

IAC Student Collaboration Webinar

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



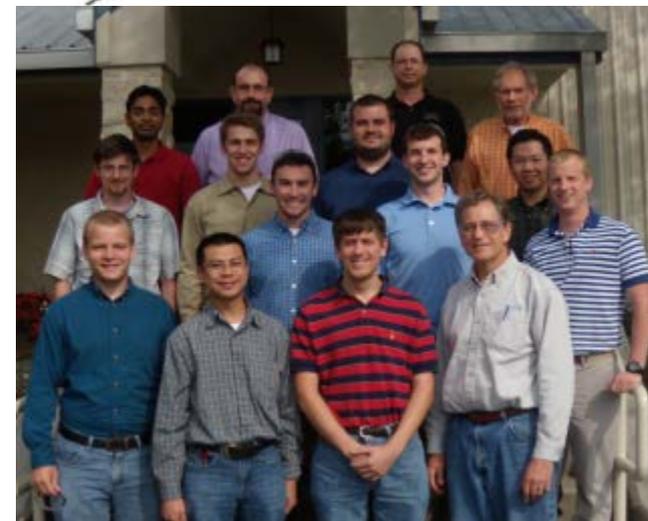
Thomas Wenning, PE
Oak Ridge National Laboratory

**IAC Student Webinar
Series
November 2015**



Industrial Assessment Centers 2012-2016

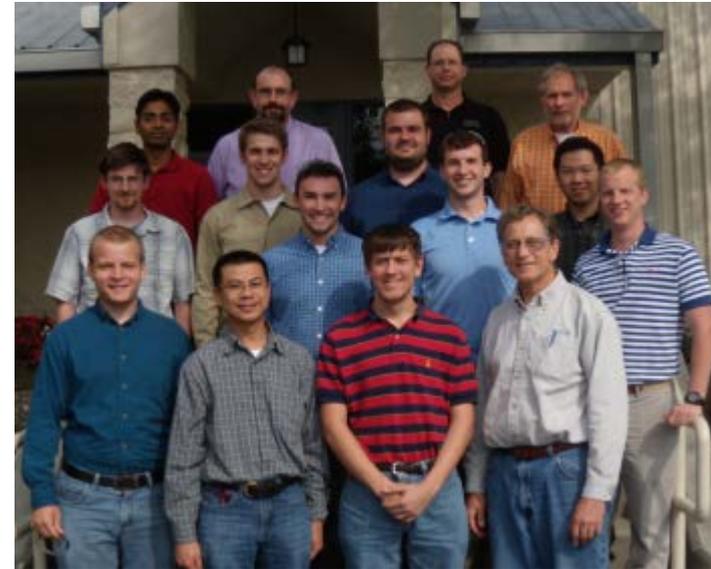
Energy Efficiency & Renewable Energy



- Alternative to student meeting
- Monthly student-led webinars
- Proposed Structure:
 - 40 min student presentation
 - 20 minutes of Q&A/open dialogue
- Allow students to connect



- Mechanism for IAC-to-IAC student collaboration
- Possible topics:
 - Relevant items for day-to-day IAC operations (client recruitment, report writing, etc.)
 - New technologies and innovations
- Rotate speakers and topics each month
- Each center will lead or contribute a presentation to a future webinar





We want your feedback (date, time, topics, etc)!
....and Volunteers!

Webinar Survey

1. Did you find this webinar helpful (1 being least helpful and 5 being most helpful) ?

1 2 3 4 5

2. What topic or topics would you like to see addressed in future IAC student-led webinars?




3. Would you be interested in leading a future webinar?

Yes
 No

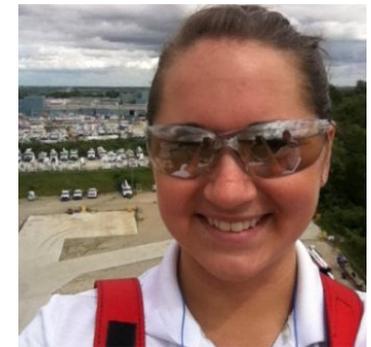
4. If interested in leading a future webinar, please list your name and contact email.




- **Topic:** World Energy Engineering Congress Overview
- **Who:** Kaustubh Gosavi and Maria Blaneck Iowa State University IAC

kdgosavi@iastate.edu

mblanek@iastate.edu



IOWA STATE UNIVERSITY

IOWA STATE UNIVERSITY
College of Engineering

World Energy Engineering Congress

IAC Webinar Series

By

Kaustubh Gosavi

Maria Blaneck

November 17th, 2015

IAC at Iowa State University

- Started in 1991
- Perform 20 assessments per year
- Team of two master's students and eight undergrad
- Travel throughout Iowa, Minnesota, Wisconsin, Nebraska, Dakotas, and Illinois
- Director- Dr. Greg Maxwell

Outline

- Overview
- Sessions Attended
- New Technologies at Expo
- Best Practices at ISU's IAC

Overview

- Took place between September 30th – October 2nd in Orlando, FL
- 260 speakers from 20 countries
- 70,000 sqft of exhibit space



Sessions Attended

Rooftop Units 101

By

Mark Stetz, PE

Stetz Consulting LLC

Rooftop Units 101

Rooftop units (RTUs) include packaged air conditioners and heat pumps

- Serve ~58% of all cooled commercial buildings
- And ~69% of the cooled commercial building floor space
- Consumption of ~2.1 Quads (10^5 BTU)
- Low installed efficiency due to advanced controls and lack of adequate equipment maintenance

Rooftop Units 101

- Rooftop Units 101
 - Components and Controls
 - Cooling section
 - Heating section
 - Fans
 - Economizer & Sensors

Rooftop Units 101

- Cooling section
 - Most common is Direct Expansion / Air Cooled models
 - Multiple scroll, reciprocating, or screw compressors
 - Air-cooled condenser with multiple fans
- Heating section
- Fans
- Economizer & Sensors

Rooftop Units 101

- Cooling section
- Heating section
 - Natural Gas - furnace section built in
 - Electric – staged electric resistance heating elements
 - Hot Water – boiler provides hot water to heating coil
- Fans
- Economizer & Sensors

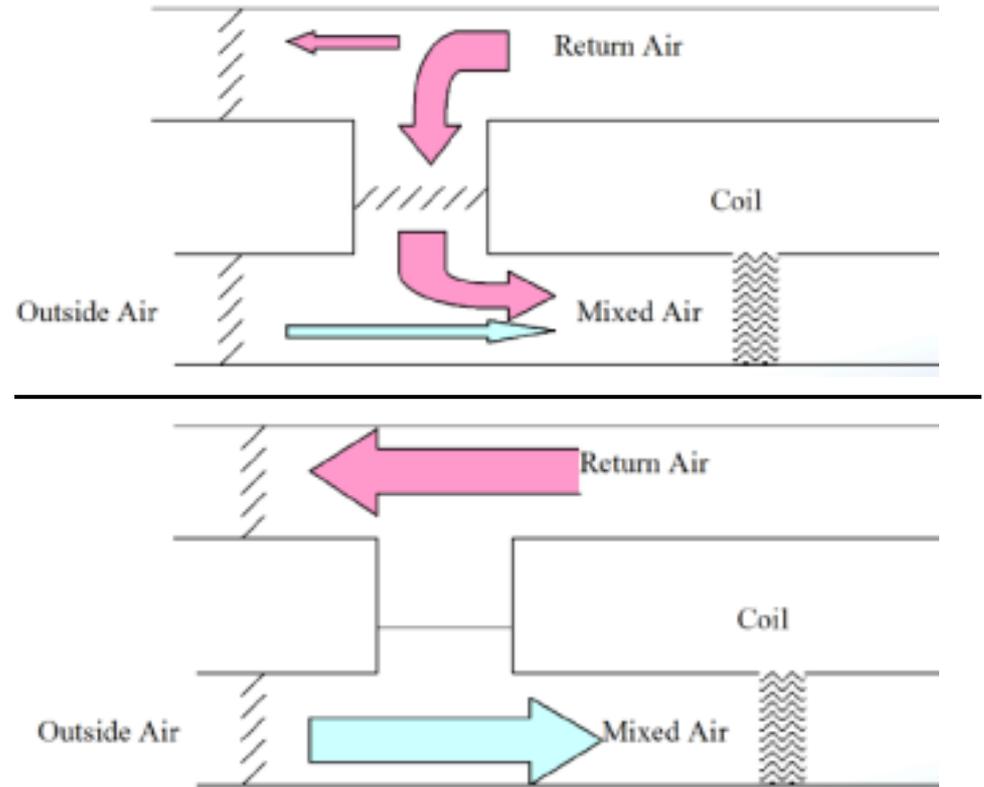
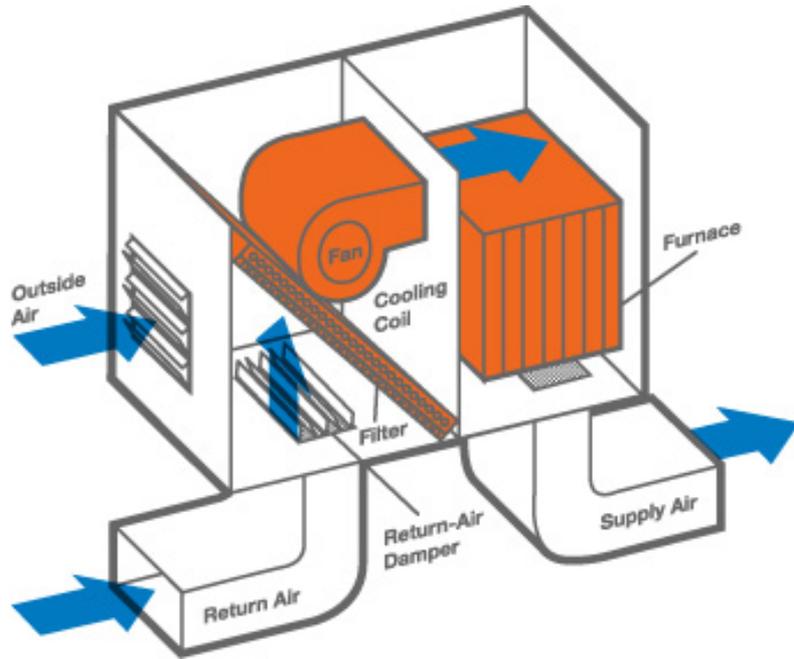
Rooftop Units 101

