Building Efficiency for a Sustainable Tomorrow (BEST) National ATE Center

National Science Foundation
Advanced Technology Education

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CTE Dean
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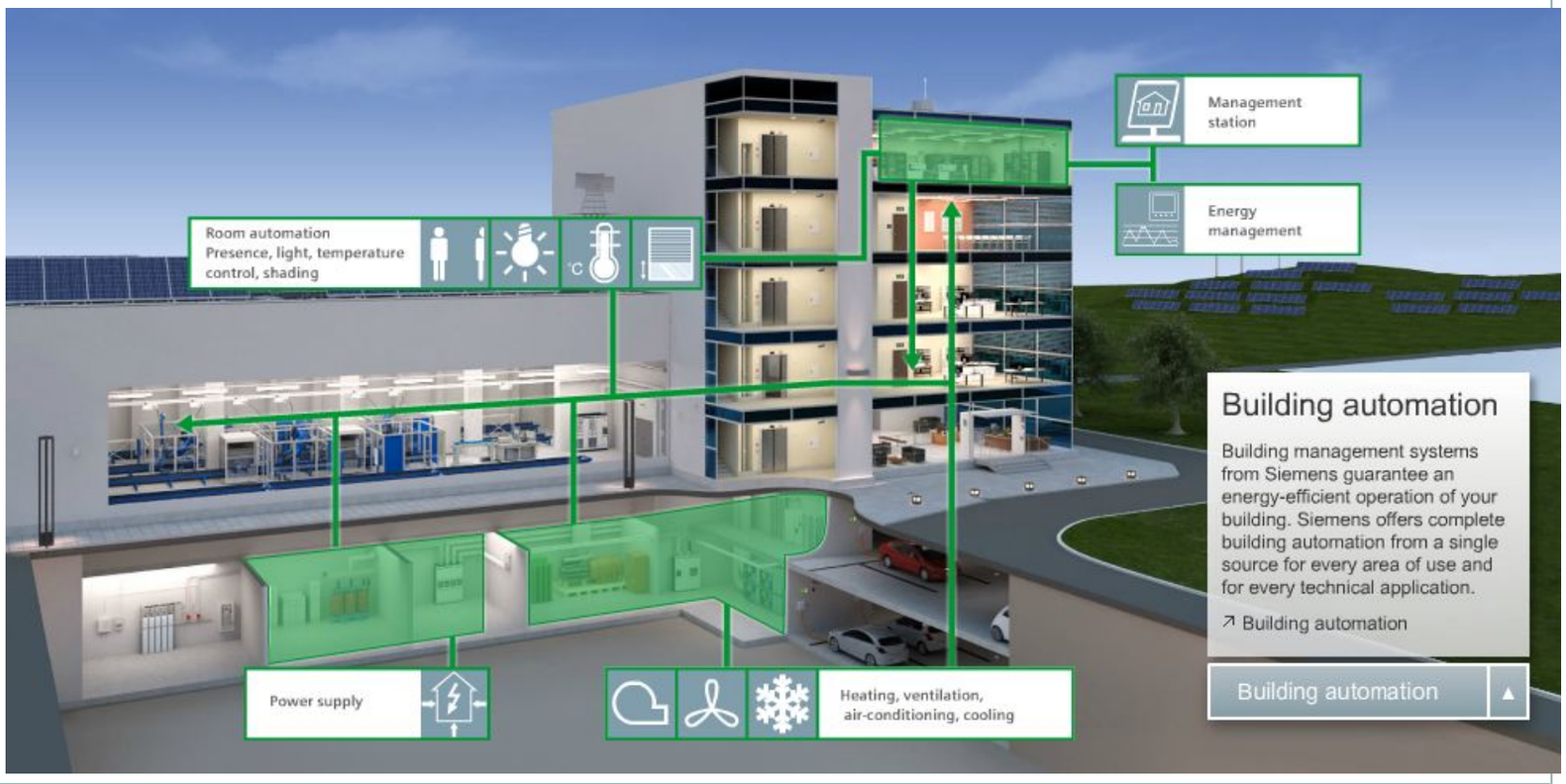
BEST
Building Efficiency for a Sustainable Tomorrow

