Building a Next Generation Workforce for Next Generation Buildings

Thursday 23rd, 2018
4:00pm – 5:30pm
Panelists

Cedar Blazek  
Science, Technology and Policy Fellow,  
U.S. Department of Energy Building  
Technologies Office

Erik Schmidt  
Director of Sustainability,  
City of Chattanooga

Richie Stever  
Director of Operations and  
Maintenance,  
University of Maryland Medical Center

Brian Lovell  
President,  
Association of Controls Professionals
City of Chattanooga: Sustained Efforts in Energy Management

Erik Schmidt, Director of Sustainability
Office of Mayor Andy Berke
Our Place,
Our History
“Dirtiest City in America”
U.S. EPA, via Walter Cronkite, 1969

Miller Plaza, Miller Park Redevelopment

Former steel foundry site, future South Broad redevelopment site
“Top Ten Comeback Neighborhoods”
-Southern Living

“Best City Ever” - Outdoor Magazine
...twice!
#25 of “The 41 Places to Go”
(in the World)
-New York Times

➢ Lookout Mountain
➢ Moccasin Bend/Stringers Ridge
➢ Downtown
➢ Tennessee River
➢ Walnut St. Bridge
➢ Coolidge Park
Strategy

Operations/Facilities

Engagement

Funding
The City of Chattanooga owns and maintains over 2,000,000 square feet of municipal facilities

Managing departments:

- Public Works Department, Office of the City Engineer, Facilities Management
  - Asst. City Engineer
  - Facility Manager
    - Technology Specialist (Building Automation Controls; HVAC Systems; Water Heating)
  - Building Maintenance, General Supervisor
    - 311 Call Center - platform for addressing building maintenance requests (in addition to being the platform for citizens to submits service requests)

Public Works, Parks Division
  - Director of Parks Maintenance

Public Works, Waste Resources Division (Moccasin Bend Wastewater Treatment Plant)
  - Director of Plant Operations

Other Independent Departments

- Police Department
  - General Supervisor

- Fire Department
  - Logistics and Technology Chief

- Libraries
  - Administrative Services Manager,
    - Facility Maintenance Supervisor
Public Works Department, Office of the City Engineer, Facilities Management

Downtown ‘Core Campus’

- City Hall
- City Council
- City Hall Annex
- The Development Resource Center
  - Public Works
    - Office of the City Engineer
      - Engineering / Construction Management
      - Water Quality Engineering
      - Water Quality Management
      - GIS Division
  - Economic and Community Development, Land Development Office (permits)
  - Chattanooga Department of Transportation (CDOT)
  - Chattanooga-Hamilton County Regional Planning Agency (RPA)
  - Hamilton County Wastewater Treatment Authority

Additional facilities...

- Paul Clarke Building
  - Citywide Services (garbage, recycling, brush collection)
  - Street Maintenance (emergency, mowing, snow and ice, street construction, street sweeping, and urban forestry)
- WellAdvantage Center (City’s LEED-certified wellness center, including physicians offices, pharmacy, exercise facilities and classroom/meeting spaces)
- Outdoor Chattanooga (located in Coolidge Park on the Tennessee River)
- Bessie Smith Cultural Center and African American Museum
- Youth and Family Development Centers (19 locations, including several public pools)
- Wood Recycling Center and Household Hazardous Waste Collection
- Public Works, Fleet Maintenance Buildings
Facilities managed by the Department of Public Works, continued...

- Public Works, Parks Division
  - 106 sites
  - 35 miles of greenway and trails
  - 53 tennis courts
  - 41 playgrounds
  - 3 dog parks
  - 2 golf courses

- Public Works, Waste Resources Division
  - Main WWTP campus and facilities
  - 1,263 miles of sewer lines
  - 7 large pump stations
  - 8 custom-built storm stations
  - 53 underground wet-well mounted submersible pump stations
  - 171 residential/grinder stations
  - 8 combined sewer overflow facilities
Engagement - Operations

COMMITMENT

- US Department of Energy Better Buildings Challenge
- 20% EUI Reduction Goal, 10 years
- 2012: 107M kWh
- 2016: 96M kWh
- Leading by example