- Cooling section
- Heating section
- Fans
 - Supply – moves air through unit
 - Return – pulls air from return duct
 - Constant speed and variable speed for newer units
- Economizer & Sensors

Rooftop Units 101

- Cooling section
- Heating section
- Fans
- Economizer & Sensors
 - Economizers act as a control strategy
 - Provides maximum savings in climates with significant hours in the 45° – 65° range
 - Integrated economizer: dampers modulate, compressor enabled
 - Non-integrated: dampers open to 100%, compressor disabled
 - Temperature control vs. Enthalpy control

- Typical economizer operation
 - Recirculate ~80% - 90% of return air
 - Introduce ~10% -20% of outdoor air



- Economizing operation
 - Exhaust 100% of return air
 - Introduce 100% outdoor air

Common Issues with Economizers

- Scheduled / unscheduled operation
- Unusual operation
- Non-optimal supply air temperatures
- Simultaneous heating and cooling
- Poor economizer operation

Rooftop Units

- Damper faults prevalence of 25% - 40%
 - cause an energy loss potentially as much as 0.02 to 0.1 Quads (1% - 5%) in the entire U.S. → ≈ \$0.6 - \$3.0 Billion
- Simple fixes if problem identified
 - Check wiring and fuses on controllers
 - Check for rust / corrosion
 - Replace temperature and enthalpy sensors
 - Ensure low-temperature lockout is enabled
 - Hook up to data loggers!

Rooftop Units

“Economizers are great in theory.
Not so much in practice.”

Sessions Attended

Reducing the Energy Consumption of Mist Collectors

By

Nathan Payne

Nissan Group of North America

Nissan Facility

- Nissan operates a single power train facility located in Decherd, TN
- Production for 2015 will exceed one million engines



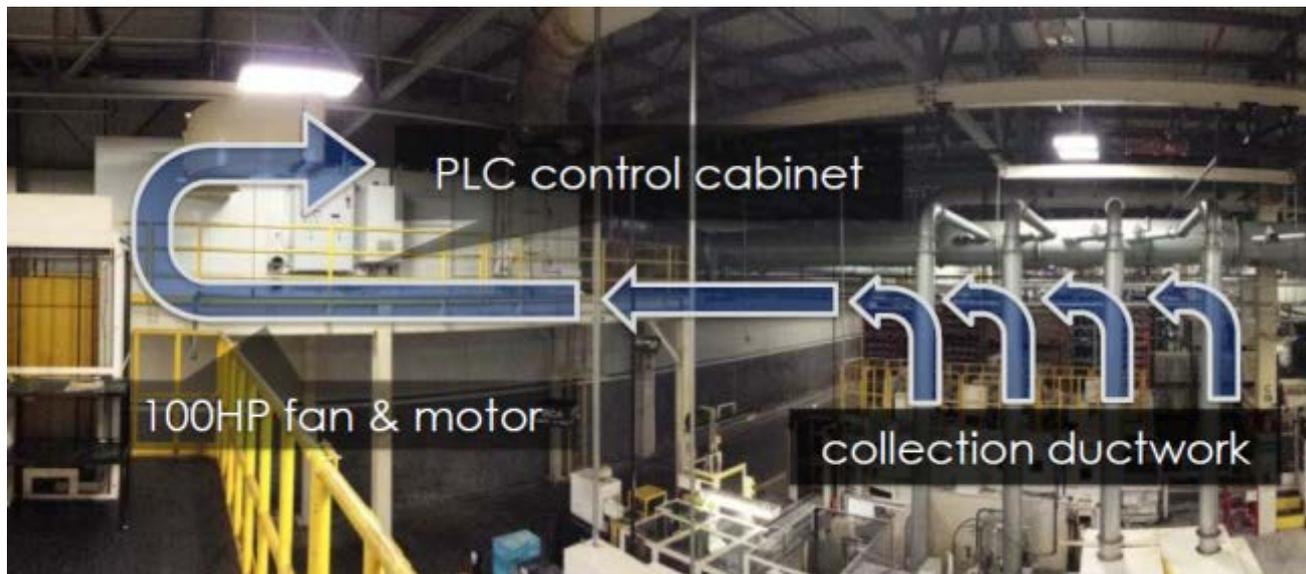
Mist Collectors

- The mist collector systems are a significant energy consumer in manufacturing



Mist Collectors

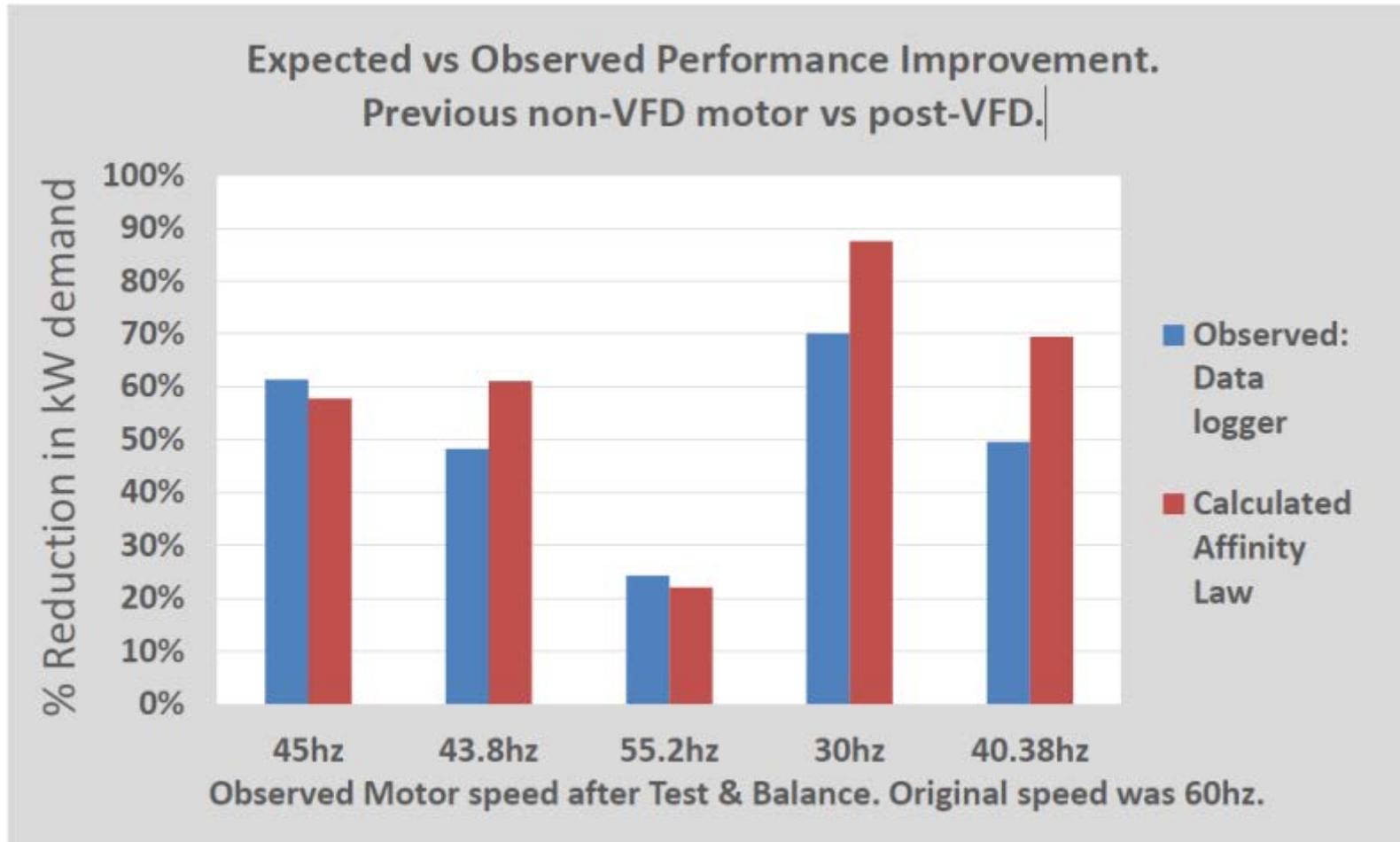
- Energy savings can be achieved by integrating multiple projects:
 - Throttling: installation of inverters on fan motors
 - Balancing: adjust the flow to reduce system restriction
 - Automation: adjust fan speed to optimize with system conditions



