Greenbuild Global Health & Virtual Wellness Summit



Efficiency versus Wellness: A data informed approach



- Jeff Murrell | U.S. Department of Energy
- Nora Wang | Pacific Northwest National Laboratory
- Brian Gilligan | U.S. General Services Administration
- Shona O'Dea | DLR Group

Our presenters and moderator







High Performance

Design Leader,

Shona O'Dea, LEED/WELL AP



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Healthy Bldg. Program Manager, Federal Energy Management Program (FEMP)

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Learning Objectives / Learning Level

- Gain knowledge of industry landscape regarding healthy buildings
- Baseline a building's performance in health using key metrics
- Identify a building's improvement opportunities using targets set up in WELL v2
- Calculate the cost benefits of healthy buildings to support holistic design or retrofit decisions
- Learning Level: Intermediate
- Rating System (if applicable): WELL v2

Digital White Board

We will be sharing a link to a digital white board with all attendees so and ask that you input the metrics that you believe are indicative to high performing buildings.

Ask yourself:

- If you were in a high performing building, what would you **feel** like?
- If you were in a high performing building, what would you see in the space that would confirm that?
- What would you **measure** to confirm or deny if you were in a high performing building at all?

You can access the digital white board at the link in the chat box

At the end of this session, we will open the digital white board and see what the group has created together.

You can also follow along with your fellow attendees have to say on this in real time!

Greenbuild GHW Summit Session (GHW06)

Welcome to our digital white board! We will use this space to collaborate together on how we might quantify the attributes of a healthy space.

To do so ask yourself three (3) questions -

What would you feel like in a healthy space?
 What would you see in a healthy space?
 What would you measure to confirm a space is healthy?

Please list your answers in the corresponding quadrants below.





Digital White Board

- You can access the digital white board at the link we have pasted in the chat box.
- To add a sticky note to paste a comment you can:
 - A. Copy and Paste one of the sticky notes already there and edit the text
 - B. Expand the toolbar on the left-hand side and select from the sticky options there
- At the end of this session, we will open the digital white board and see what the group has created together.
- If for some reason you cannot access the Mural link or have trouble using it, not to worry we have lots to share today!

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Healthy Buildings Initiative

Nora Wang Esram

American Council for an Energy-Efficient Economy





Value Propositions

Non-energy benefits, such as health and productivity improvements, can have large economic benefits which are currently unaccounted for in energy efficiency project valuation methodologies.

Leveraging buildings to achieve broader energy goals (demand reduction, smart buildings, building-grid integration) requires gaining knowledge and developing measurement of human outcomes, which represent the best interest of building owners, business owners, and building occupants.

3-30-300

On average, companies spend \$3 in utilities, \$30 in rent, and \$300 in payroll per square foot per year.



Challenges: How to quantify occupant benefits in the context of energy efficiency decision making.

Empirical studies on IEQ have not been fully translated to building system design and operation.

Some IEQ standards for building design have not changed in the past 100 years.

Interaction of building systems and diversity of the existing installations makes it more challenging to copy healthy building strategies from one building to another.

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Programmatic Objectives

- Integrate occupants' health outcomes with energy efficiency measures.
- Quantify potential financial benefits from productivity gains.
- Develop a toolkit aka "program-in-a-box" (data collection guide, cost-benefit calculator, equipment library) to help facility managers make holistic decisions on building retrofits and operation.





8 Primary metrics to baseline building performance. (10-question supplemental occupant survey)



Baseline measurements are compared with target values to calculate improvement potentials.



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Correlations were developed for lighting (horizontal illuminance), thermal comfort (PMV), and IAQ (ventilation rate, CO₂), Humidity, and Circadian Stimulus based on published empirical studies.