BEST PRACTICES

- 2012: Begin benchmarking in Portfolio Manager
  - Retrocommissioning
  - Lighting
  - Supplemental Load Reduction
  - Air Distribution Systems
  - Heating and Cooling Systems
<table>
<thead>
<tr>
<th>REPORTING</th>
<th>RESULTS</th>
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<tbody>
<tr>
<td>● Energy Star Portfolio MGR</td>
<td>● 10% EUI Reduction</td>
</tr>
<tr>
<td>● DOE Better Buildings</td>
<td>● LED retrofits going in most buildings</td>
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<tr>
<td>● Open Data Portal</td>
<td>● Controls in highest density facilities</td>
</tr>
<tr>
<td></td>
<td>● Funding for Library HVAC</td>
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<td></td>
<td>● Demand response reductions</td>
</tr>
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<td></td>
<td>● Public Works Energy Policy</td>
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</table>
What’s working?

- Retro-commissioning
- Taking buildings to Energy Star rated
- Over $10K saved in <12 months through EPB’s ‘Power Savers’ demand response program
- EPB Key Customer Engineer provided energy assessments that provided additional energy modeling that helped verify anticipated savings
- “Showcase Project”: Downtown Library, replaced 800 existing fluorescent bulbs with 108 LED lights with controls; replacing 40 year-old HVAC
- 61-facility lighting project ($1.4MM)
- MBWWTP energy savings projects: VFD’s and LED’s previously installed; currently executing a design-build contract to further reduce energy use at the plant, which uses a little over half of the City’s municipal energy demand
## Showcase Project: Chattanooga Public Library

**SECTOR TYPE**
Local Government

**LOCATION**
Chattanooga, Tennessee

**PROJECT SIZE**
109,000 square feet

**FINANCIAL OVERVIEW**
Project Cost: $1,509,000*

### Annual Energy Use

<table>
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<tr>
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<tbody>
<tr>
<td><strong>Energy Use</strong></td>
<td>62.34 kBtu/sq.ft.</td>
<td>36.78 kBtu/sq.ft.</td>
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</table>

### Annual Energy Cost

<table>
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<tr>
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<tbody>
<tr>
<td><strong>Energy Cost</strong></td>
<td>$180,500</td>
<td>$118,700</td>
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</tbody>
</table>

**Energy Savings:**

**41%**

**Cost Savings:**

**$61,800**
Funding - Budgeting for Outcomes

**FUNDING**
- Operational Budget
- Capital Budget
- Grant Opportunities
- Demand Response
- Measurable Outcomes

**PARTNERS**
- EPB
- Local Foundations
- SSDN/SSCF
- TN Dept. of Environment & Conservation
- U.S. Department of Energy
What’s next?

- $4.5MM Capital Budget, FY 2019-2020
- 10 acres available for PV solar array at MBWWTP
- Will power over 30% of main plant operations
- MBWWTP uses over 50% of BBC portfolio
- Ongoing design-build contract for greater efficiencies
Who's next?

- Grant-funded initiative to develop a green-collar jobs training program for at-risk/low income youth
- SSDN/Southeast Sustainable Communities Fund ($300K)
- USDOE CELICA: Partners with EPB & green|spaces
- Based off Stan Johnson’s workforce development program, Socially equal energy efficiency development (SEEED), based in Knoxville, TN

**Build It Green**, B.I.G., a program by green|spaces

- Focused on job skills in energy efficiency
- Graduated first class
- 9/10 have found employment
- Assisted with solar install on NextGen homes
- Second class underway
Questions?

Erik Schmidt, Director of Sustainability

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University of Maryland Medical Center’s Apprenticeship Program

Richie Stever
Director of Operations and Maintenance
University of Maryland Medical Center
Better Buildings Workforce Guidelines

Brian Lovell
President
Association of Controls Professionals
University of Maryland Medical Center

- 2 campuses (1 mile apart)
  - 800 bed flagship teaching hospital
  - 200 bed community teaching hospital
- 3.5 million square feet total
- Mission
  - Deliver superior health care
  - Train the next generation of health professionals
  - Discover ways to improve health outcomes worldwide
## Department of Labor Projections

