actionable Intelligence



↑ CO2

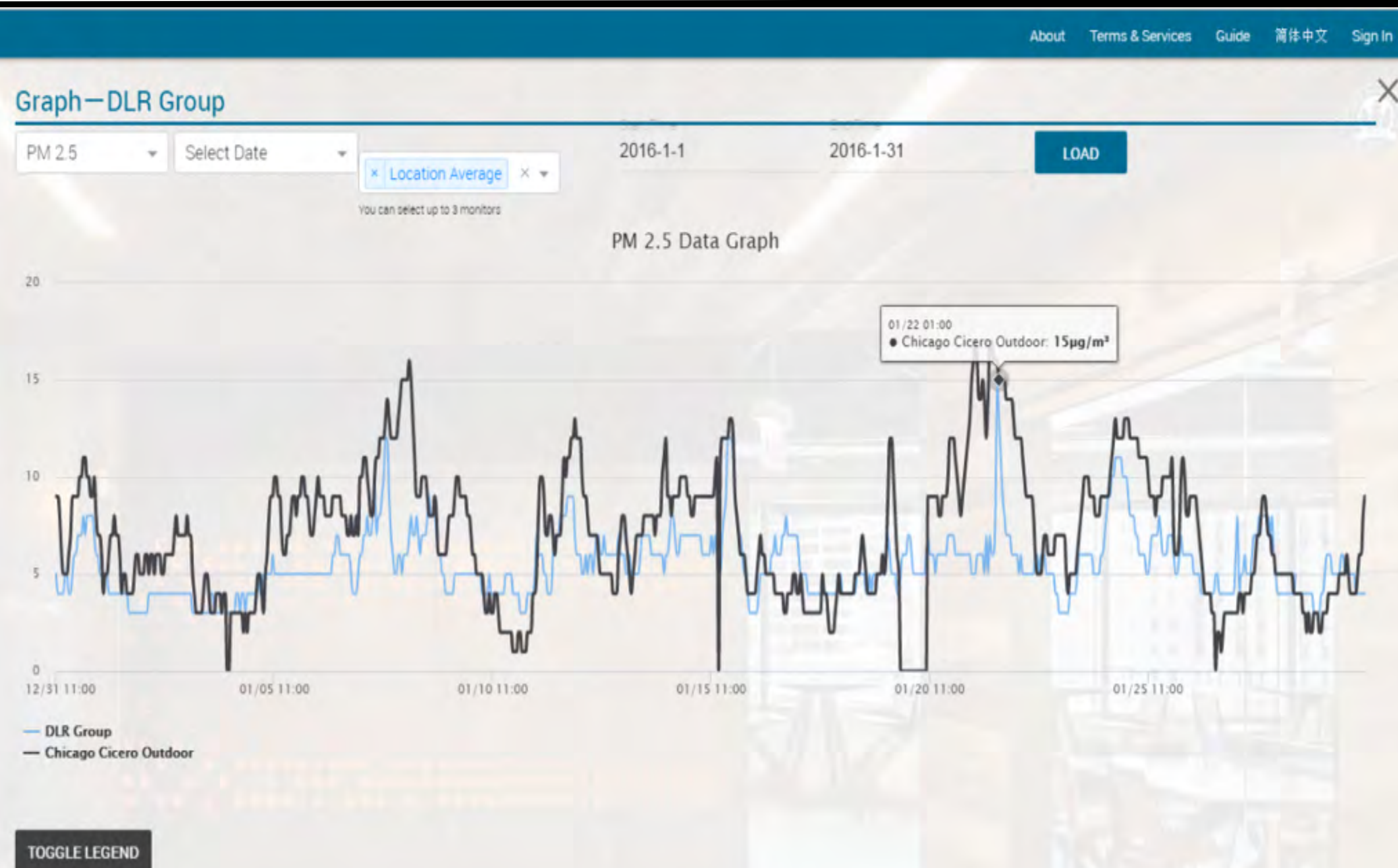
↓ Comfort

↓ Productivity



# Indoor Air Quality

Building Data  $\leftrightarrow$  Actionable Intelligence



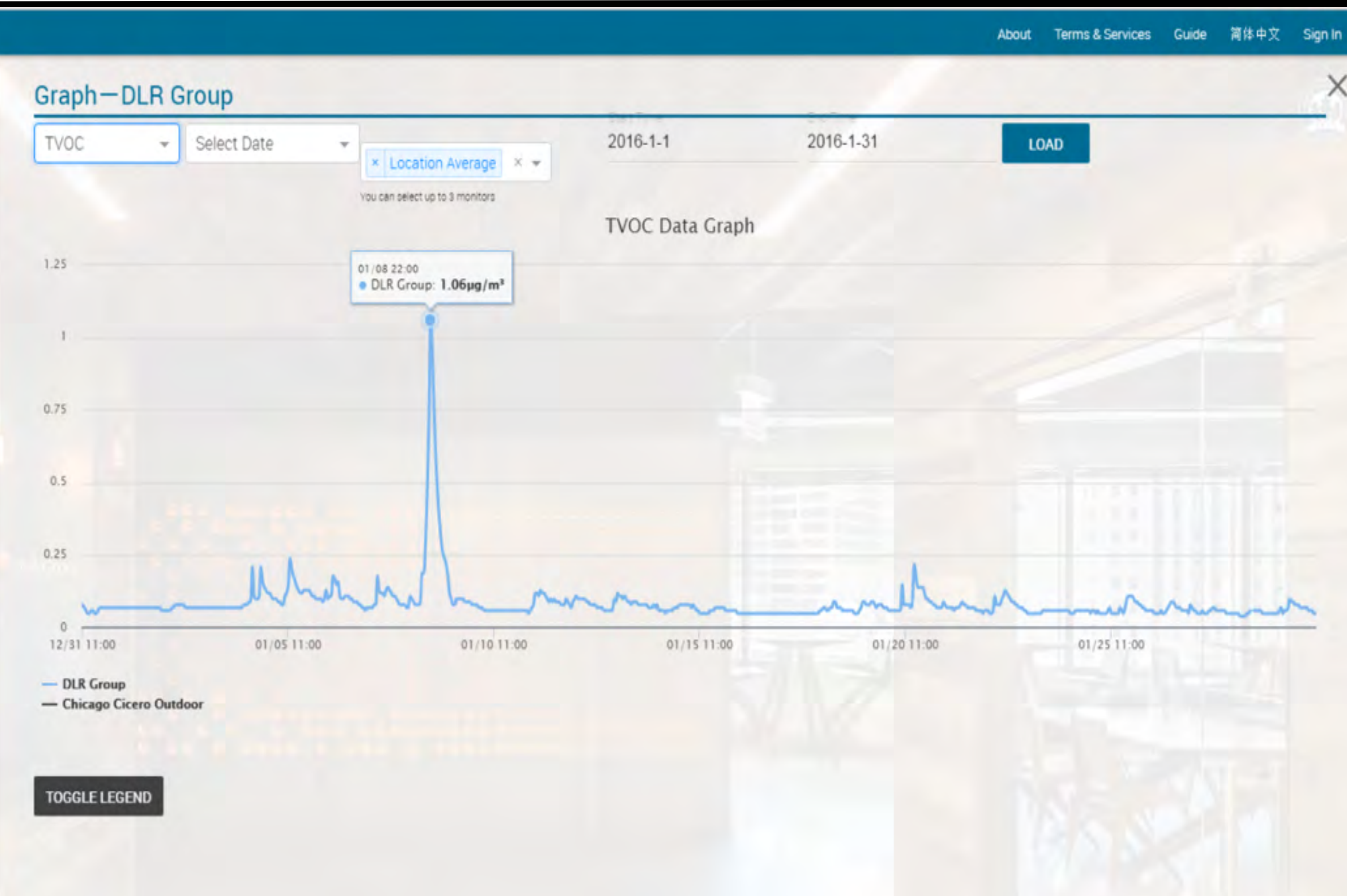