Our Vision & Mission

- Support the transition to high-performance, energy efficient buildings especially in the commercial building sector by helping stimulate a national agenda for building efficiency
- Highlight the critical role of building technicians in leading the transition to high performance buildings
- Support the development, dissemination, and adoption of exceptional building technician education programs in community colleges nationally
- Gain industry support and sponsorship for national certifications in High Performance Building Technician education and BAS education targeted to community college graduates



The BEST Center has a strategic focus on the commercial buildings sector

- Buildings account for about 40% of U.S. greenhouse gas emissions (GHGs), and commercial buildings account for almost 20% of the total.
- Commercial buildings are the only sector that has outpaced gross domestic product in emissions growth.
- Because of the critical importance of transportation and industry for economic health overall, buildings represent a key controllable source of GHGs if available technologies are fully deployed with trained operations personnel.
- The convergence of advanced technologies and EE goals in the commercial buildings sector makes advanced technician education critical.

The need for the BEST Center

- Community colleges are uniquely positioned to provide critically needed technician education in building science, energy management, building automation systems, and related fields
- Improve building performance by professionalizing building operations through effective community college education
- Address climate change, recognizing the critical role of building efficiency in reducing production of greenhouse gases
- Economic drivers include: cost savings from lowered energy bills; and improve worker productivity by improving indoor environmental quality (IEQ
- Improve energy literacy for technicians as well as building occupants
- Engage all building stakeholders, including building owners, managers, and occupants in energy efficiency and conservation efforts

A RACE AGAINST TIME, A CALL TO ACTION

The goals of the BEST Center

1. Build and transform the instructional capacity of community colleges in the field of high performance building technician education

The goals of the BEST Center

2. Engage industry stakeholders in a national collaboration with community colleges to support high quality instructional programs for new and incumbent building technicians

The goals of the BEST Center

3. Strengthen the national STEM pipeline for educating building technicians and engineers, starting in high school

Who We Are

Principal Investigator and Co-PIs

- Laney College (CA) – PI & Co-PI
- Georgia Piedmont Technical College (GA) – Co-PI
- Milwaukee Area Technical College (WI) - Co-PI
- Lawrence Berkeley National Lab (CA) - Co-PI

Dissemination Partners

- Adv. Technology Environmental and Energy Center (IA)
- Central New Mexico Community College (NM)
- College of DuPage
- Lansing Community College
- Others

Curriculum Partners

- Our network of community college partners

Research Partners

- Building Intelligence Group, LLC
- Pacific Northwest National Lab (WA)
- UC Berkeley

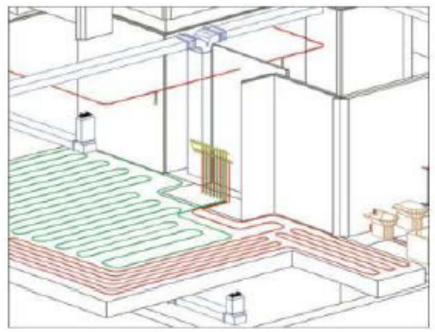
Strategic Partners

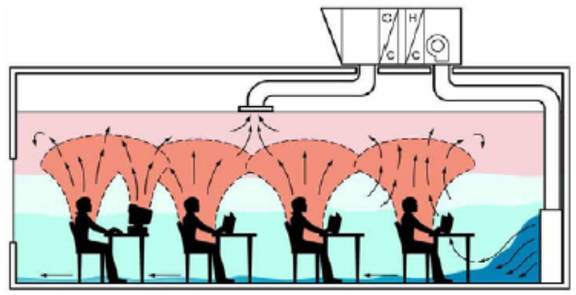
- US Department of Energy
- National Institute of Building Sciences
- California Energy and Utilities Sector Navigator
- Industry partners including:
  - Siemens
  - Automated Logic Control
  - Kele
  - Honeywell
  - …..