Success

- To allow throttling
 - VFDs were installed into fan motors
 - Allows air flow rate to be adjusted by lowering the fan RPM
- To allow balancing
 - Dampers were opened and fan RPM lowered
 - In opposite case, dampers frequently 80% - 90% closed
- To allow automation
 - System added to automatically adjust the speed of the fan to maintain specific vacuum strength

Outcome



Sessions Attended

An Innovative Approach to Economizers in Data Centers

By

Shrenik Ajmera & Tejas Desai,
Willdan Energy Solutions

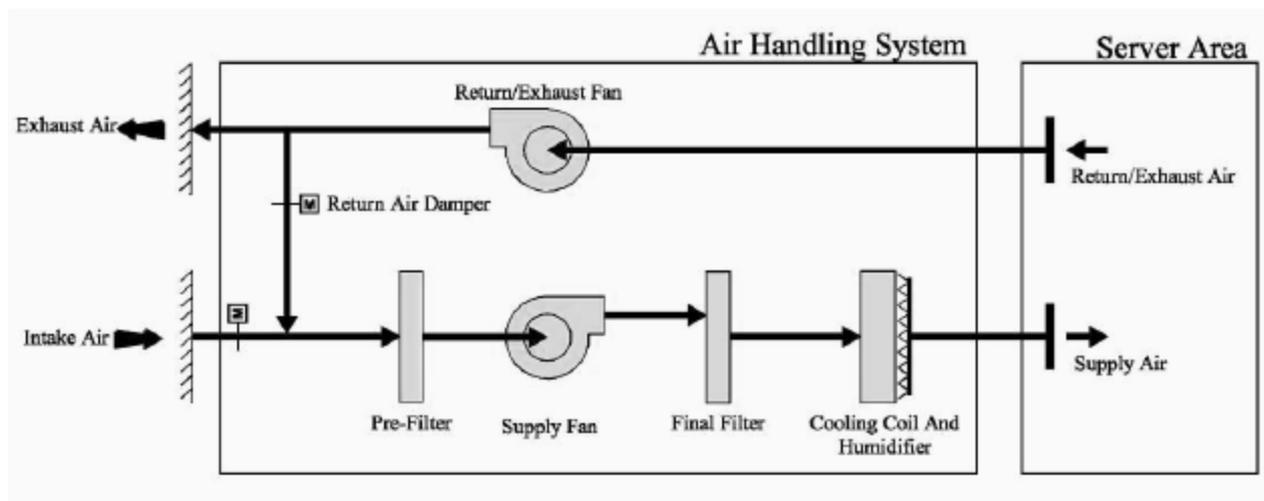
Economizers in Data Centers

- What is free cooling?
- Advantages of Economizers
 1. Energy and Cost Savings
 2. Good for Environment / Green Credits
 3. Operational Benefits – Potential Back-up System
 4. Longer Service Life of Mechanical Equipment
 5. Provision for Maintenance of Equipment during Downtime
 6. Keep Up with the Data Center Industry

