Running an IAC, Management Roles & Guidelines

Michael R. Muller,

Rutgers University

Who is this guy?

Michael R. Muller

Professor & Director

- **At Rutgers since 1979**
- **Professor of Mechanical and Aerospace Engineering**
- **Director, Center for Advanced Energy Systems**
- **Began EADC in 1976**
- **Field Manager since 1992**
- **Current passions:**
  - Steam engines
  - Operation of cooling towers
  - NOx in biofuels

Strategy for next 2 hours

- **Programmatic briefing**
  - Program structure
  - Rules and procedures to keep DOE happy
  - Keys to being a successful center
- **Interactive**
  - Q&A at several points will make this exercise most useful and interesting
- **Creativity vs. structure**
  - The IAC promotes creativity in technical issues- advancing the industrial assessment process
  - Programmatically there is a structure which all centers use
    - Centers are part of a national program!

Why do this webinar?

- **For general knowledge about what we do and how we do it**
- **For people who may consider applying to be an IAC at some point**
- **For people looking to develop or improve technical assistance programs and are interested in one that has survived 40+ years!**

USDOE's Industrial Assessment Centers

- **IACs are located at accredited engineering schools at universities throughout the USA**
  - Major function is to perform industrial assessments at nearby manufacturing plants
    - Assessments are performed by teams made up of faculty and students
    - Normally consists of a one day site visit at an industrial plant
    - Is an integrated assessment: considers
      - energy
      - waste
      - productivity

What plants are eligible?

- **Focus is on Small and Medium-Sized Enterprises (SMEs)**
- **Size of Manufacturers**
  - Clients will be required to have annual energy bills under $2.5 million but greater than $100k unless special permission is granted from the Field Manager or DOE
- **In addition, clients must also meet all five of the following conditions:**
  - Must be a US Manufacturer
  - Be within 150 miles of an IAC
  - Sales under $200 million
  - Fewer than 500 employees
  - Have no in-house energy professional

Who is eligible?

- **Range of Eligible Manufacturers**
  - SIC code for manufacturing 20 - 39 / NAICS 31 – 33
  - For agriculture, NAICS 11 with the following exclusions:
    - NAICS 111 – Crop Production
    - NAICS 113 – Forestry and Logging
    - NAICS 114 – Fishing, Hunting and Trapping
  - For mining, NAICS 21
    - Excluding 213 – Support Activities for Mining
  - For Wastewater, NAICS 22
    - Size limit of 3-10 million gallons per day