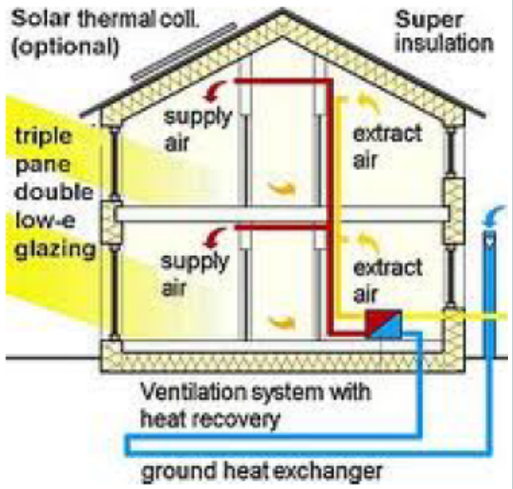
Key Program Themes of the BEST Center

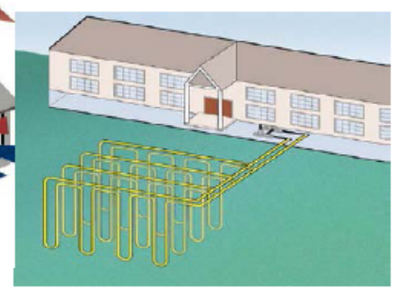
- Building Automation Systems
- High Performance building operations
- Energy Management
- Energy Efficiency in buildings
- Lighting efficiency technology
- System integration
- Zero Net Energy Buildings

performance: passiv classroom elements









Critical Goals for Year Five

- Support program implementation efforts through model curriculum, professional development, and facilitation
- Stimulate industry partnership and support for college programs
  - National Certification for Building Technicians
  - National Certification for BAS Technicians
  - Lab design and development and equipment acquisition
  - Curriculum improvement and recognition
  - Job opportunities for college grads
- Track program implementation at partner colleges & student participation
- Document instructional labs
- Document Lab installations
- Document new programs & courses
- Develop strategy for high school STEM engagement
- Secure continuation funding

Benefits for Participating Colleges

- BEST Center Web-based resources including
  - Model curriculum documentation
  - Virtual lab tours
  - Research reports
  - Community college program tracking by state
  - National job search database by state
- Support for lab design, equipment acquisition, and software licensing
- Support for mentorship and grant development
- Professional development opportunities including workshops and webinars
- Access to onsite technical assistance
- Participation in a national technician certification initiative

Overview of this Institute

- Group discussions
  - Marketing
  - BEST Center impacts
  - ATE application
- Virtual lab tours
  - Please provide feedback
- Hands-on labs
  - BAS
  - Use data loggers to collect and interpret information
  - Use Building Energy Saver
- Tour and discussion of ZNE buildings
- Application of BAS technologies
- Keynote: Extreme weather and climate change

Action Plan Presentations

- Self assessment
- Vision and goals for my program
- Actions taken at my college (previous workshop participants)
- What I have learned
- Actions I plan to take
- How the BEST Center can help my college
- How I can help the BEST Center
- Summary

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The Role of Skilled Workers in the First Industrial Revolution

- The industrial revolution was led not by the inventors but "an army of mostly anonymous artisans and mechanics, the unsung foot soldiers of the Industrial Revolution whose names do not normally appear in biographical dictionaries… They were mechanics, instrument makers, metal workers, and other specialists, who could accurately produce parts, who could read blue prints and compute velocities, and who understood tolerance, resistance, friction, lubrication, and the interdependence of mechanical parts."
  - --Economic Historian Joel Moykr, *Enlightened Economy*

- "Economic historians have long understood that most of the economic benefit from many major new technologies does not come from the initial commercialization of the original invention but from the eventual implementation. New knowledge and a long string of improvements follow for decades after the invention, continually altering the technology and the skills needed.
- "Implementation is slow and difficult: much new knowledge must be acquired through experimentation or learning by doing; each incremental improvement in technology requires new skills; the large scale acquisition of new skills often requires new training institutions, new standards, and[even] new labor markets."
  - ---James Bessen, *Learning by Doing*

Building Operations and Complexity

- Building technicians are confronted with a rapidly evolving operating environment that includes: Building Automation Systems, energy conservation goals, occupant comfort standards and requirements, and rapidly changing equipment and software.

- Current conditions in buildings represent a convergence of sustainability objectives, information technology, digital technology, and evolving equipment leading to a high degree of operational complexity for which technicians must receive advanced training.

What will building technicians of the future be required to know and do?