### Occupations with the most job growth, 2016 and projected 2026

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Total, all occupations</td>
<td>159,063.8</td>
<td>+43,538.3</td>
<td>+12,498.0</td>
</tr>
<tr>
<td>Home health aides</td>
<td>911.5</td>
<td>+342.7</td>
<td>+7,691.0</td>
</tr>
<tr>
<td>Personal care aides</td>
<td>2,816.1</td>
<td>+777.6</td>
<td>+9,152.0</td>
</tr>
<tr>
<td>Software developers, applications</td>
<td>1,089.3</td>
<td>+30.7</td>
<td>+8,369.0</td>
</tr>
<tr>
<td>Medical assistants</td>
<td>634.4</td>
<td>+13.9</td>
<td>+8,055.0</td>
</tr>
<tr>
<td>Market research analysts and marketing specialists</td>
<td>595.4</td>
<td>+138.3</td>
<td>+7,220.0</td>
</tr>
<tr>
<td>Medical secretaries</td>
<td>574.2</td>
<td>+129.0</td>
<td>+7,262.0</td>
</tr>
<tr>
<td>Financial managers</td>
<td>689.0</td>
<td>+18.7</td>
<td>+7,290.0</td>
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<tr>
<td>Combined food preparation and serving workers, including fast food</td>
<td>3,425.2</td>
<td>+579.9</td>
<td>+7,370.0</td>
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<tr>
<td>Registered nurses</td>
<td>25,014.2</td>
<td>+438.1</td>
<td>+7,490.0</td>
</tr>
<tr>
<td>Construction laborers</td>
<td>2,167.1</td>
<td>+150.4</td>
<td>+7,230.0</td>
</tr>
<tr>
<td>Licensed practical and licensed vocational nurses</td>
<td>724.5</td>
<td>+88.9</td>
<td>+7,710.0</td>
</tr>
<tr>
<td>Cooks, restaurant</td>
<td>1,287.2</td>
<td>+143.2</td>
<td>+7,740.0</td>
</tr>
<tr>
<td>Janitors and cleaners, except maids and housekeeping cleaners</td>
<td>2,921.2</td>
<td>+236.6</td>
<td>+7,390.0</td>
</tr>
<tr>
<td>Teachers and instructors, all other</td>
<td>963.9</td>
<td>+96.0</td>
<td>+7,650.0</td>
</tr>
<tr>
<td>Sales representatives, services, all other</td>
<td>634.2</td>
<td>+94.9</td>
<td>+7,710.0</td>
</tr>
<tr>
<td>General and operations managers</td>
<td>2,063.1</td>
<td>+203.5</td>
<td>+10,040.0</td>
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<tr>
<td>Receptionists and information clerks</td>
<td>1,051.7</td>
<td>+96.5</td>
<td>+7,730.0</td>
</tr>
<tr>
<td>Business operations specialists, all other</td>
<td>1,021.9</td>
<td>+70.3</td>
<td>+7,620.0</td>
</tr>
<tr>
<td>Teacher assistants</td>
<td>1,308.1</td>
<td>+147.7</td>
<td>+7,290.0</td>
</tr>
<tr>
<td>Laborers and material movers, hand</td>
<td>2,142.6</td>
<td>+112.5</td>
<td>+7,100.0</td>
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<tr>
<td>Elementary school teachers, except special education</td>
<td>1,410.9</td>
<td>+194.1</td>
<td>+7,200.0</td>
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<tr>
<td>Waiters and waitresses</td>
<td>2,653.5</td>
<td>+773.0</td>
<td>+6,760.0</td>
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<tr>
<td>Heavy and tractor-trailer truck drivers</td>
<td>1,621.7</td>
<td>+190.3</td>
<td>+7,580.0</td>
</tr>
<tr>
<td>Stock clerks and order fillers</td>
<td>2,109.6</td>
<td>+100.0</td>
<td>+7,460.0</td>
</tr>
<tr>
<td>Customer service representatives</td>
<td>2,920.8</td>
<td>+136.3</td>
<td>+7,210.0</td>
</tr>
</tbody>
</table>

Footnotes:

(1) Data are from the Occupational Employment Statistics program, U.S. Bureau of Labor Statistics. Wage data cover non-farm wage and salary workers and do not cover the self-employed, owners and partners in unincorporated firms, or household workers.