The Assessment Report

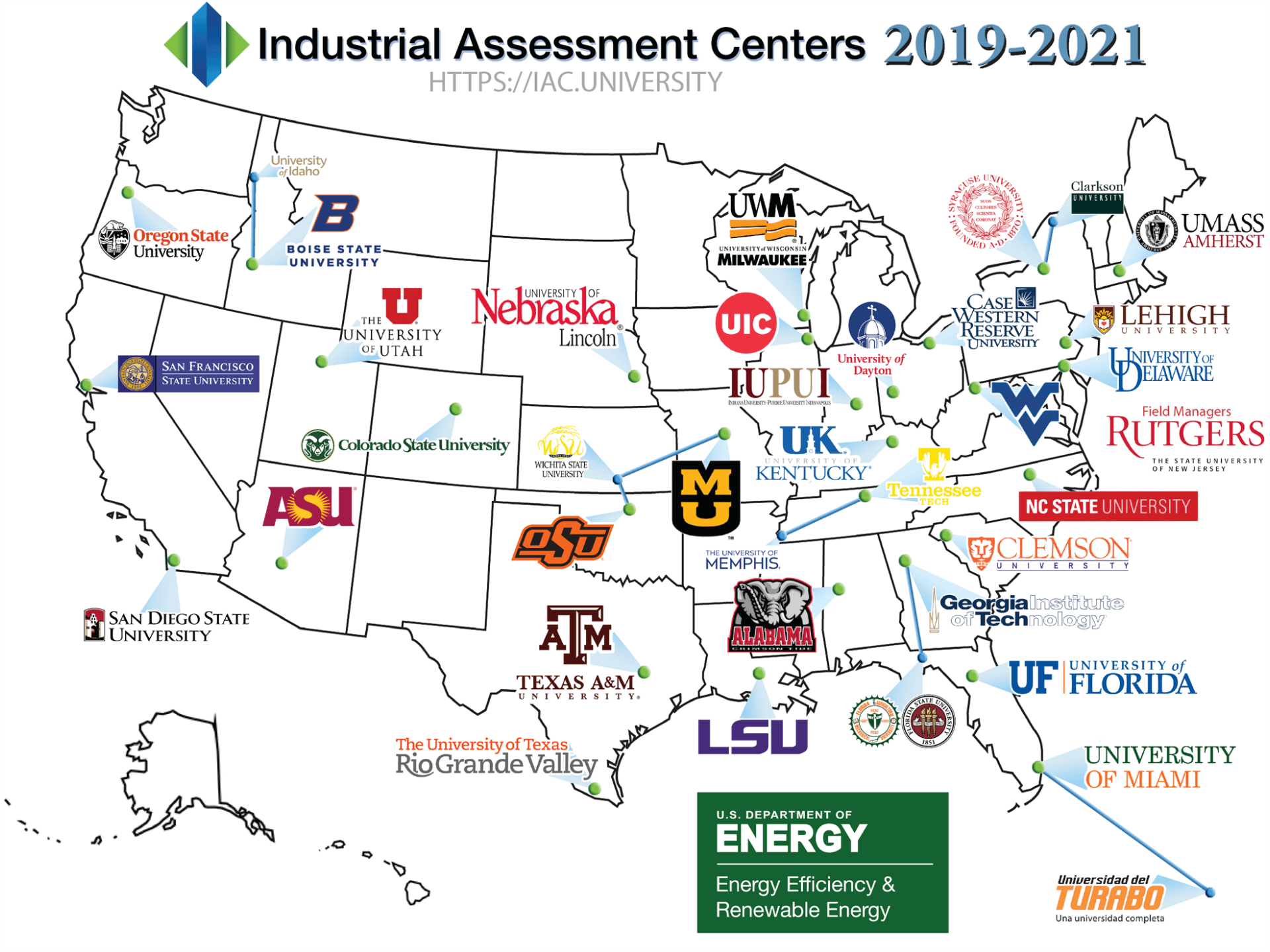
- **Assessment results in a formal report being sent to the client firm**
  - Each report has several recommendations which provide:
    - Sufficient engineering design to explain the recommendation
    - Anticipated savings
    - Implementation costs
    - Simple payback

The Assessment Report

- **Assessments also provide awareness of important related issues**
  - Cybersecurity
  - The Industrial Internet of Things
  - Energy management

Industrial Assessment Centers 2019-2021

HTTPS://IAC.UNIVERSITY



History of IAC Program

- **IAC program was formed in 1976, as the Energy Analysis and Diagnostic Program (EADC)**
  - Result of Oil Embargo
  - Originally 4 Universities
- **Students were always involved**
  - Goal was to fill gap in education
  - Energy Conservation was not taught in Engineering
- **Database was added in 1981**
  - In 1992 the database was put online
- **In 1995, waste minimization and productivity capabilities were added and the program became the IAC**
  - Recently a new focus on water and waste water treatment plants

History of IAC Program

- **Number of schools has reached 31**
  - Satellite schools make the numbers hard to count
- **Number of assessments per year**
  - Lowest = 12
  - Highest = 40

