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Built environment facing climate change
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Indoor Environment Design for Smart Buildings

Authors: *Anna Gagneur*

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Session no.: 9 / May 28th 2019

Introduction

Smart buildings refer to the capability of a building to sense, interpret, communicate and respond to changing conditions, which are introduced by requirements of occupants to the indoor climate, operation of technical building systems and demands of intelligent energy systems.

- Intelligent indoor climate technologies for smart buildings (focusing on non-residential)
- Overall target to provide and ensure wellbeing for building occupants
- Generating indoor environments that comply with the needs of smart buildings
- Design options focused on providing a comfortable indoor climate for single occupants or groups in smart buildings
- In such buildings the design of indoor climate system sets boundaries for smart management of indoor conditions

Workshop Discussion

How to assess indoor environments in future buildings?

- Current and future methods for control and assessment of indoor environment are presented and discussed

The main objective of this workshop is to identify possibilities and challenges of indoor environment design for smart buildings that will provide and ensure wellbeing for building occupants.

Participants

- Professor Arsen Melikov
  Technical University of Denmark (DTU)
- Professor Risto Kosonen
  Aalto University
- Dr. Panu Mustakallio
  Halton Oy
- Anna Gagneur, WELL AP™
  Halton Oy

Programme

10 min	**Objective of the workshop** Anna Gagneur, Halton Oy
15 min	**Future design and assessment of indoor environment** Prof. Arsen Melikov, Technical University of Denmark (DTU)
5 min	**Questions and discussion**
15 min	**Halton Vario system design giving flexibility for smart indoor climate** Dr. Panu Mustakallio, Halton Oy
5 min	**Questions and discussion**
15 min	**Room systems as a service platform for smart buildings** Prof. Risto Kosonen, Aalto University
5 min	**Questions and discussion**
50 min	**Open discussion**

We spend 90 % of our time indoors – How do we make it count?

Indoor air quality and ventilation
- Ventilation rate or fresh air
- Pollutants, including VOCs
- CO_2
- Aroma
- Moisture content

Thermal comfort
- Indoor air temperature
- Mean radiant temperature
- Air velocity
- Relative humidity
- Clothing
- Activity

Lighting & Daylighting
- Quantity
- Quality
- Glare
- Daylight

Noise & acoustics
- Background noise
- Privacy & interference
- Vibration

Biophilia & views
- Connections to nature
- Views outside

Look & feel
- Design character & brand ethos, including color, shape, texture & art
- Cultural, gender & age sensitive design

Interior layout & active design
- Workstation density
- Task based spaces & ergonomics
- Breakout spaces and social features
- Active design

Location & access to amenities
- Access to amenities
- Transport
- Quality of public realm

Source: Health, wellbeing and productivity in offices. The World Green Building Council (2014).