Types of Economizers

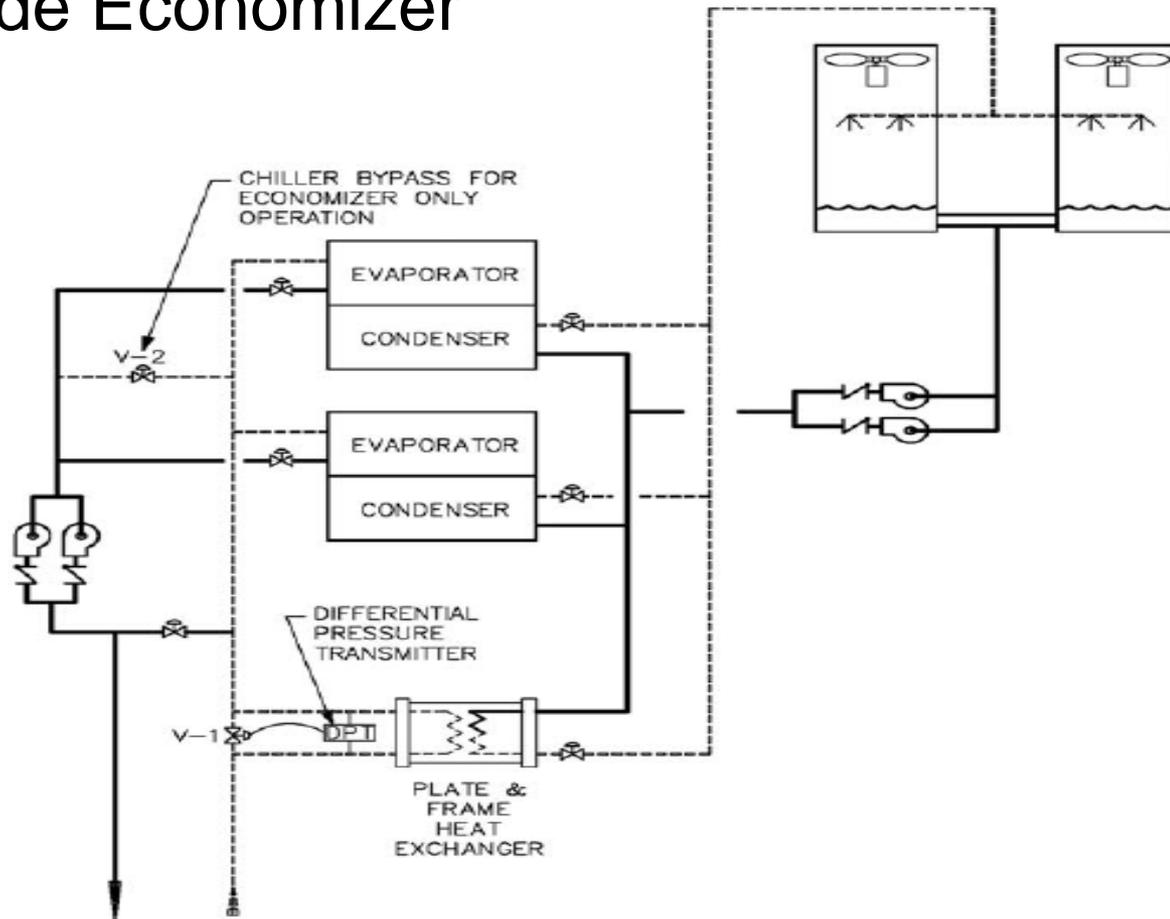
Air Side Economizers

- Direct airside economizers and indirect airside economizers

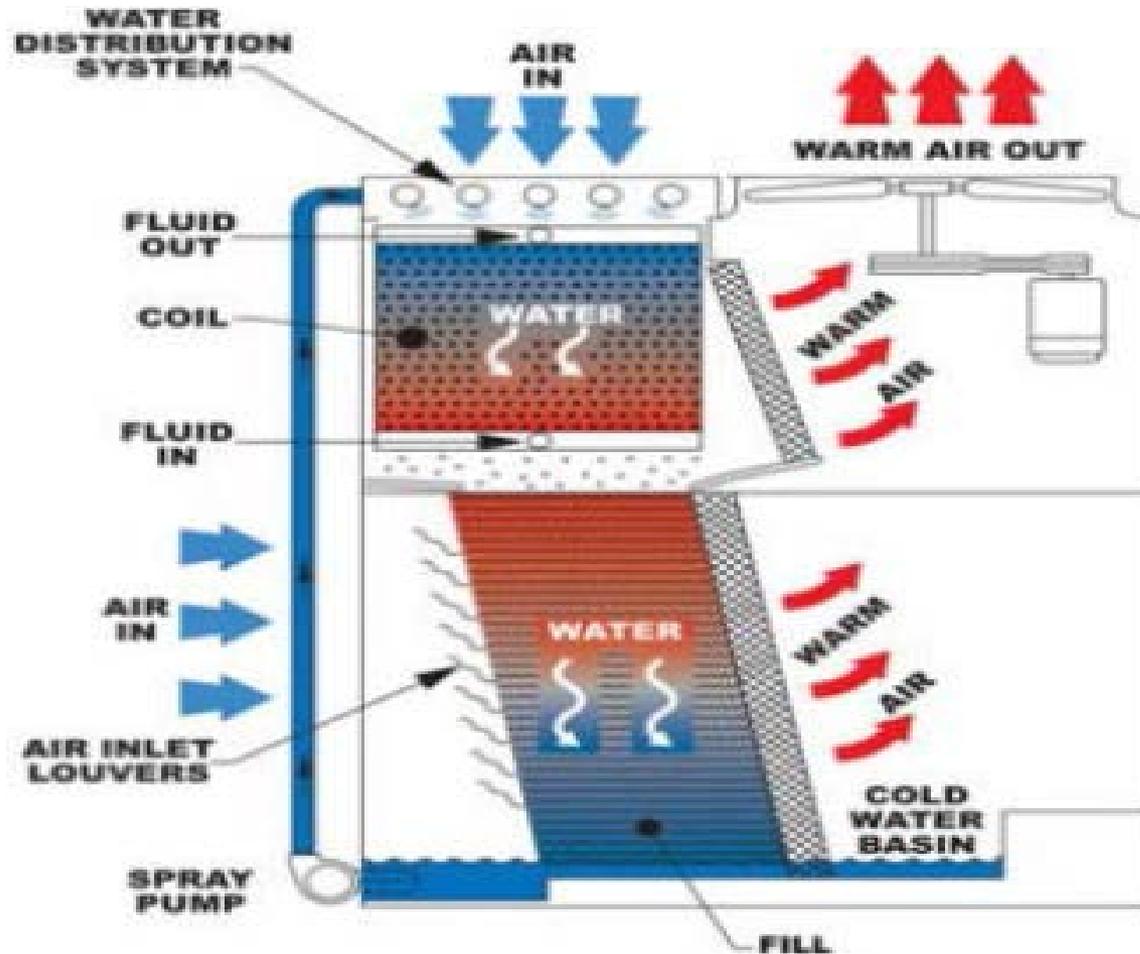


Types of Economizers

Water Side Economizer



Closed Circuit Cooling Towers (CCCT)



Advantages of CCCT

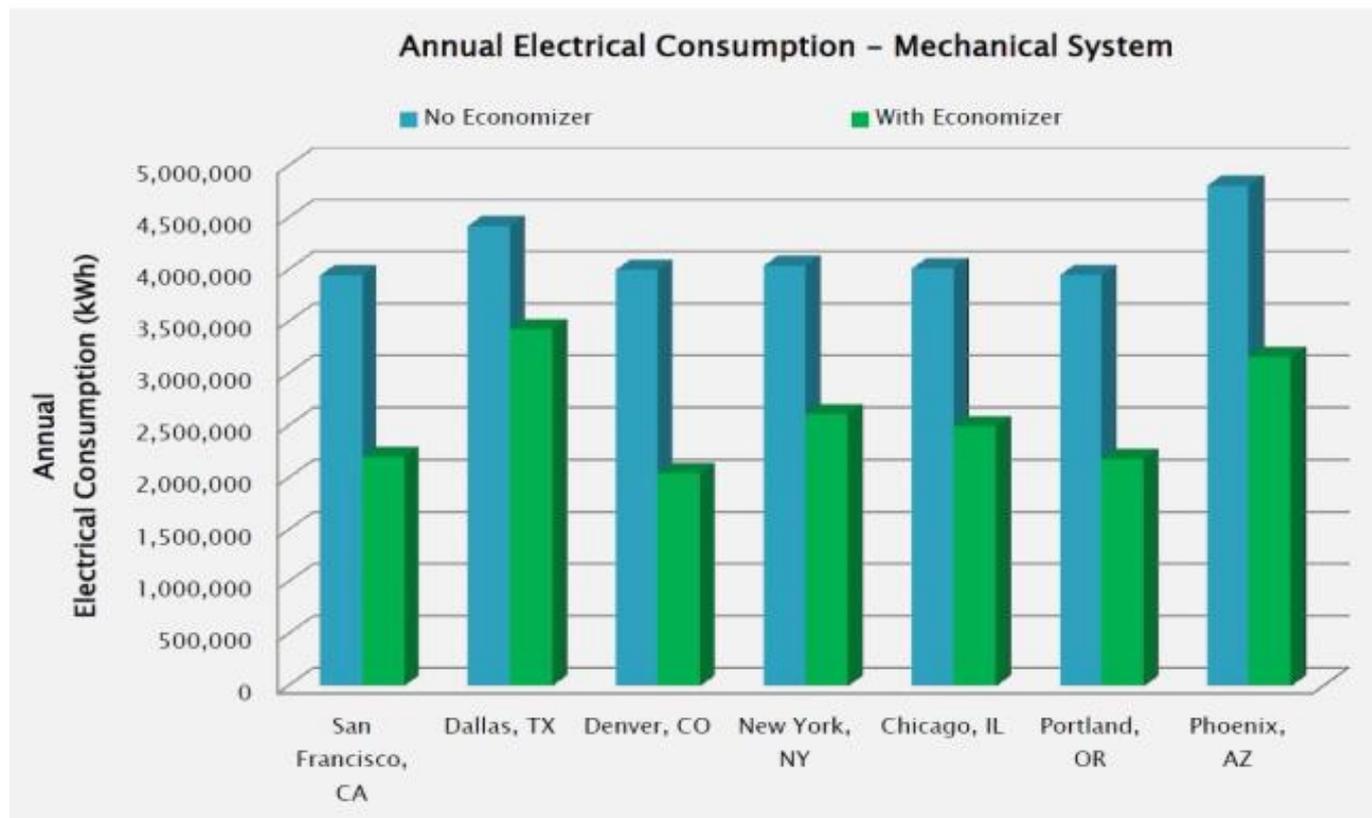
1. Operation without refrigeration
2. Protects the quality of the process fluid,
3. reduces system maintenance
4. provides operational flexibility
5. No need of isolating heat exchanger
6. Run dry in colder temperatures.
7. Retrofitted on data centers with air-cooled chillers

Case Study

IT Load: 1,200 kW (constant)

