Intelligently building the campus of the future… today!

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NORESCO
Sustainability Services
Global provider of intelligent building technologies

- **55,000** Employees
- **$17.8B** Net sales
- **54** Factories
- **41** Design centers
CAMPUSES INCLUDE...

<table>
<thead>
<tr>
<th>Residence Halls/Housing</th>
<th>Dining Halls/Restaurants</th>
<th>Classroom Spaces</th>
<th>Laboratory Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative / Office Spaces</td>
<td>Athletic Complexes</td>
<td>Performance Art Spaces</td>
<td>Libraries</td>
</tr>
<tr>
<td>Conference Centers</td>
<td>Health Care Facilities</td>
<td>Student / Employee Centers</td>
<td>Data Centers</td>
</tr>
<tr>
<td>Museums / Fine Arts Spaces</td>
<td>Innovation / “Maker Spaces”</td>
<td>Physical Plant Facilities</td>
<td>Retail Areas</td>
</tr>
</tbody>
</table>

The demands and specific attributes of education and campus spaces varies significantly building to building and institution to institution, all contributing to the complexity of a “campus”
TRENDS DRIVING EDUCATION AND CAMPUSES

- Enrollment Growth
- Increased Mobility
- Funding Sources Shift
- Hyper Competition
- World-Class
- Brand Extension
- Evolving Classrooms
- Social Responsibility
- Security Concerns
RESULT IN . . .

- Open, collaborative buildings
- Enhanced cognitive function, wellness, productivity
- Operational and energy efficiencies for ROI
- LEED® Platinum

- Digital, tech-enabled experience
- Interactive student, faculty, staff and visitor experiences
- Innovative building solutions
- Attracting and retaining the best talent (students, staff, Faculty)
- Attracting maximum research dollars

- Secure, flexible network
- IT design incorporated into construction planning
- Adaptable building systems based on usage

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THE VALUE OF INTELLIGENT CAMPUSES

Which group benefits the most from technologies installed in intelligent buildings across intelligent campuses?

A. Senior administrators
B. Faculty and staff
C. Students
D. General public and visitors
E. Security and IT
F. Environmental, Health and Safety
G. Operations
COMPONENTS OF INTELLIGENT CAMPUSES

- Connectivity
- Comfort/Environment
- Accessibility
- Sustainability and Efficiency

Intelligent impact

- Optimized temperature comfort; access
- Energy saving solutions
- Incorporated "user friendly" solutions
- Lower operational costs
- Energy efficiency; systems and labor
- Incident management platform
- Integrated safety and security systems
- Data analytics and insight

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WHY MASTER PLANNING?
Focus on the triple bottom line

People

Resiliency

Planet

Economics
WHY ARE WE IGNORING THE 90%?
TOOLS TO ACHIEVE THE TRIPLE BOTTOM LINE

Framework to support master plan development

Other rating systems

- fitwel
- Green Globes
- Enterprise Green Communities
- Sustainability Tracking, Assessment & Rating System™ (STARS)
- ENERGY STAR®
- Living Building Challenge
- IGCC
- Envision

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# STRATEGIC PROGRAMMING APPROACH

## OCCUPANT FOCUSED & SUSTAINABLE DESIGN CERTIFICATION COMPARISONS

<table>
<thead>
<tr>
<th>COMPARABLE VARIABLES FOR CERTIFICATION</th>
<th>WELL BUILDING STANDARD</th>
<th>FITWELL WORKPLACE</th>
<th>LEED EB O&amp;M/ARC</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd Party Reviewer</td>
<td>GBCI</td>
<td>CfAD</td>
<td>GBCI</td>
</tr>
<tr>
<td>Documentation Requirements</td>
<td>Similar to LEED</td>
<td>Less Rigorous</td>
<td>Rigorous</td>
</tr>
<tr>
<td>Approach</td>
<td>Occupant Focused</td>
<td>Occupant Focused</td>
<td>Design and Operations Focused</td>
</tr>
<tr>
<td>Number of Strategies</td>
<td>105 Features, including prerequisites</td>
<td>63 Credits, with no prerequisites</td>
<td>40 Optional Credits, and 12 prerequisites</td>
</tr>
<tr>
<td>Integration with LEED</td>
<td>Overlap throughout WELL Features and LEED Credits</td>
<td>Overlaps with Various Points via Indoor Air Quality</td>
<td>Overlaps with WELL Features</td>
</tr>
<tr>
<td>Intent</td>
<td>Focused on improving occupant health through building design and operations</td>
<td>Focused on occupant health through building operations and environs while maximizing existing attributes of the building</td>
<td>Focused on building design and operations</td>
</tr>
<tr>
<td>On-Site Assessment</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
INTEGRATIVE PROCESS

An iterative, collaborative approach that involves a project’s stakeholders from visioning through completion of construction and throughout building operation (Source: USGBC)
SUSTAINABILITY & RESILIENCY STRATEGIES

“Building RESILIENCY”

- Health and wellness of occupants
- Limit exposure and vulnerability to climate
- Utilizing alternative energy solutions to minimize stress on existing campus energy systems and lower carbon emissions
- Adaptation and anticipation

The project’s ability to respond to short and long-term stresses so the outcome doesn’t have a long-lasting effect on the ability of the project to remain a vital part of the overall campus environment.
Design each project to help achieve a campus-wide goal of “CARBON NEUTRALITY”