Program Rationale – Technical Assistance

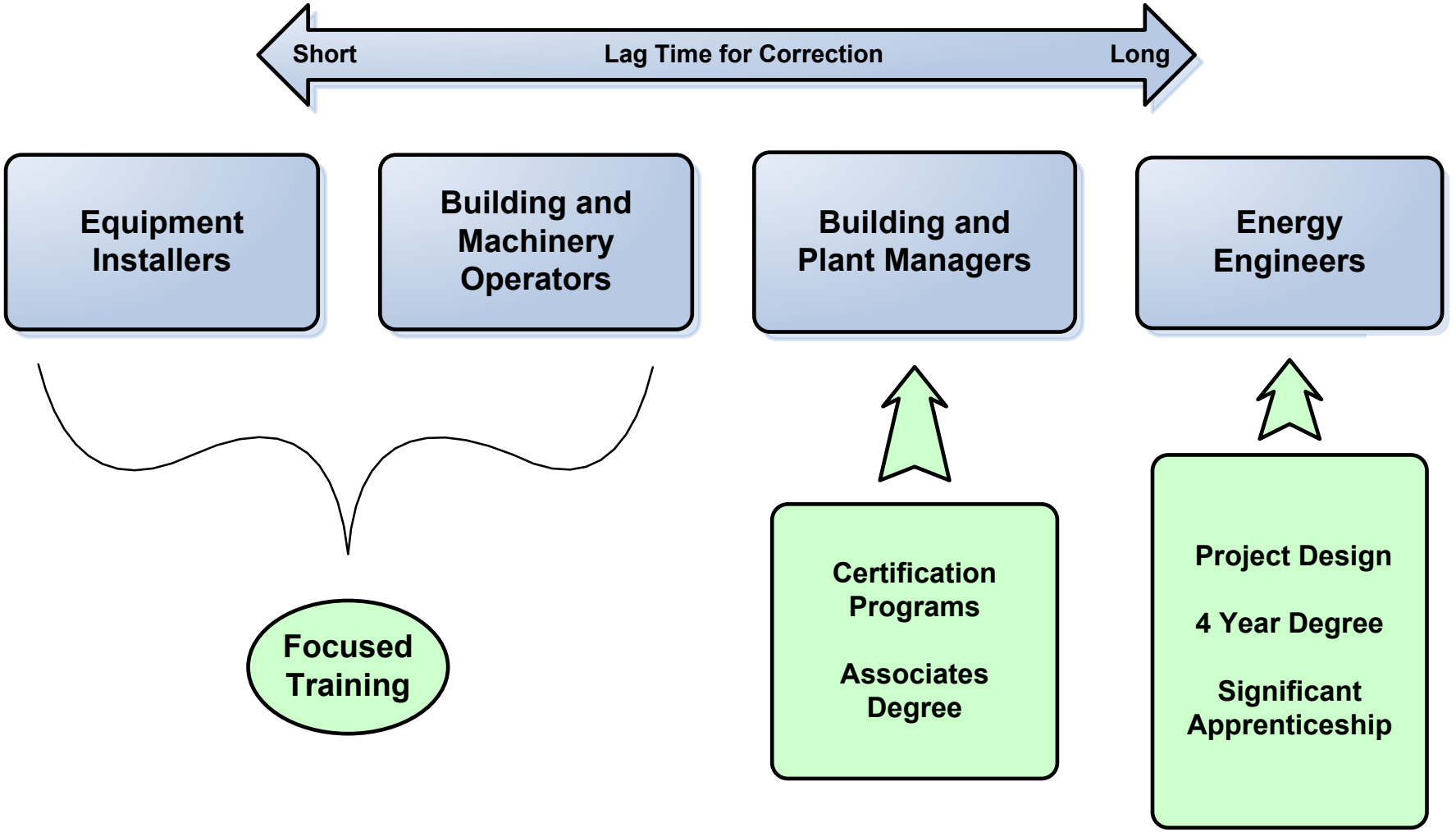
- **Small and medium sized manufacturers have difficulty staying up with energy technologies**
- **This program assumes that good energy efficiency projects exist**
  - Will be implemented because they save money
  - Based on what drives manufacturer
  - Even with waste, “green” does not get it done
- **We are an “idea” service**
  - Not an engineering design service!
  - We do not compete with consultants
    - Actually we create business
  - Not a financing vehicle

Program rationale – the students……

- **The Workforce "Perfect Storm" – PSEG CEO**

- **Workforce issues impact competitiveness**
- **Competitiveness impacts national security**