Cooling Load: 386 Tons

CHWS: 60° F, CHWR: 70° F



Sessions Attended

Case Study of Thermal Energy Storage

By

Larry Nelson

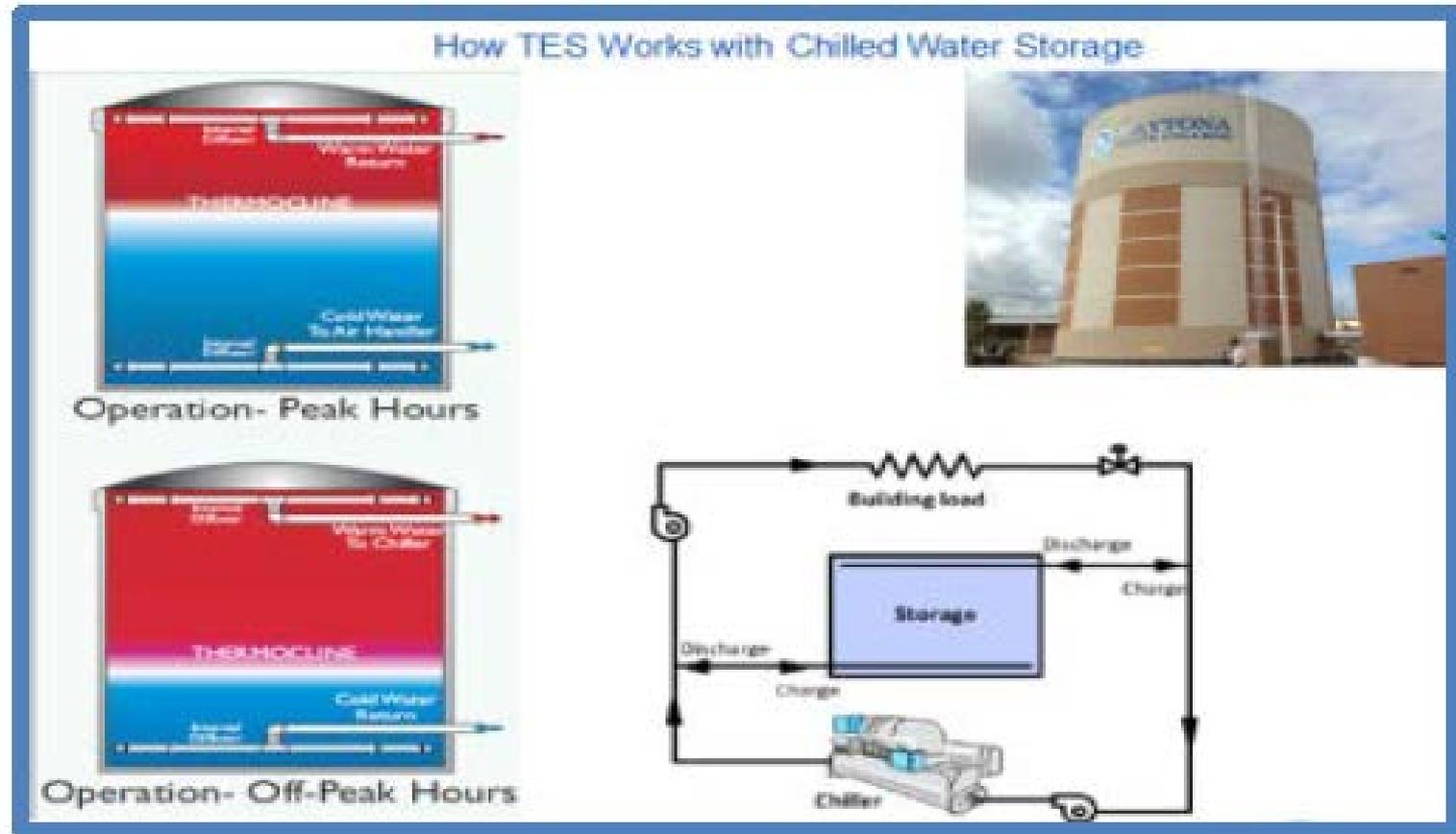
Business HVAC Program Manager

Florida Power and Light Company

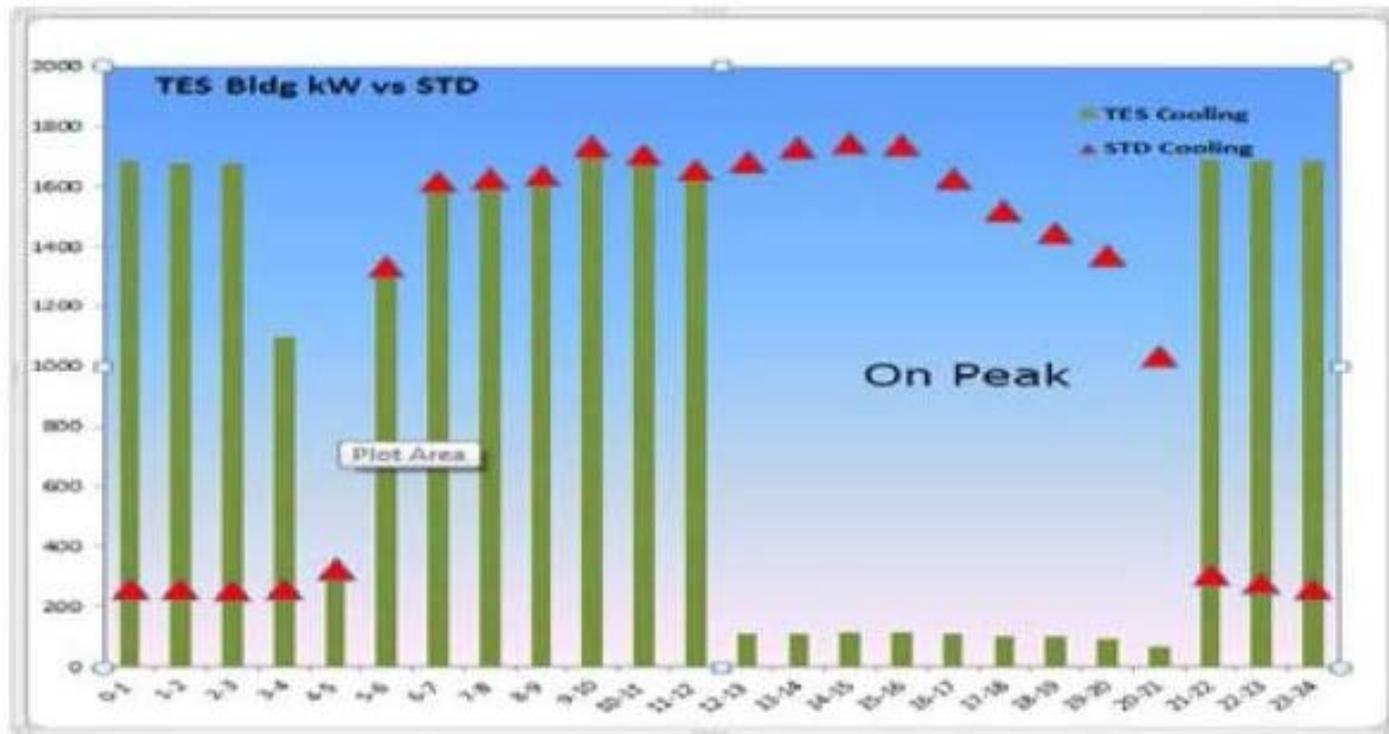
Background



Operation

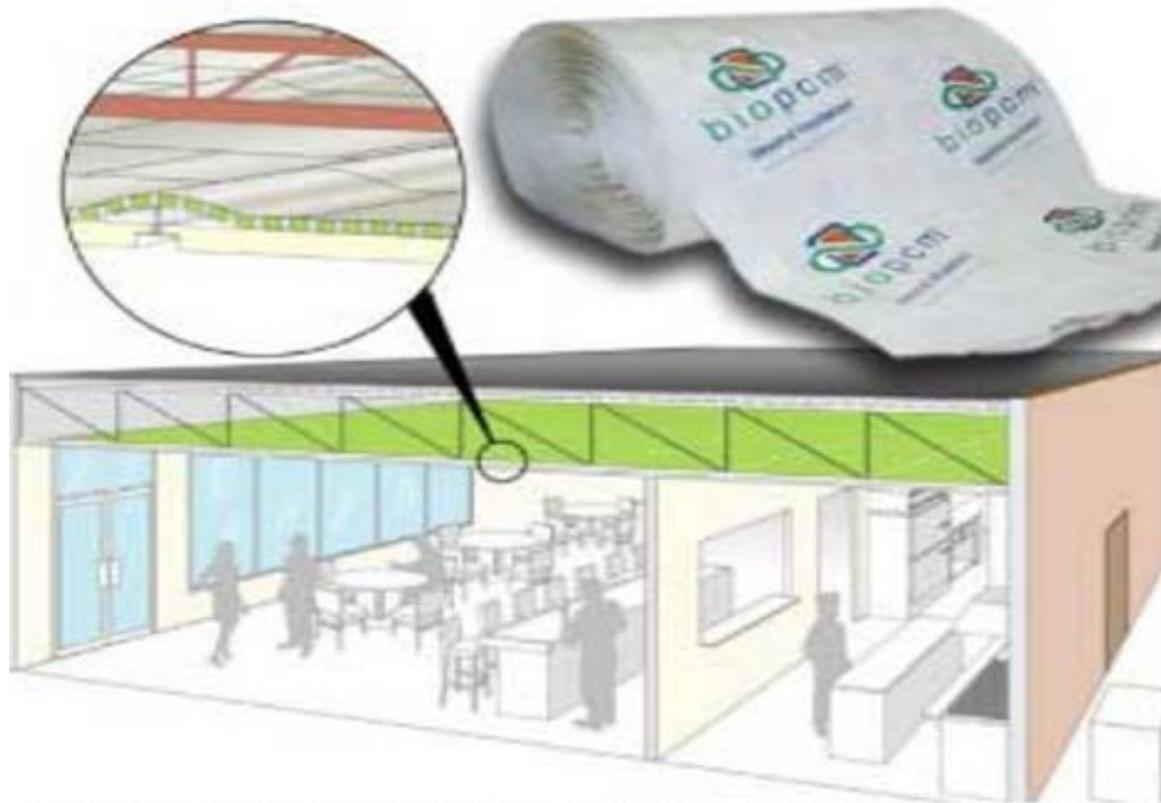


Results

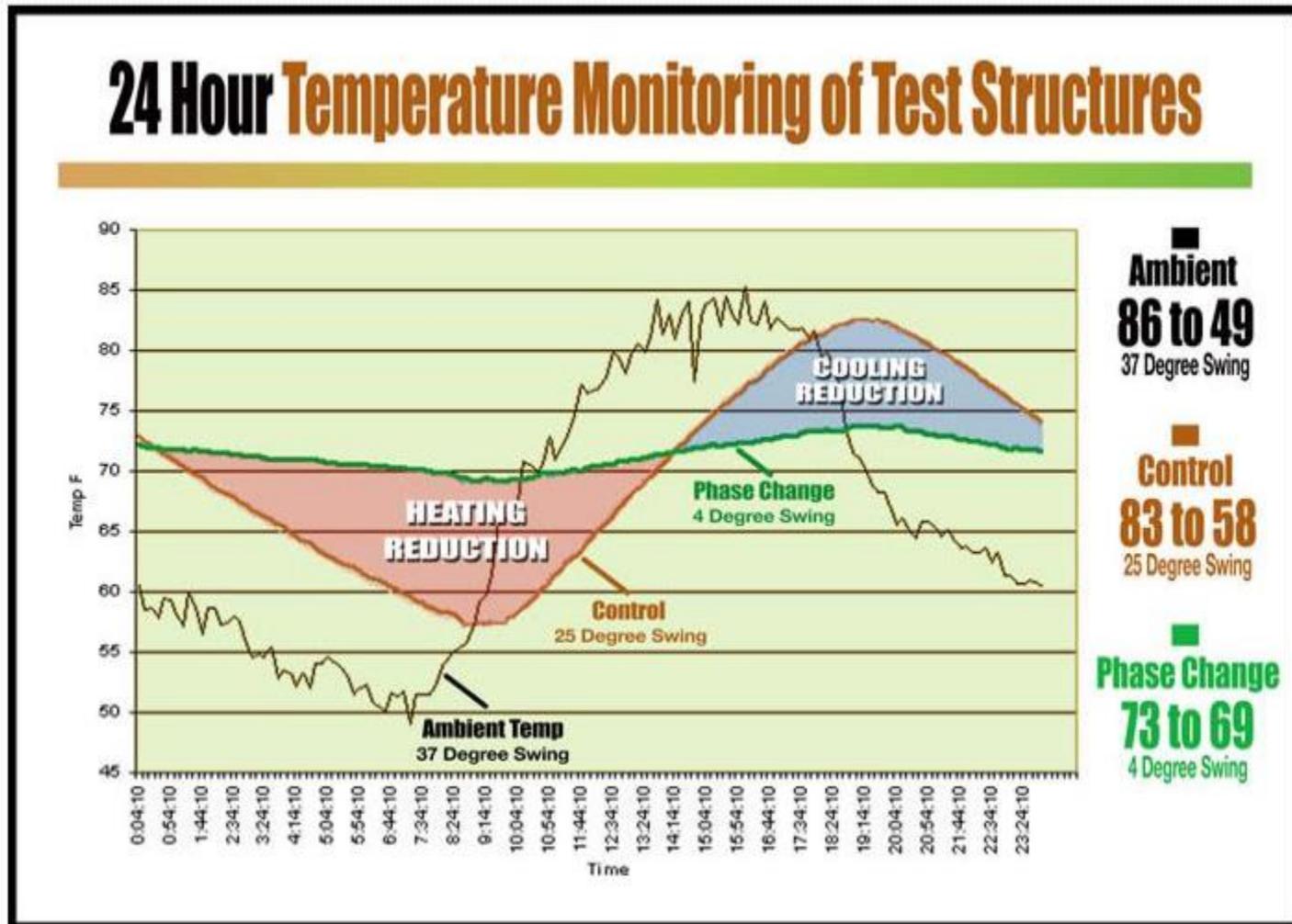


New Technologies at Expo

Smart Thermal Mass by Phase Change Energy Solutions



Operation



New Technologies at Expo

Benjamin Panelboards with Smart Metering



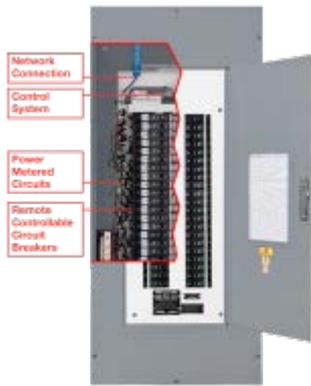
42 circuit Breaker Control Panelboard

Web-based Power Metering Interface



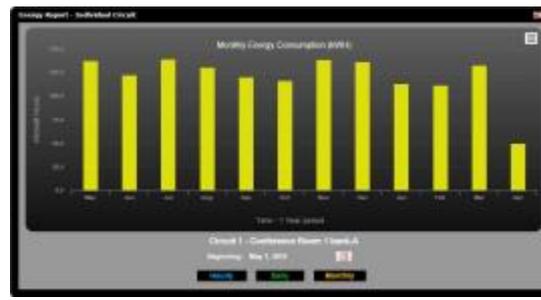
Interior - Breaker Control Panelboard

- Uses: lighting, audio, commercial, industrial
- Can be new or retrofitted into existing panelboard
- Customizable control options
 - Remotely controlled and site controlled
- Customizable metering options
- Sequential operation with built-in time delay to prevent in-rush current impacts from LED driver loads
- Great to easily identify areas of power consumption
- Metering data stored for free



Power Monitoring

Panel	Breaker	Status	Current (A)	Voltage (V)	Power (W)	Energy (kWh)
1	1	ON	15.2	120	1824	1.2
1	2	ON	12.5	120	1500	0.8
1	3	ON	10.1	120	1212	0.6
1	4	ON	8.7	120	1044	0.5
1	5	ON	7.3	120	876	0.4
1	6	ON	6.1	120	732	0.3
1	7	ON	5.2	120	624	0.3
1	8	ON	4.5	120	540	0.2
1	9	ON	3.8	120	456	0.2
1	10	ON	3.1	120	372	0.1
1	11	ON	2.5	120	300	0.1