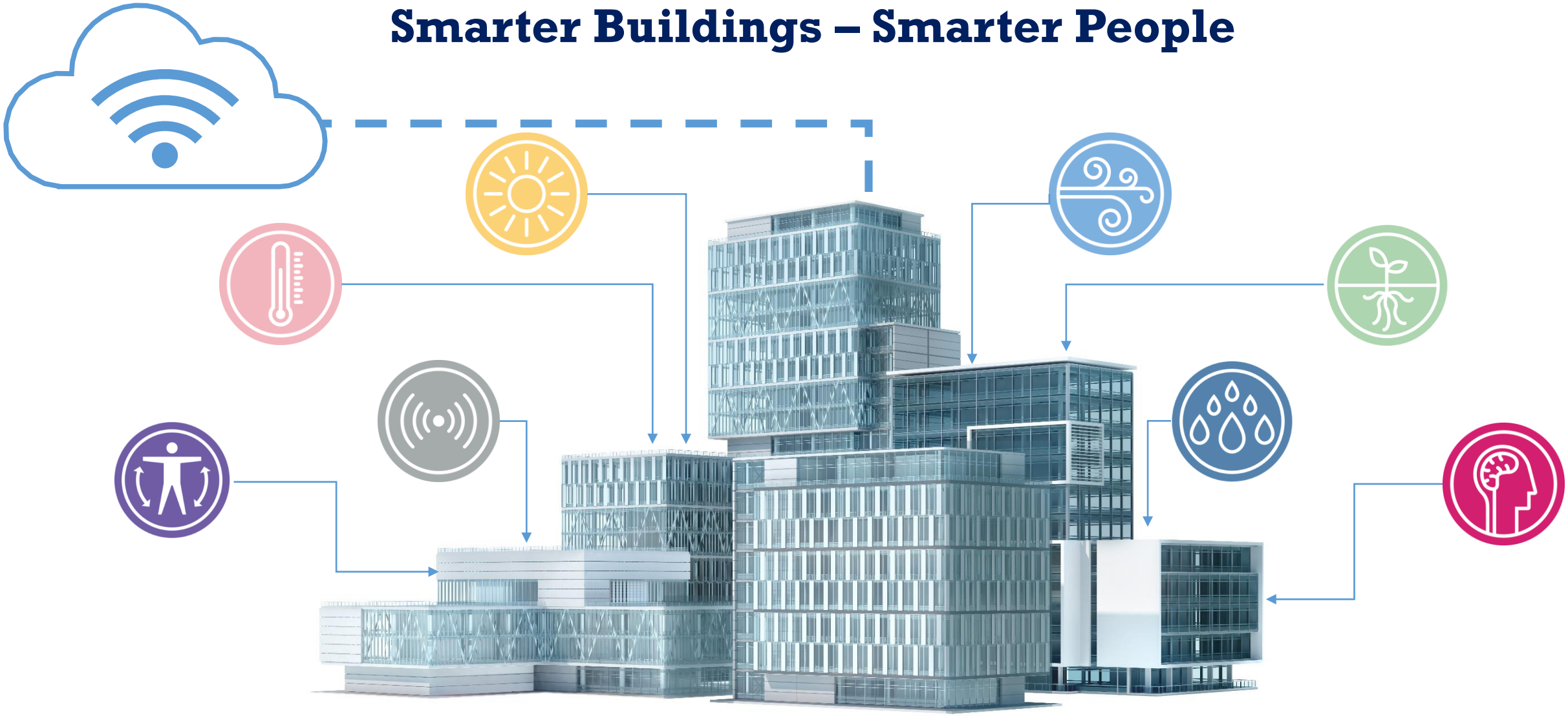
The WELL Building Standard

The WELL Building Standard is a **performance-focused** building rating system.

WELL is built on features of the built environment that impact human health and wellbeing.

- Air
- Water
- Nourishment
- Light
- Movement
- Thermal Comfort
- Sound
- Materials
- Mind
- Community

Smarter Buildings – Smarter People



Adaptive Control for Comfort and Sustainability

SENSE → CAPTURE → ANALYSE → STORE → PREDICT

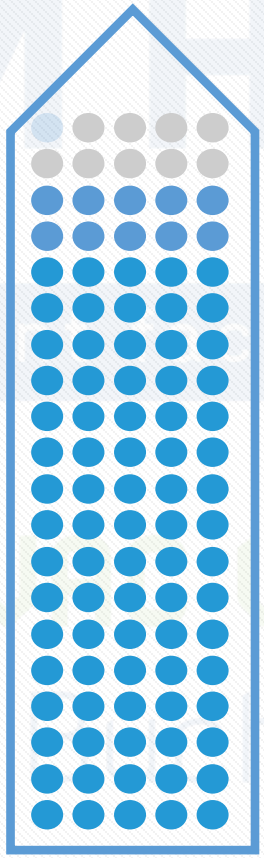
Indoor Environment Sensoring

- Air quality
- Thermal comfort
- Lighting
- Acoustics
- Space usage
- Water systems
- …

Smart Adaptive Solutions

User Experience

How much does it cost?



- 1% Energy costs
- 9% Rental costs
- 90% Staff costs in salaries and benefits

10% Variation

A 10% variation applied equally to each cost has a far from equal impact

+/– 0.1%

Energy costs

+/– 0.9%

Rental costs

+/– 9.0%

Staff costs

Source: Health, wellbeing and productivity in offices. The World Green Building Council (2014).v

It all starts from the people

The Built Environment is Changing

”When the pace of change outside your organization is faster than the pace within, you will be out of business.”

Stephen Shapiro

Presentations and Questions

Open Discussion

- What are occupant needs in terms of indoor climate?
- Can indoor climate control be automatic and still serve the individual?
- What are the barriers for implementing occupant-based design of indoor environments in smart buildings?
- What are the research and development needs?
- How to provide individual and smart indoor climate while maintaining system flexibility to floor layout changes?
- How can this design be made standard procedure?

Thank you!

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