↑ PM2.5

= Comfort

↓ Health

# Indoor Air Quality

Building Data  $\leftrightarrow$  Actionable Intelligence



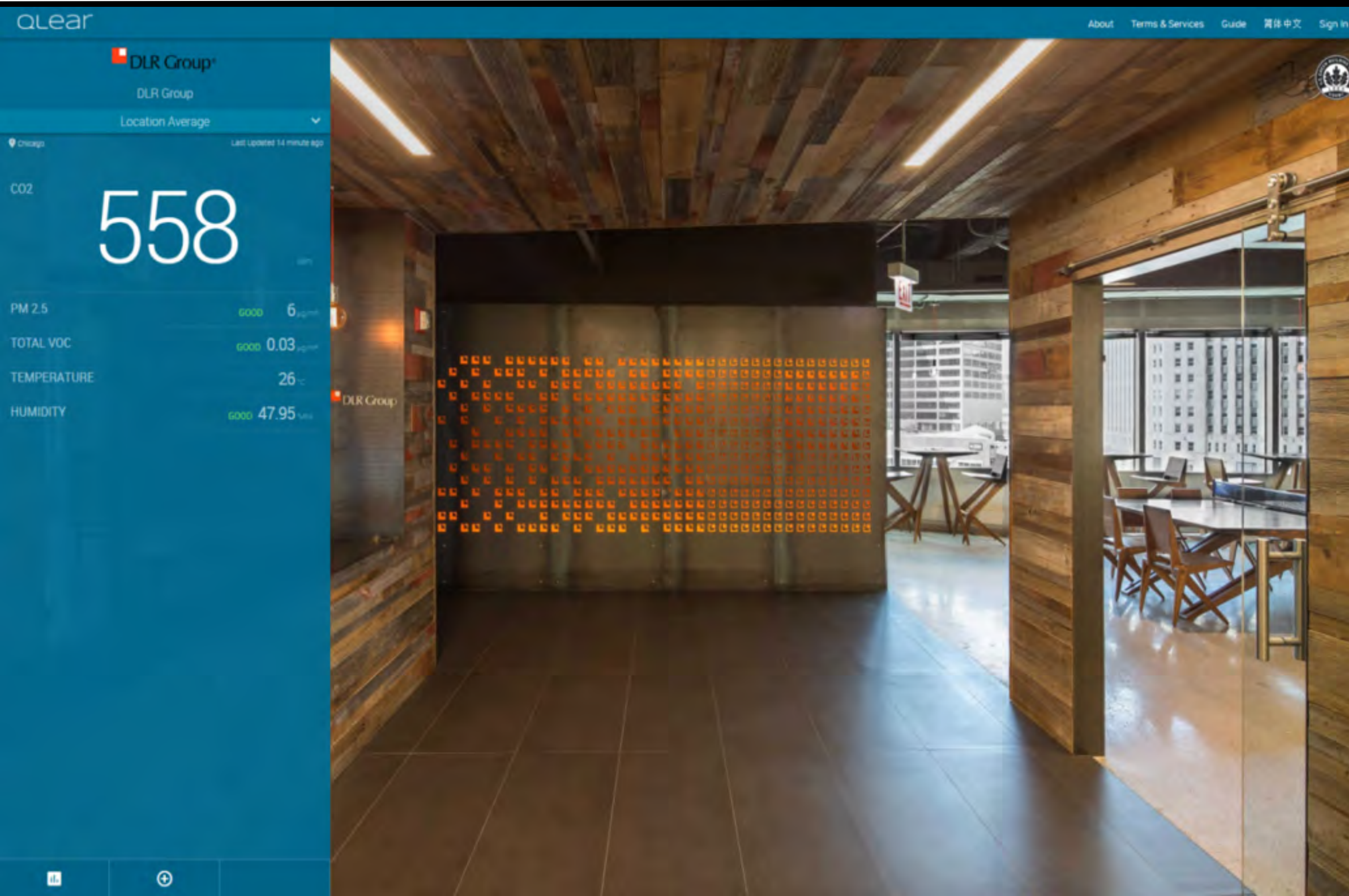
↑ TVOC

= Comfort

↓ Health

# Indoor Air Quality

Building Data  $\leftarrow$   $\rightarrow$  Actionable Intelligence

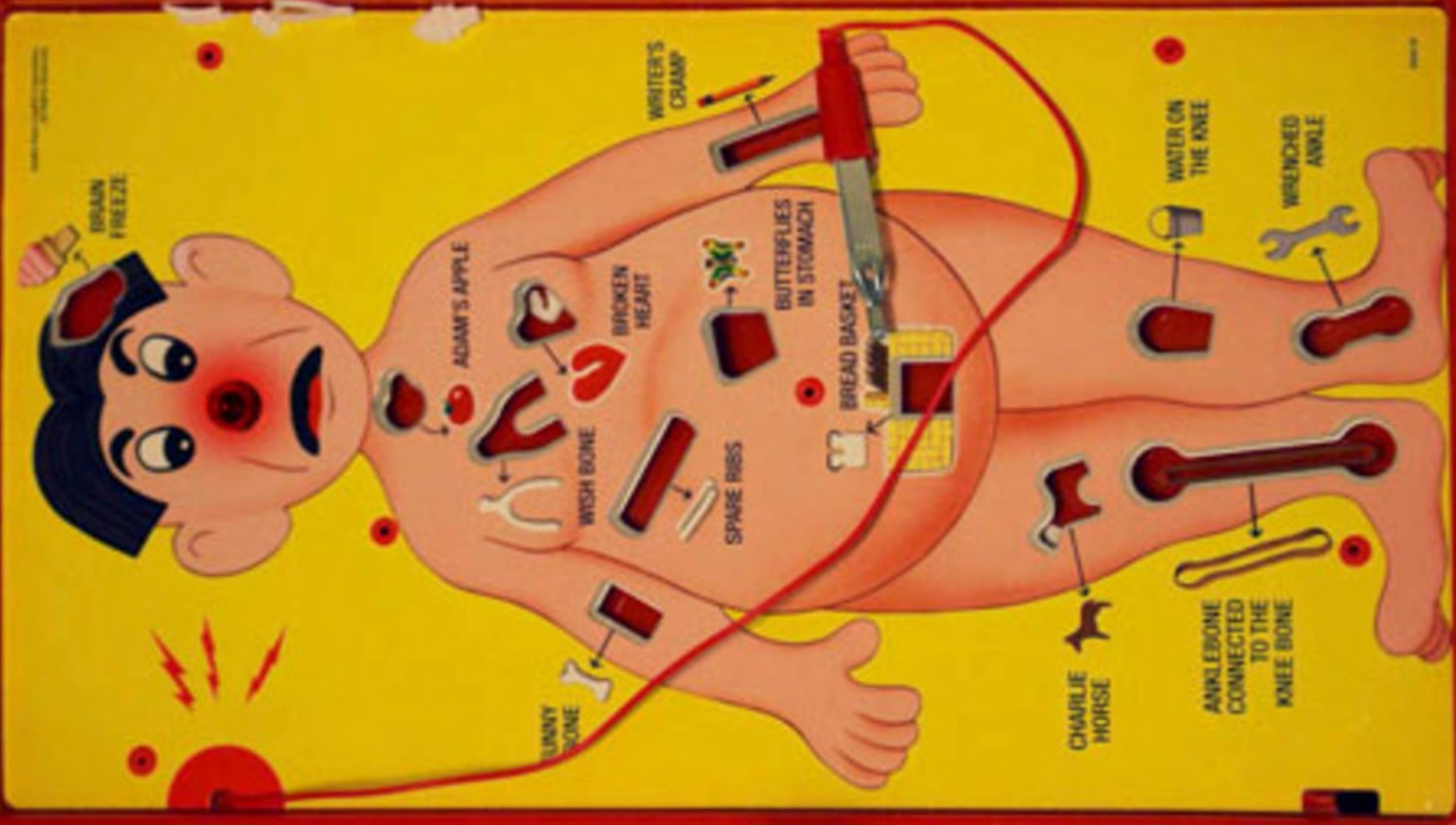


↑ IAQ Variables

↑ Understanding

↑ Solutions





Choose your audience.



**Choose your  
story.**

(or stories)  
(make it personal)



GLOBAL CO<sub>2</sub>  
**405**

OFFICE CO<sub>2</sub>  
**280**





**RESET 重生™**  
健康空气认证

**抽查 81%** <sup>②</sup>  
PM2.5净化率

楼内PM2.5: 33 $\mu\text{g}/\text{m}^3$   
楼外PM2.5: 178 $\mu\text{g}/\text{m}^3$   
监测时间: 2016年03月18日