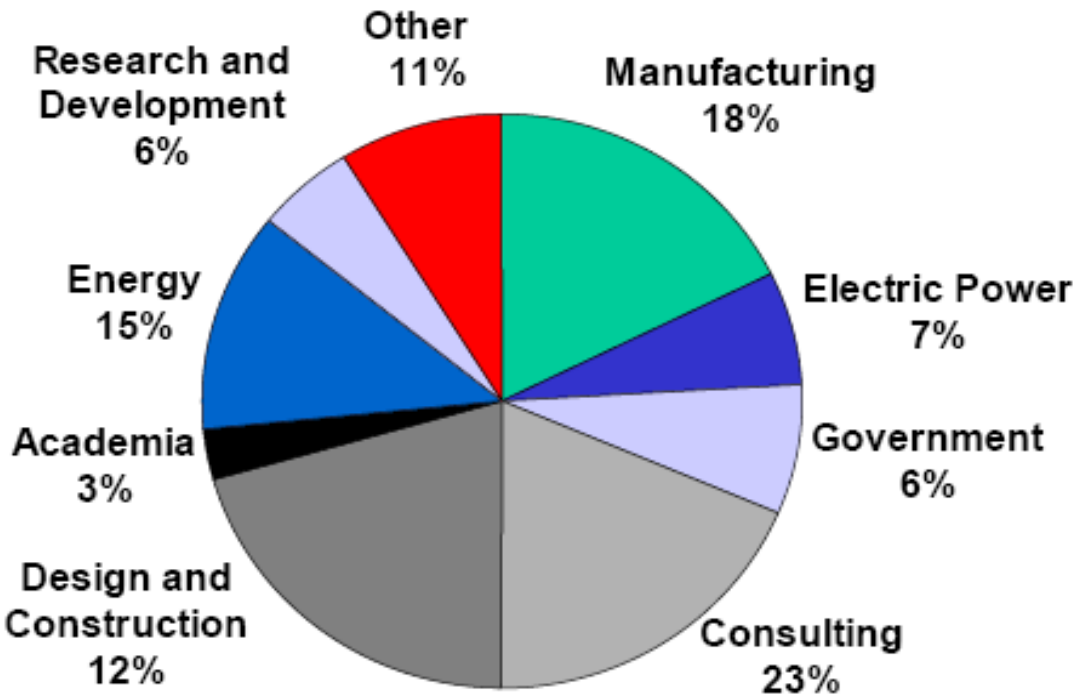
Workforce Solutions Depend on the Tasks!