Key Competencies

- Apply systems thinking to perform root cause problem-solving
- Use data analysis for fault detection & energy conservation
- Apply critical thinking skills to building system diagnostics
- Present ideas effectively orally and in writing to building stakeholders including owners, managers, and occupants

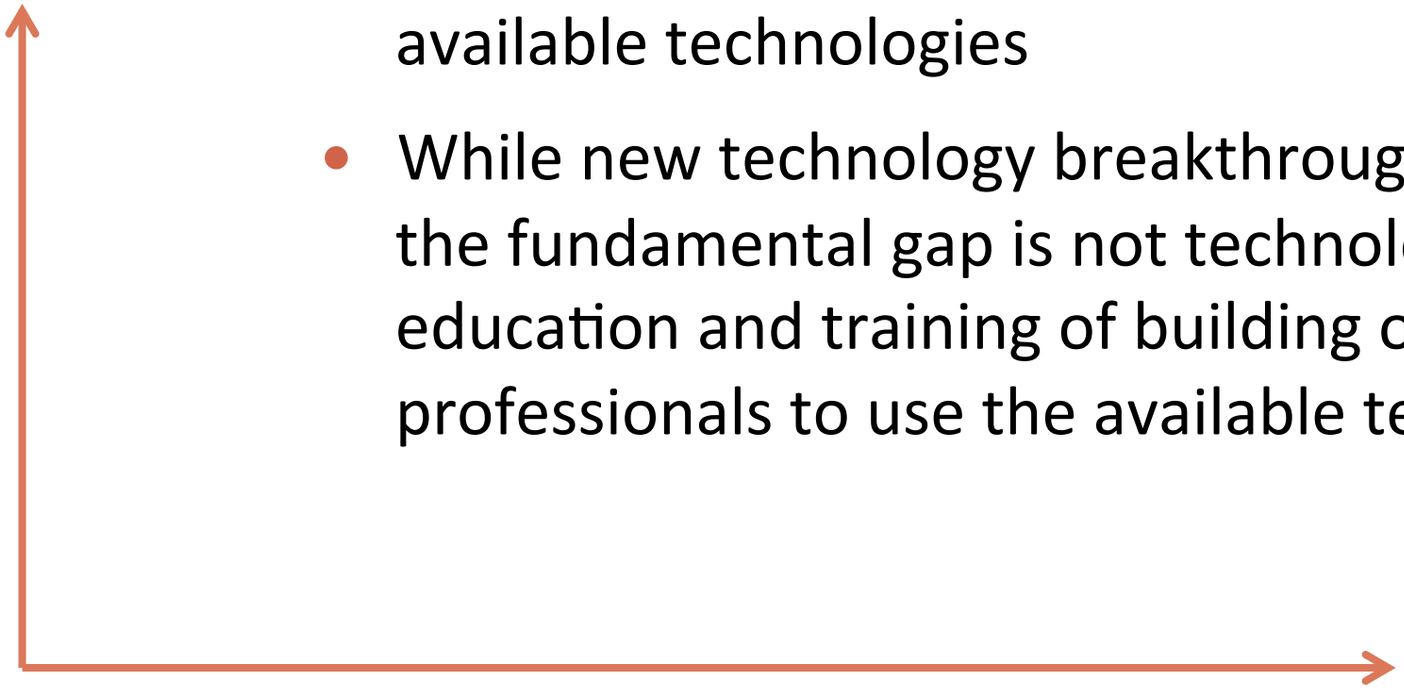
High level Job Functions

- Perform ongoing energy use analysis and optimize mechanical system operations
- Measure and verify system performance
- Troubleshoot system-level problems
- Develop cost-benefit analysis for capital improvement opportunities
- Use soft skills to work with teams, work with multiple stakeholders, and present ideas to building managers
- Apply routine preventative maintenance strategies and practices
- Ensure currency of knowledge and skills by engaging in ongoing professional development activities

The Education Challenge

- Much of the technology already exists to efficiently operate buildings, satisfy design intent, and improve occupant comfort through a combination of construction technologies, improved system operations, attention to proactive maintenance, and application of available technologies
- While new technology breakthroughs are likely, the fundamental gap is not technology but education and training of building operations professionals to use the available technology

Vertical axis - represents intensive progress – creating and using new technologies



Horizontal axis - represents extensive progress – expanding use of existing technologies