1	12	ON	2.1	120	252	0.1
1	13	ON	1.8	120	216	0.1
1	14	ON	1.5	120	180	0.0
1	15	ON	1.2	120	144	0.0
1	16	ON	1.0	120	120	0.0
1	17	ON	0.8	120	96	0.0
1	18	ON	0.7	120	84	0.0
1	19	ON	0.6	120	72	0.0
1	20	ON	0.5	120	60	0.0
1	21	ON	0.4	120	48	0.0
1	22	ON	0.3	120	36	0.0
1	23	ON	0.2	120	24	0.0
1	24	ON	0.1	120	12	0.0
1	25	ON	0.1	120	12	0.0
1	26	ON	0.1	120	12	0.0
1	27	ON	0.1	120	12	0.0
1	28	ON	0.1	120	12	0.0
1	29	ON	0.1	120	12	0.0
1	30	ON	0.1	120	12	0.0



Circuit Schedule

Circuit 1 - Conference Room 1 Bank A

Circuit Status: ON System Type: 1500V AC 277V 60 Hz 3P

Order No.	Description	Circuit On	Circuit Off	Days to Run	Status / Exclude
1	10000	08:00	18:00	Mon - Wed, Fri	
2	10000	08:00	18:00	Mon - Wed, Thu, Wed, Fri, Sat, Sun	
3	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	
4	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	
5	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	
6	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	
7	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	
8	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	
9	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	
10	10000	08:00	18:00	Mon - Wed, Thu, Fri, Sat, Sun	

Best Practice at ISU's IAC

- **Bills Study to save valuable time at plant site**
 - After bills analysis, observe trends in bills
 - Record any unusual energy consumption behavior
 - Co-Relate this behavior with plant process
 - Discuss these issues with plant personnel in morning meeting

THANK YOU!
QUESTIONS?