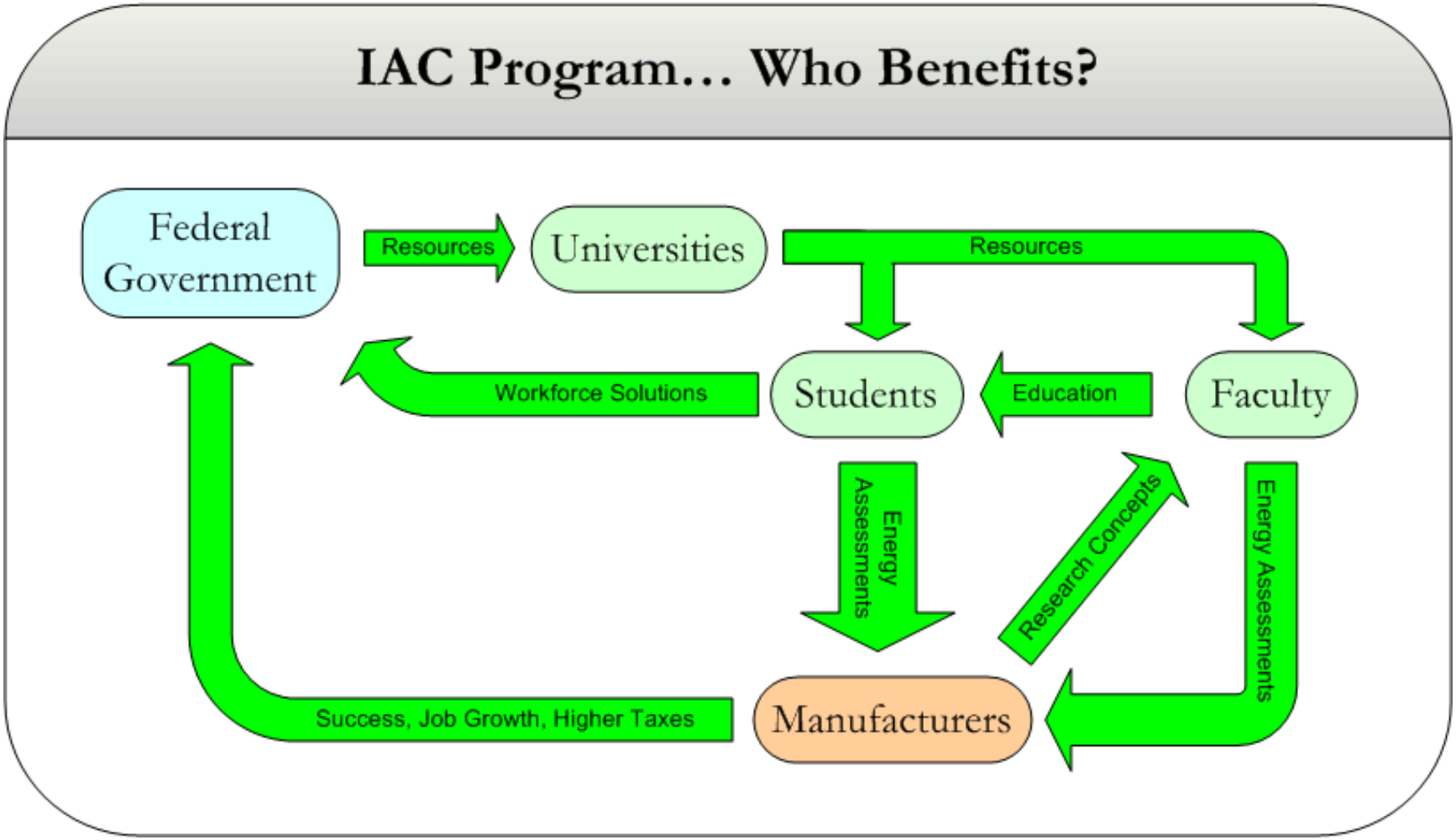
Does the IAC help with workforce issues?

2,500 alumni with 56% now working in energy related positions!

IAC Alumni Employment by Sector



The IAC Program is WIN-WIN



Management of the Program

- **Three levels of Management**
  - US Government – Department of Energy
    - Advanced Manufacturing Office (AMO) establishes policy and budget
    - DOE Golden Field Office manages contracts with the universities
  - Field Management – Rutgers University
    - provides technical oversight, center performance reviews, manages the database
    - Helps to publicize the program
    - Insures continuous improvement
    - Information transfer between DOE and the centers
  - Center Management – University
    - Universities do the work! -- Lots of local management needed

What makes a good center?

- **Faculty**
  - Somewhat rare skill sets
- **The University**
  - Size doesn't matter – support from dean etc. does
- **The demographics**
  - Easier if located in area with substantial manufacturing
- **The students**
  - NEVER A PROBLEM – LIMITLESS SUPPLY!

Faculty makeup

- **Hands-on…. Life in factories is rugged**
- **Faculty tend to be specialists – assessment work is for generalists**
  - Not necessary at the start – but a broad technical interest is a must
- **This is real problem solving – not theory**
  - Plants will spend money based on your recommendations
- **An interest in applied research problems is a benefit**
- **Two fully involved faculty is best, one is ok, a group is not good**
  - Experience is key – 5 faculty involved gain experience slowly

Benefits

- **How does it benefit the Faculty?**
  - Provides steady funding and income
  - Great opportunity to work closely with students
  - Often problems discovered at a plant leads to research

"Its in the factories where I get my ideas!"

Arvind Atreya,
Director of the IAC,
University of Michigan

Why is the IAC at Universities???