Labor Force Shares in Next 10 Years

U.S. Labor Force Shares by Age, 1970 to 2014 and Projected 2014 -2024 (percent)

Source: U.S. Bureau of Labor Statistics

More 55+ in labor force than 16-24
Evaluation of Team

LEGEND
- Retiring in 5-8 years

Diagram showing the hierarchical structure of a team with various roles and levels, including Director of Operations and Maintenance, Facility Director, Facility Coordinator, Facility Staff, Facility Team, Facilities Water Supply Coord, Facilities Waste Management, Facilities HVAC, Facilities Maintenance, and Facilities Estates.

Roles include Electrician, Plumber, Painter, Painter II, Electrician, Multi Trade Specialist, HVAC, Facility Coordinator, Facility Staff, Facility Team, Facility Management, Facility Maintenance, and Facility Estates.
UMMC Operations and Maintenance Department

- HVAC Department
  - 8 Technicians
  - 1 Retiring
- Plumbing Department
  - 4 Technicians
  - 1 Retiring
- Electricians
  - 6 Technicians
  - 3 Retiring
- Electronics Department
  - 4 Technicians
  - 2 Retiring

- Mechanics/General
  - 22 Technicians
  - 8 Retiring
- Stationary Engineers
  - 5 Technicians
  - 1 Retiring
- Management/Office
  - 11 People
  - 1 Retiring

Summary:
Total = 60
Retiring = 17
28%
State of the Department

• 28% of the Department nearing Retirement!
  – Average tenure is 24 Years.
  – Results in an unprecedented increase in turnover.
  – Most leaders are departing soon.
  – Loss of institutional knowledge.
  – No succession plan.
  – No formal career ladder.
  – Highly skilled candidates demand high wages.
How do we attract this segment of the workforce?

U.S. Labor Force Shares by Age, 1970 to 2014 and Projected 2014 -2024 (percent)

Source: U.S. Bureau of Labor Statistics
Population Health: Reduce the Unemployment Rate?

Unemployment rates and earnings by educational attainment, 2017

- Doctoral degree: 1.5% unemployment rate, $1,743 median weekly earnings
- Professional degree: 1.5% unemployment rate, $1,836 median weekly earnings
- Master's degree: 2.2% unemployment rate, $1,401 median weekly earnings
- Bachelor's degree: 2.5% unemployment rate, $1,173 median weekly earnings
- Associate's degree: 3.4% unemployment rate, $836 median weekly earnings
- Some college, no degree: 4.0% unemployment rate, $774 median weekly earnings
- High school diploma: 4.6% unemployment rate, $712 median weekly earnings
- Less than a high school diploma: 6.5% unemployment rate, $520 median weekly earnings

Total unemployment rate: 3.6%
All workers: $907

What should we do?

We should develop an apprentice program!
So we did!

2 Different Ways

Building Automation Apprentice
- **Funding:** Wrote a business case for the new position
- **Job Description:** Brand new with an apprentice addendum
- **Education:** a curriculum that was approved by Maryland DLLR
- **Training:** OJT at UMMC

HVAC, Plumbing and Electronics Apprentices
- **Funding:**
  - Split a retired HVAC technician’s wage into 2 apprentices
  - Used a retired Electronic technician’s wage for (1) apprentice (some money left)
- **Job Description:** Modified MultiTrade Job description with an apprentice addendum
- **Education:** Partnered with Association of Builders and Contractors (ABC)
- **Training:** OJT at UMMC
III. **Education and Experience**
   1. High School Diploma or equivalent (GED) required.
   2. Possess a journeyman’s license in one of the following areas: Electrical, Plumbing, Steamfitter, HVAC or a certification in electronics from an appropriate technical school
   3. Four years of experience in the primary licensed/certified trade. Two years valid technical experience in the secondary area of expertise with the ability to perform quality workmanship in accordance with accepted standards.
   4. No experience required if entering Skilled Trades Apprenticeship Program.

IV. **Knowledge, Skills and Abilities**
   1. Highly proficient technical skills in operating shop equipment, hand tools and measuring equipment, such as, calipers, micrometers, dial indicators, and voltage testers. Knowledge of pipe fitting, soldering, rigging, drilling, tapping and installation.
   2. Effective verbal communication skills are required to work with management and clinical staff and external vendors. Effective writing skills are necessary to write deficiency reports on equipment and maintain required documentation. Ability to read complex technical equipment operation manuals.