SK大厦

健康空气

地铁周边

地标建筑

名企开发, 金融行业聚集地

12元/天/m<sup>2</sup> <sup>②</sup>

朝阳-CBD



步行3分钟



更多>>

10  
步行10  
分钟内



餐饮84家



酒店30家



健身房18家



银行83家

预约看房

北京优办 > 写字楼出租 > 朝阳CBD写字楼 > SK大厦

楼盘信息

房源信息

全景图片

配套、交通地图

更多楼盘

咨询电话: 400-810-6698

业主类型: 大业主

物业等级: 甲级

得房率: 70%

净层高: 2.6m

建筑面积: 107627m<sup>2</sup>

物业: 凯德置地集团

层数: 35层

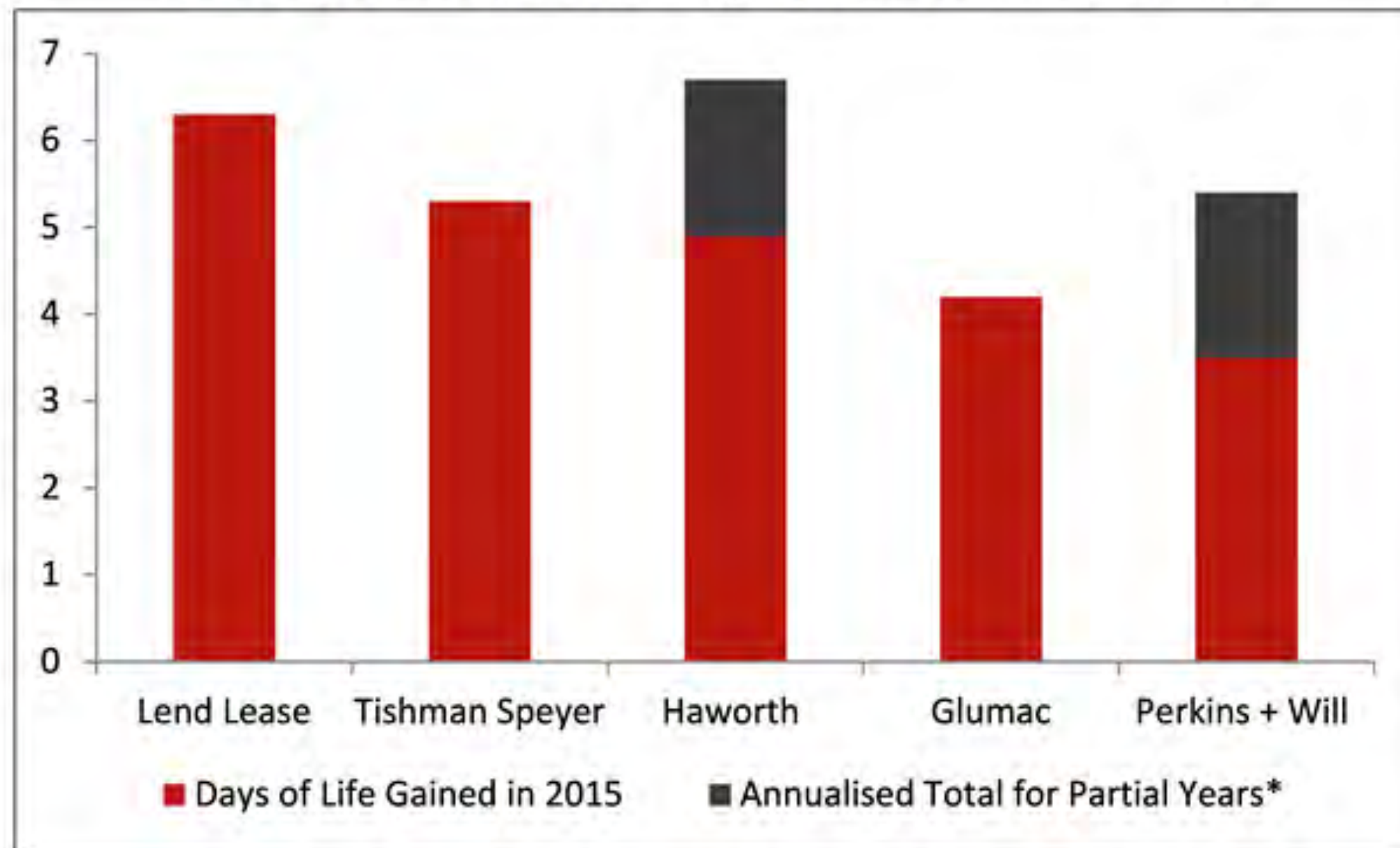
物业费: 29元/m<sup>2</sup>·月

SK大厦是著名房产开发商凯德置地(中国)投资有限公司所有, 软硬件品质达到目前北京5A写字楼的顶级水准, 总体使用率不低于76%, 标准层净高3.0-3.2米, 并在顶层设有12.9米挑空的空中楼阁。



Following air quality improvements in their offices, employees from the top-ranked offices in Shanghai gained on average 5.6 days of life in 2015. The results from indoor air quality specialist GIGA are the first-ever attempt to quantify the health effects of good indoor air on people's lives in China, in terms of days of life. Employees at Lend Lease were the biggest winners, gaining on average 6.3 days of life last year. Based on annualised projections for buildings not tracked for the full year, Haworth did even better at 6.7 days. The calculations were made using real-time continuous data from RESET-certified spaces and an algorithm incorporating medical research out of Beijing that correlates the impact of PM2.5 (particulate matter sized 2.5 microns or smaller) on human health. The chart below shows the top 5 workplaces listed by GIGA.

Chart: Top 5 Office Spaces in Shanghai (in terms of indoor air quality)



Note: Annualised Total for Partial Years refers to projected gains over 2015 for qualified offices which were not operational or tracked for the full 12 months of the year.