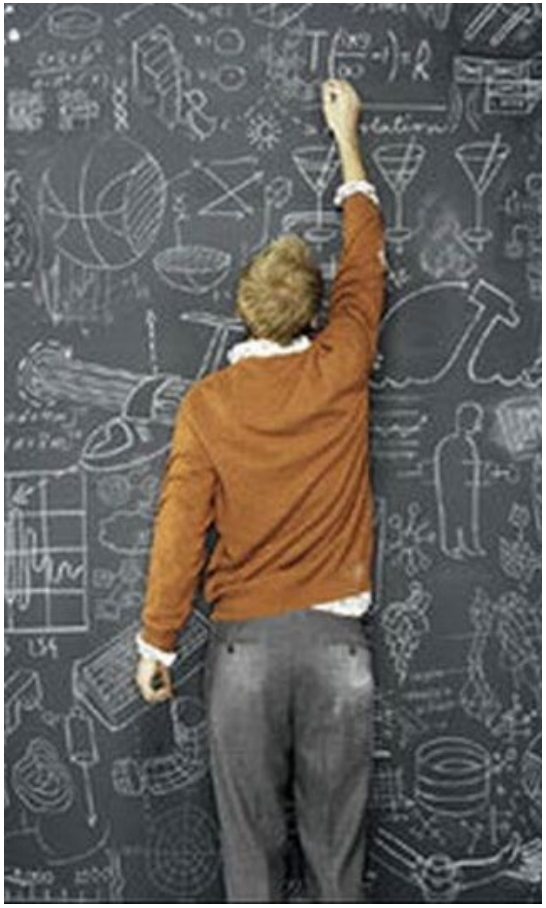
- **Could put it with ESCOs, lowest bidder**
  - Could hire students from nearby schools
- **Faculty provide creativity; technical competency**
  - Must rise above the “low hanging fruit”
  - Teaching faculty are empowered in the classroom
    - Look at the examples in Cengal’s many books – he was a center director at Nevada - Reno
- **Workforce training of creative students**
- **Independent opinions**
  - No “upselling” later

University Rationale for Having an IAC

- **Most universities have a commitment to their communities**
  - Three charges – Education, Research, and Service
  - Many centers are state schools
- **Hosting an IAC gives practical engineering experience to**
  - Students
  - AND faculty!!!
- **While not a research program, factory visits lead to**
  - Funding for research
  - Research ideas
- **BUT…. Practical work is not welcomed by everyone at a university who sees their role as only theoretical**

We are in the business of IDEAS

- **Energy efficiency and continuous improvement is about ideas**
- **If we are the first with an idea, it is unlikely to be implemented**
  - But if it is a good idea, management will hear it again.. and when they do, they may act
- **We warranty nothing but our best effort**
- **You are are probably the smartest person to visit this factory….**



Center requirements

- **Space for center**
  - Work stations, printer, student desks, cabinets
    - Should be a hangout for your students to study as well as work on IAC
  - 250 sq ft is reasonable… most centers have more
  - Sign on the door
  - Good way to get University buy in
- **Faculty and staff**
  - Only requirement is a director
  - Assistant director(s) a plus
- **Students**
  - The life-blood of a good center

The Center Director

- **PI on award; primary contact with DOE and Rutgers**
  - When there are Co-PIs someone must be designated
  - Change of Director requires approval of DOE
- **Directors normally will have tenure and an appointment in an ABET accredited engineering program**
- **Directors must lead a minimum of five assessments per year.**
  - DOE is anxious to have directors who are significantly involved in the base program
  - Avoid having bigshots who are not involved

Assistant Director(s)

- **Title awarded by PI**
- **Can have multiple Asst. Directors**
  - If you must, you can have an Assoc. director but that is confusing
- **Must be approved to lead assessments by DOE or Rutgers**
- **Must have faculty status**
  - Graduate students cannot lead assessments
- **Works best if Asst. Director can take over for the Center Director if, for example, the director takes a sabbatical leave**

Conflicts of Interest

- **ALL center personnel are**
  - explicitly prohibited from consulting for clients for a period of 2 years
  - should not take research funds, gifts, or other support from vendors of equipment
- **Clients who wish to have further work done can:**
  - Provide a gift to the university/center to cover costs
  - Support a senior design project
- **In most cases clients are referred to third parties as service providers**
  - We tell congress that our program creates MORE business for ESCOs, not less