The screenshot shows the IAC Forum website interface. At the top, there is a navigation bar with the text "IAC FORUM A Website for Students and Alumni of DOE's Industrial Assessment Center" and the Oak Ridge National Laboratory logo. Below this is a menu with "Registry", "Exchange", "Careers", "Resources", and "Contacts". A sponsor notice for "USDOE Advanced Manufacturing Office" is also present. The main content area features a large banner for the "COLLEGE OF ENGINEERING" with a photo of three people and the text "Student Research Awards and 2013 Center of Excellence Announced". Below the banner are three columns: "LinkedIn" (with a link to a group of over 500 members), "IAC Website of the Month" (highlighting Boise State University), "News" (listing recent announcements like a \$5 million grant and industry study), and "Metrics" (a line chart showing participation and certificates from 2004 to 2014).

COLLEGE OF ENGINEERING
Student Research Awards and 2013 Center of Excellence Announced
See more IAC news

LinkedIn
The IAC Forum manages a [LinkedIn Group](#) with over 500 members.

IAC Website of the Month
 BOISE STATE UNIVERSITY

News

- Energy Department Announces \$5 Million for Residential Building Energy Efficiency Research and University-Industry Partnerships
- ACEEE Summer Study on Energy Efficiency in Industry August 4-6, 2015
- IETC June 2-5, 2015 in New Orleans

[More news...](#)

Metrics

Year	Participating	Certificates
2004	400	100
2005	400	100
2006	350	100
2007	300	100
2008	300	100
2009	350	100
2010	350	100
2011	400	100
2012	500	100
2013	450	100
2014	400	100

[Metrics page...](#)

➤ Lead Student Responsibilities

- Ensure all students complete registry entry
- Ensure all students complete exit interview
- Ensure that lead/active/inactive status is current

➤ Exit Interviews

- Identify new lead students
- Update contact information for alumni
- Capture alumni career data

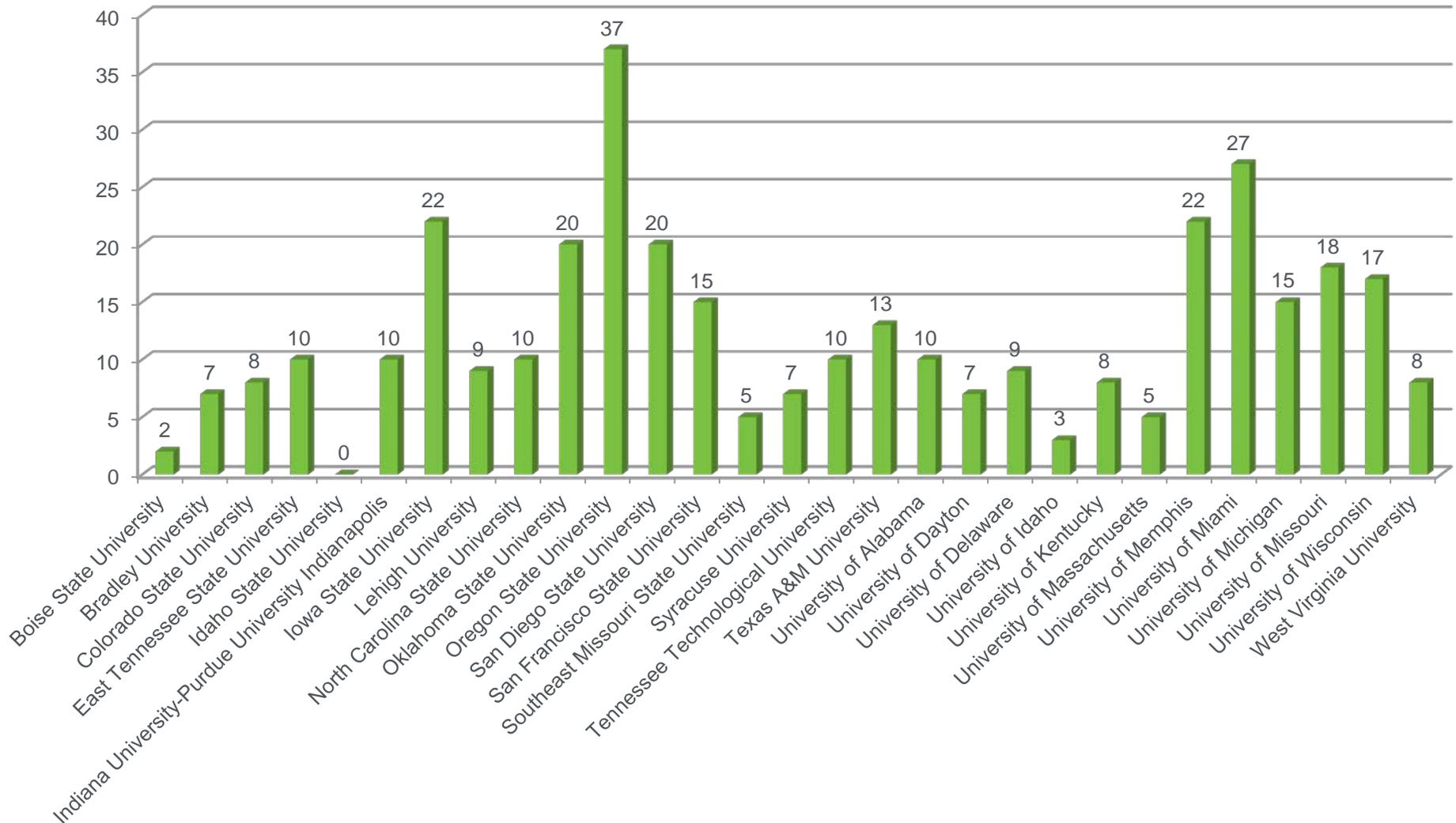


The screenshot shows the IAC Forum website with a navigation menu (Registry, Exchange, Careers, Resources, Contacts) and a main banner for the Oak Ridge National Laboratory. A red arrow points to the 'Registry' link in the navigation menu. A text box on the banner reads: 'New students must create a registry record; alumni are asked to maintain the registry information'. Below the banner are sections for LinkedIn, IAC Website of the Month (Boise State University), News, and Metrics.

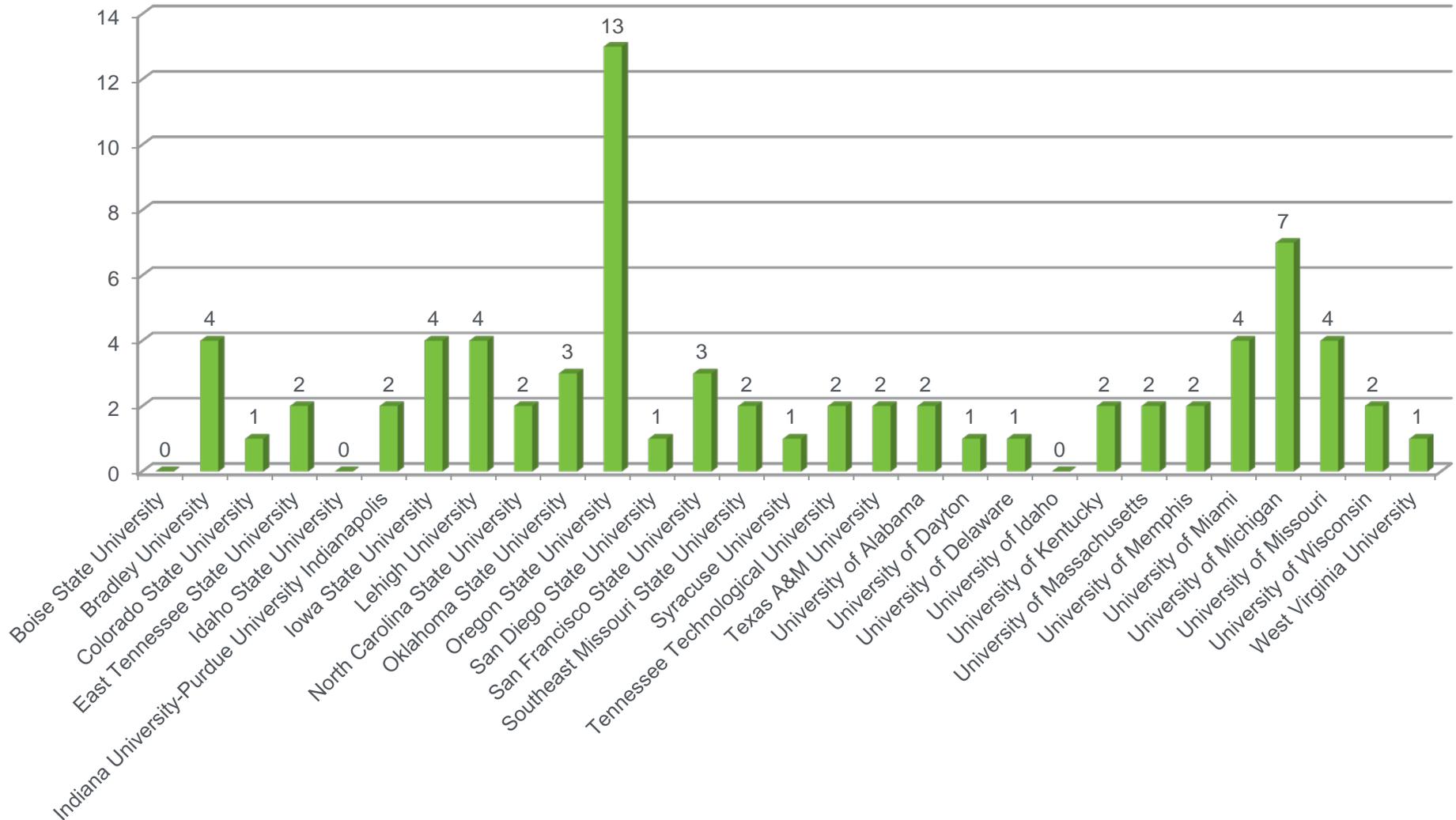
Year	Participating	Certificates
2004	450	100
2005	400	100
2006	350	100
2007	300	100
2008	350	100
2009	300	100
2010	350	100
2011	450	100
2012	400	100
2013	350	100
2014	300	100
2015	250	100