Baseline Metric	Diagnosis Metrics
Horizontal Illuminance	Task Lighting
	Architectural Shading
Glare	Window Treatment and Shading
	Desk Configuration
	Air Filters MERV
Dartiquiata Mattar (DM)	Positive Building Pressure
	Outdoor Air Intake Location
	Combustion-based Equipment
PM / CO ₂	Testing and balancing
CO ₂	Air Distribution Effectiveness
CO ₂	Air Distribution/Ventilation System
CO ₂ / VOC	Outdoor Airflow Supply
VOC	Low-emitting Materials and Products
Dradiativa Maan Vata	Personal Thermal Devices
	Enclosure Heat Loss/Gain

A decision tree to deep dive into the area where primary metric is way below the target value and identify improvements.





Example output from a pilot building:

Baseline Health Performance



Building Size: 26,190 sq.ft. No. of Occupants: 92 Improvement Cost: \$149,000 Energy Cost Savings: \$44,000 (10-yr NPV) Personnel Gains: \$2,163,000 (10-yr NPV)

Benefit / Cost Ratio Energy: **0.3** Energy + Health: **14.8**



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Example recommendations from a pilot building:

	lssues	Recommendations
Thermal Comfort	Mostly too cool in open offices. Survey shows some complaints of too warm in afternoons, especially spring and summer. Lack of thermal control in open offices.	Increase temperature setpoint in open space; provide supplemental heating (heated chairs); and add automated shading to windows to reduce solar heat gain.
Indoor Air Quality	No health-related issue. The building is likely over ventilated.	Reduce outdoor airflow by 40% with continuing CO ₂ monitoring to ensure no negative impact on occupants.
Electric lighting	The occupant survey reveals that the occupancy sensors are not functioning properly. Some space is underlit.	Recommission occupancy lighting sensors and install daylighting sensors. Add task lighting to underlit workstations.
Circadian Rhythm	Survey complaints about daylight access; window proximity is good but could be better.	Lower partition walls and provide color-tuning task lighting to workstations without windows.

HBI "Program in a Box"

Equipment Library



HBI Training Materials



Healthy Building Initiative (HBI) Program Training Slides

Pacific Northwest National Laboratory

July 2020



HBI Calculator (Excel)

U.S. DEPARTMENT OF ENERGY Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Healthy Building Initiative Excel Tool

The U.S. Department of Energy's Federal Energy Management Program (FEMP), in partnership with the General Services Administration (GSA), is currently investigating how traditional building energy efficiency measures can impact health in the federal sector through the Healthy Buildings Initiative (HBI).

FEMP is currently funding research at the Pacific Northwest National Laboratory (PNINL) to develop a framework for evaluating indoor environmental quality (IEQ) metrics and quantifying the potential financial implications related to improving occupant productivity in federal buildings. The goal of this initiative is to accilitate more holistic decision making in regard to energy efficiency and IEQ when making building upgrades.

This tool allows users to input IEQ data, occupant survey results, and other building information to receive customized improvement recommendations and the potential financial gains of investing in improving IEQ.

 Use the "Gen. Inputs" tab to enter the number of employees, cost of employees, payback length, and discount rate in highlighted cells. Enter the optional energy and cost information.
 Use the "Cont. Monitor Data" tab to copy and paste continuosly measured temperature, humidity and carbon dioxide data.
 Use the "Spot Data" tab to enter measurements for circadian stimulus, horizontal illuminance, and particulate matter.
 Use the "Survey Data" tab to enter the results of the occupant survey.
 S. Use the "Diagnostics" tab to enter the required additional building information, which

will be based on the data entered in the previous tabs. The "Results" tab will show the output of the analysis.

More detailed information on how to collect and enter this information is available in the accompanying training slides.

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FEMP



Resources:

- FEMP Healthy Buildings Initiative website: Coming Soon!
- PNNL Healthy Buildings Initiative website:

https://www.pnnl.gov/projects/healthy-buildings

• Energy and Health Nexus white paper:

https://www.pnnl.gov/sites/default/files/media/file/EED_0831_BROCH_HealthyBuildi ngs_v4.pdf

Case Studies

https://www.pnnl.gov/healthy-buildings/news-and-publications



CONCLUSION & AUDIENCE QUESTIONS



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