   “Gives us an apprentice with the right attitude and aptitude and we can teach them the rest!”
Has it been successful?

You be the judge!
Meet the Apprentices.
Chris

- Hire date: **August 24, 2015**
- Apprentice Position: **Building Automation Apprentice**
- Apprentice Program Sponsor: **University of Maryland Medical Center**
- Chris's Story:
  - Employee of a local fish store (understood basic mechanical systems)
  - Avid video game player (perfect for understanding how one action over here, impacts another item over there)
  - Over the past 2.5 years, Chris has really grown both personally and professionally.
    - He moved out of parent's house, now rents his own apartment in Baltimore City
    - Has excelled in every single class he has taken and has become a real asset as it relates to the programming and maintenance of the building automation system.
    - One thing to note about Chris is while in High School he was barely getting passing grades and throughout this program received all A pluses.
Darren

- Hire date: September 12, 2016
- Apprentice Position: Plumbing Apprentice
- Apprentice Program Sponsor: Associated Builders and Contractors - Baltimore Metro Chapter
- Darren's Story:
  - Was an employee of the Receiving department at UMMC.
  - His manager saw his drive & ambition and recommended him for the apprentice program.
  - No mechanical experience.
  - Over the past 1.5 years, Darren has also grown both personally and professionally.
    - He moved out of his grandmother's house and leased his own apartment.
    - His aunt was so proud of him that she bought him a car.
    - His preceptors (2 master plumbers) have adopted him into their families both inside and outside of work.
    - Darren is learning about the facility, about the profession and about life.
Josh

- Hire date: **September 12, 2016**
- Apprentice Position: **HVAC Apprentice**
- Apprentice Program Sponsor: **Associated Builders and Contractors - Baltimore Metro Chapter**
- Josh's Story:
  - Had little bit of HVAC experience
  - Wanted to work in at a large institution.
  - Not enough experience to be hired directly into an HVAC position
  - Gladly accepted admission into the UMMC apprentice program.
  - Learning about the pneumatic control system on campus
  - While the facility is moving towards digital controls, there is still a large portion of the campus that operates on control air.
  - Positioning himself uniquely in the department as he is one of the few that understand both the pneumatic and the digital controls.
Jordan

- Hire date: **March 26, 2018**
- Apprentice Position: **Electronics Apprentice**
- Apprentice Program Sponsor: **Associated Builders and Contractors - Baltimore Metro Chapter**
- Jordan’s Story:
  - Entered the workforce as a carpenter’s helper when he was 18.
  - Began working at UMMC as a temporary employee through an agency.
  - Converted to a permanent employee in March.
  - Now he is working on the following systems:
    - Pneumatic tube system
    - Fire alarm and suppression systems
    - Synchronized clocks
  - He is more responsible at home:
    - Paying bills on time (has more money)
    - Attending functions on time
    - Purchased a new car.
Organization Chart Today

Total = 65
Retiring = 17
26%
Stationary Engineer Apprentice Collaboration Program

Sponsors:
Baltimore City Mayor’s Office
Maryland Department of Labor, Licensing and Regulation

Training Partner:
Baltimore City Community College

Participating Employers:
Baltimore City Convention Center
Baltimore City Department of Public Works
Johns Hopkins University
Under Armour
University of Maryland Medical Center
University of Maryland School of Medicine
Veolia North America
QUESTIONS?
Overview

- Preparing Students for 21st Century Workforce
- Better Building Workforce Guidelines (BBWG) – Embedding Advanced Commercial Building Skills into Existing Community College Programs
- BBWG Community College Pilot Program
- BBWG Pilot Program Alignment to Related Initiatives
- Looking Forward – Educational Trends
- Key Take-Aways
Preparing Students for a 21\textsuperscript{st} Century Workforce