<http://www.iacforum.org/>

Number of Students Currently Listed as Active in the IAC Student Registry



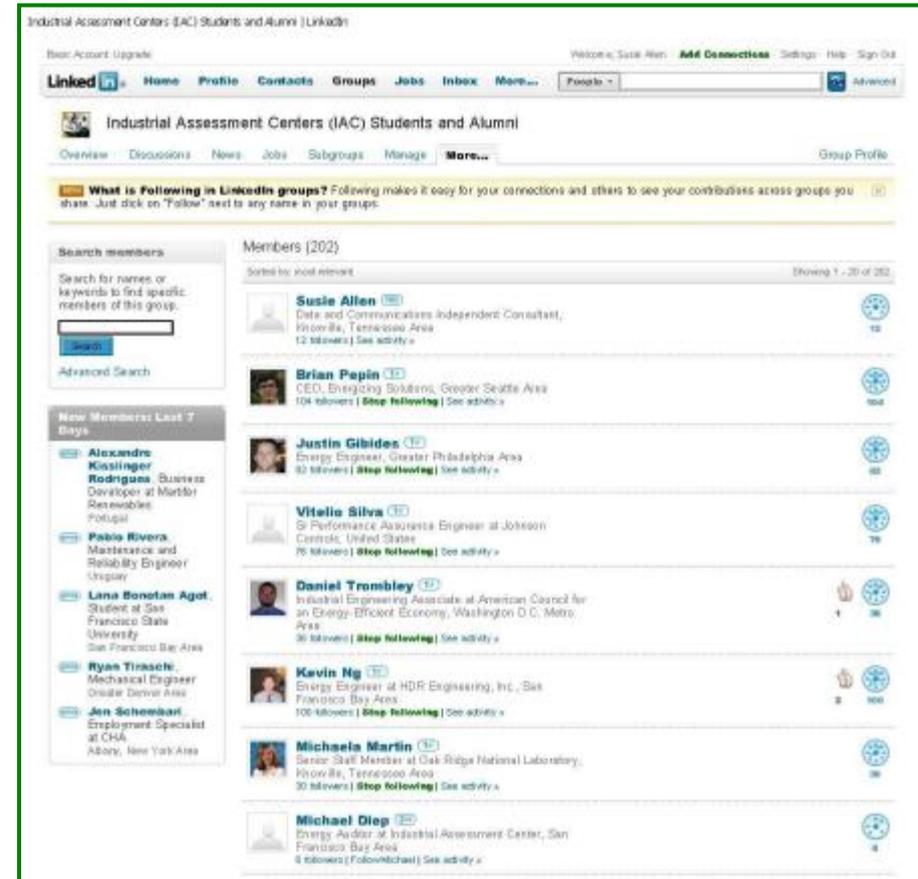
Number of Currently Active Students Listed as "Lead Student"



- On-line requests are processed through the certificates link on www.iacforum.org
- **Students and alumni must be in the IAC registry to receive certificates**
- Deadlines occur 3 times per year:
 - October 1, March 1, and July 1
- Certificate process
 - Student initiates request online,
 - Director/AD receives email notification with link
 - He/she completes the request online
 - Certificates arrive
- Certificates are mailed to the Directors within 30 days of deadline
- **Applications for the October 2015 round of IAC Certificates have been processed and have been delivered to centers**



- Established in 2008
- Professional networking site for IAC students and alumni
- 570+ members
- News items, professional profiles, discussions
- **Please utilize for ongoing collaboration or technical questions**



<https://www.linkedin.com/grp/home?gid=912947>

NEW Facebook IAC Page & Group

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

The screenshot shows the Facebook page for the US DOE Industrial Assessment Center Program - IAC. The page features a large cover image of two workers in hard hats. Below the cover image is a navigation menu with options like 'Timeline', 'About', 'Photos', 'Likes', and 'More'. A '100 Likes' badge is visible, along with a 'Promote Page' button. The 'ABOUT' section includes a map of the United States and the text 'US DOE Industrial Assessment Center Program - IAC Organization'. A post from the University of Dayton is partially visible at the bottom.

The screenshot shows the Facebook group page for the US DOE Industrial Assessment Centers. The group has 3 members. The cover image is the same as the page. The group page includes a 'Write Post' section, a 'RECENT ACTIVITY' section with a post from Thomas Wenning about EERE News, and a 'MEMBERS' section. A 'CREATE NEW GROUPS' section is also visible, along with 'RECENT GROUP PHOTOS' and a 'Chat (38)' button.

Page - <https://www.facebook.com/USDOE.IAC>

Group - <https://www.facebook.com/groups/543916505784912/>

Request: Pictures, Video Clips, Articles & Stories



The requested video cannot be displayed in your region

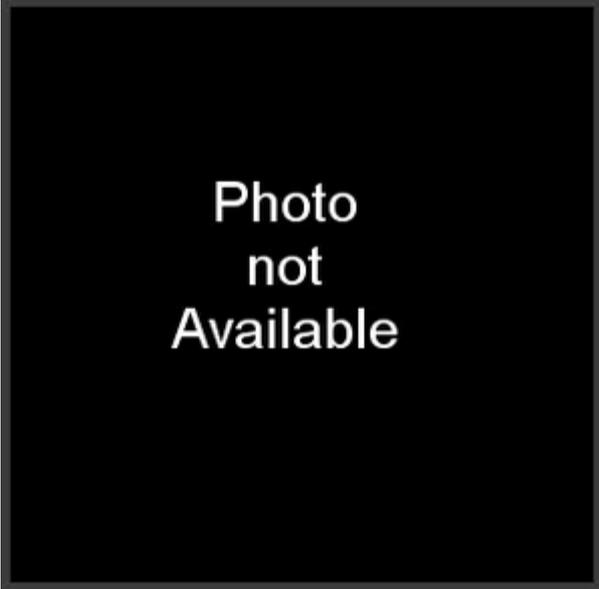
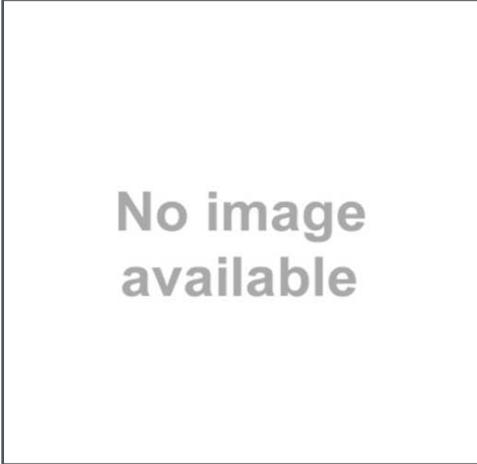


Photo
not
Available



No image
available

Please send to:
wenningtj@ornl.gov

Thank You!

Thomas Wenning, PE

IAC Student Activities Coordinator

Oak Ridge National Laboratory

865-946-1504, wenningtj@ornl.gov