- Water reduction of 40% or greater over baseline
- Energy reduction of 37% or greater over baseline
- Alternative energy solutions
- Material selections
Design each project to help achieve “OCCUPANT WELLNESS”

- Increase ventilation and air quality without compromising energy goals
- Create active occupants with showcasing interior staircases
- Connectivity to the outside

The next generation of sustainable buildings are now healthy buildings—focused on indoor environmental quality and a building’s impact on the occupants’ health, wellness and productivity.
APPLYING MASTER PLANNING TECHNIQUES

Columbia University

University of Colorado Boulder
SUSTAINABILITY & RESILIENCY STRATEGIES

- Water – Indoor/Outdoor Reduction
- HVAC – Optimize Energy Performance, Indoor Air Quality Strategies, Thermal Comfort
- Thermal Envelope – Optimize Energy Performance,
- Material Selection – Product Disclosure and Optimization
- Lighting and Daylighting
- Renewable Energy
UTC CENTER FOR INTELLIGENT BUILDINGS

- State-of-the-art innovation and technology center, conference center and customer showcase
- A “living laboratory” for advanced building solutions, with 24 patent applications pending
- Targeting U.S. Green Building Council’s LEED® Platinum certification
- Uses 60% less annual energy costs than a standard office building

1. Projected savings based on building energy model from ASHRAE 90.1-2010, Appendix G

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STAKEHOLDER REQUIREMENTS

Operational Efficiencies

Energy reduction through highly efficient equipment and advanced controls

Enhanced Experience

Use mobile device to interact with building systems, the campus environment and services

Protecting People and Property

Advanced situational awareness and building system automation supported by intelligent security response and centralized command centers
INTELLIGENT BY DESIGN

IT installation integrated with construction plan

Energy efficiency
- Chiller plant controls
- Lighting controls
- Building energy management

Operational efficiency
- Space utilization heat maps
- Equipment service dashboard
- Elevator monitoring

Safety & security
- Single entry access
- Situational awareness
- Centralized alarm monitoring

Occupant experience
- CIB Building Applications
- Ventilation control for improved cognitive function
- Connected workplace
ENERGY EFFICIENCY

• High-efficiency equipment and chiller plant
• Solar panels for 30% of the building’s energy needs
• Positioning the building to minimize tropical sunlight
• Water re-use and reclamation
• Data analytics to streamline building operations
• Targeting LEED® Platinum
OPERATIONAL EFFICIENCY

High Efficiency Equipment
- Efficient Variable Speed Chillers
- LED Lighting Systems
- Variable Refrigerant Flow Technology
- Regenerative Elevators

Controls and Integrated Solutions
- Integrated Building System Controls
- Advanced Plant Control Algorithms
- Occupant Detection and Response
- Traffic Dispatching Optimization

Smart Grid
- Onsite Solar Generation
- Net Metering and Real Time Monitoring

60% less annual energy costs than a standard office building

Projected savings based on building energy model from ASHRAE 90.1-2010

ENERGY $172,121 /YEAR SAVED $0.76/sq.ft./year SAVED

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SAFETY AND SECURITY

- Design emergency response plan (ERP) with Environmental Health and Safety team to align processes with building technologies

- Minimize security and building management labor by incorporating ERP into building design and integrating systems

- Automatically respond to building emergencies with an integrated command center
EXPERIENCE

• Electronic credentials for **seamless movement** to learn occupant behavior

• Secure, connected workspaces for an **open, collaborative environment**

• Dynamic glass to create a **comfortable work environment**

• Increased ventilation to improve **health, wellness and cognitive function**

• **Smartphone platform empowers users** to interact with building systems

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**Engagement and productivity platform**

**MyWay™**

- Control comfort
- Adjust lighting
- Open doors
- Call elevators
- Locate employees
- Reserve conference rooms
- Wayfinding

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EXPERIENCE IN GREEN BUILDINGS

COGfx Study and benefits of green building

The COGfx Study

- Crisis Response scores were 131% higher.
- Information Usage scores were 299% higher.
- Strategy scores were 288% higher.

UTC Center for Intelligent Buildings

- Doubled ventilation rate in office areas.
- 30% above the ASHRAE 62.1 standard.
- Received LEED® credit for “Enhanced IAQ Strategies.”

Green buildings and impact on market value

- The transaction prices of green buildings are about 13% higher on average.
- Buildings registered with LEED® are associated with a nearly 8% effective value increment.


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CONTINUOUS IMPROVEMENT

Data analytics and machine learning

- Improve
- Gather
- Learn
- Analyze

Data streaming up to 100k points every 15 minutes

Operational and Energy Efficiencies
- Fault detection and diagnostics (FDD) for improved operations
- Sensors for smart space management
- Sub-metering for system performance

Enhanced Experience
- Space temperature, relative humidity, reduce CO₂, to improve occupant comfort

Protecting People and Property
- Card reader activity to improve traffic patterns
- Detect security abnormalities and reduce false alarms
BEST PRACTICES

• **Partner** with companies who have **holistic experience** in intelligent building and campus solutions

• **Define key stakeholders, define escalation decision tree**

• **Define your core needs** driven by educational objectives

• **Align IT and construction plans** at the design stage

• **Collaborate** with Environmental Health and Safety to **automate and centralize** emergency response

• **Enable effective decision-making** process to serve as your compass

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