- Employers are in search of highly-trained prospective employees
- U.S. educational system is not producing enough well-qualified candidates & continues to fall behind other industrialized countries in international benchmark assessments
- Demand is also high for 21\textsuperscript{st} century skills – Collaboration, Communication, Critical-thinking, Creativity
- Of the 12 most important 21\textsuperscript{st} century skills identified by employers, communication and critical thinking were highest-rated (Day & Koorland, 1997)
- A survey of managers supervising recent science, technology, engineering, and mathematics (STEM) program graduates revealed perceived limitations in their abilities to apply theoretical knowledge in the real world, communicate effectively with colleagues, and solve problems requiring critical-thinking skills (Jollands, Jolly, & Molyneaux, 2012).
- These factors, and others, lead to an ‘opportunity gap’ for aspiring learners
Preparing Students for a 21st Century Workforce

- Darling-Hammond (2010) defines the opportunity gap as being “the accumulated differences in access to key educational resources – expert teachers, personalized attention, high-quality curriculum opportunities, good educational materials, and plentiful information resources” that enable students to have the best chance to succeed and excel (p. 28).

- At the community & technical college levels, the problem of “high-quality curriculum opportunities, good educational materials, and plentiful information resources,” are often linked to inconsistent and ineffective programmatic design.

- Instructors are most often hired for their technical or subject-matter expertise and are made responsible for curriculum development and enhancements without the requisite training to do so.

- Obvious repercussions to curriculum quality, flow of instruction, resource selection, etc.

- Better Building Workforce Guidelines (BBWG) for curriculum development was published in 2015 to help instructors and curriculum developers with this challenge.
The guide details five steps to incorporating learning outcomes into new or existing programs of study.

- Includes guidance on embedding 21st century skill instruction into curriculum.


- Based on outcomes of pilot program, the initiative will be taken to scale.
Skills required for jobs continuously in flux – this process enables current research, resulting in new student learning outcomes (SLOs), to be incorporated into existing programs of study.

The five general steps of the process are:

- **Step 1: Sort SLOs**
- **Step 2: Categorize SLOs**
- **Step 3: Rank SLOs – Levels of Learning**
- **Step 4: Design Modules**
- **Step 5: Design Courses**

Learn more at [energy.gov/betterbuildings](http://energy.gov/betterbuildings)
BBWG – Embedding Advanced Commercial Building Skills into Existing Community College Programs

Need for BBWG Community College Program

- Curriculum development in high-tech fields is marginal at best at community & technical college level
- Rapidly-evolving career pathways require strong curriculum development to keep pace
- Lack of expertise in curriculum development in the nation’s community & technical colleges
- Post-secondary technical instructors often lack formal educational theory training
- 21st century skill development requires advanced pedagogical methods
BBWG Pilot Program Alignment to Related Initiatives

- **National Science Foundation Bldg. Efficiency for a Sustainable Tomorrow (BEST) Center**
  - High-level funding by National Science Foundation – 2013 to 2022
  - Develop national technical workforce in efficient building trades
  - Georgia Piedmont Tech, Laney College, UC Berkeley National Labs

- **Association of Controls Professionals 501-(c)-3**
  - Founded in 2014 to develop ISO/ANSI-accredited certifications for building automation industry (To be announced this year)
  - Accredit building automation programs around the nation
  - Publish research specific to BAS industry workforce development
BBWG Pilot Program Alignment to Related Initiatives

- **FLOW**
  - Release of two levels of accredited certifications directed at BAS technicians
  - Design of BAS laboratories around the nation / technical support to community & technical colleges

- **AWARENESS**
  - Meetings with superintendents, college presidents, principals, corporate partners to present ACP market research demonstrating local needs
  - Meetings with congressional caucus on Career and Technical Education (CTE) to present district opportunity data and strengthen the Perkin’s Funding re-authorization bill

- **Certificates vs. Certifications**
  - National workshops / webinars / direct counseling to administrators / Perkin’s Bill language
Miami Channel 7 (ABC) Affiliate Coverage of new BAS program in Miami-Dade County, FL

Key Take-Aways

- Skills, both technical and 21st century soft skills, are in a state of flux
- Effective curriculum development is limiting program effectiveness in the nation’s community and technical colleges
- The BBWG “Embedding Advanced Commercial Building Skills into Existing Community College Programs” publication provides a process example for curriculum development
- BBWG Pilot Program – Six community & technical colleges (9-month program) will be taken to scale, incorporating lessons learned
- Other related initiatives by the NSF BEST Center & the Association of Controls Professionals are being leveraged to improve BBWG program results & dissemination


Thank you! Questions?

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