Source: GIGA

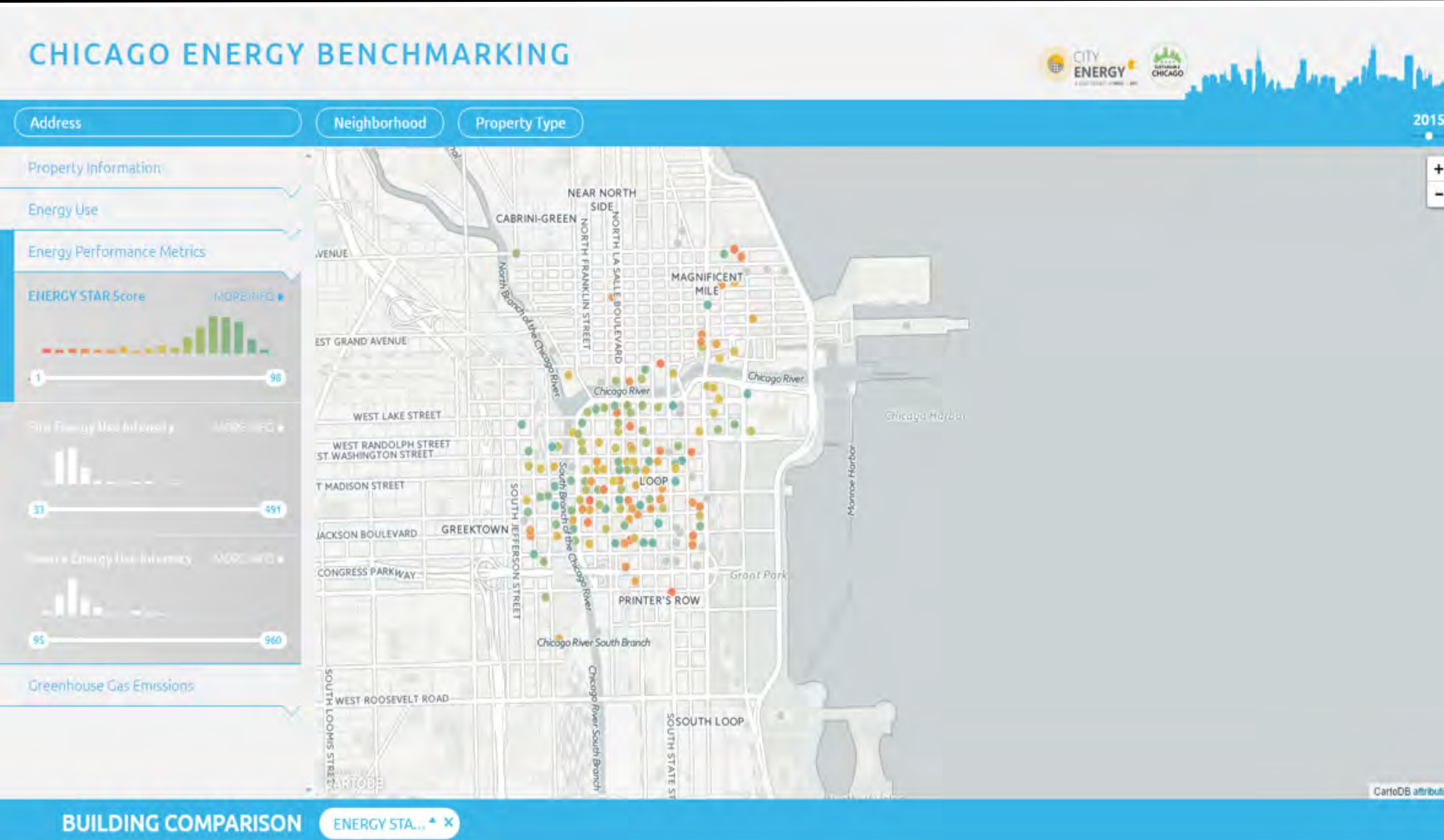
**Top 5 Office Spaces**  
**5.3**  
*days of life gained on average in 2015.*

APPD Market Reports



# Transparency in Data

## Mandatory Energy Benchmarking Ordinances



↓ Energy

↑ Transparency

↑ Competitiveness



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**GOOD**  
INDOOR PM2.5  
(ug/m3)

1.1x  
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VOC <0.12 (mg/m3) CO2 545 (ppmv) TEMP 25°C RH 53%

an hour ago



Shona O'Dea  
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Ryan Dick  
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