Other Staff

- **Where funds allow, additional staff can be valuable**
  - Includes non-engineers such as experts in marketing, business, etc.
- **Must be approved to lead assessments**
- **Most centers use their IAC status to get additional funding from states and utilities**
  - This provides funding for full time staff
- **Consultants should adhere to all conflict of interest considerations which apply to full time staff**
- **Extra faculty tend to evaporate resources!**

The Center Student Assistants

- **A major focus of the program**
- **Can include both undergraduate and graduate students (typical numbers range from 6 – 20)**
  - Hopefully, a range of experience – the newer students learning from those more experienced
- **Students MUST be making satisfactory progress toward their degree**
  - Students can love IAC work so much that their grades suffer
- **Great students make this program run better**
  - Successful students like hands-on problem solving
    - Would have grown up working on cars a generation ago
  - I over-hire because I cannot pick during an interview

The Center Student Assistants

- **Students can help right away**
  - Usually enough money to get good students
  - Dining hall should not pay more
  - Not a good place to skimp
- **Advantages and Drawbacks of Graduate Students**
  - More Experienced, but more costly
  - Feeds the research needs of faculty
  - Often have language issues

How to budget

- **DOE thinks in terms of $$/assessment**
  - $10k - $15k per (depends on their budget ☺)
- **We do the best we can within budget constraints**
  - The job fits the $$, not the $$ fits the job!
- **Many schools take "off-campus" overhead**
- **Start by taking care of faculty**
  - Best to budget 3 person-days by lead faculty for each assessment
  - 7 Assessments = 21 days = 1 person-month
  - If faculty receive less than this, they disappear
- **Then add students**
  - Personnel budgets can be >50% students at good centers

Issues unrelated to the primary mission

- **Maintaining a web page and other PR activities**
- **Generating a client list**
- **Networking**
  - Strongly encouraged!
  - Our ability to follow through on good recommendations is limited
- **Future thinking in terms of staff**
- **Training, training, training**
- **Equipment purchase and maintenance**
- **Working within the university**
  - Faculty, deans, department turf
  - Using IAC as research funding

Center Evaluations

- **Schools do not voluntarily leave the program**
  - Perhaps one or two in 40 years
- **A number of schools have not be renewed**
  - Primary reason is that faculty were not sufficiently interested
    - Secondary reasons are metrics, failure to meet minimum requirements etc
- **Centers are evaluated in many areas**
  - A report card is created every quarter


Q & A

The IAC Industrial Assessment Process

The size and shape of assessments

- **Over time there have been a large variety of programs**
  - Walkthroughs can be done 4 to the day
  - Navy had a program with 40 people for two weeks
- **Our model involves primarily a one day site visit**
- **We also believe in an "integrated assessment"**
  - An "energy audit" grown up
  - Must be integrated to include waste and productivity (dangerous, otherwise)
- **Biggest difference is we include numbers!**
  - Savings estimates, implementation costs
  - Involves details which is good use of and for students

Parts of the assessment

- **Finding a client**
- **Pre-assessment activities**
- **One-day site visit**
  - Intake meeting
  - Plant tour
  - Student brainstorming
  - Data gathering
  - Exit interview
- **Report writing**
- **Follow up implementation report**

Client Solicitation

- **Many of our centers have a backlog of clients**
- **Marketing requires a plan/money**
  - Some centers hire business students
- **Remember, we are giving something away!!!**
- **Use your partners**
  - Key at the start!
- **Be seen**
  - Do presentations at industry group meetings
  - Write short notes for newsletters of other groups
  - Work with MEPs, Utilities, State Offices, etc
    - Develop relationships – this can be a long term program
  - Workshops are very good

Client Solicitation

- **Last resort - Cold Calling companies-**
  - Industrial directors are valuable
  - Make all students call – no one is above this dirty business
    - Some students will be better, some worse – yield!
    - Lower yield means making more calls – gets same results
  - Try to talk to plant manager
  - Don't leave messages
    - Students will not be there when call is returned
  - Alumnae are great!
- **If we find a qualifying company and get to talk to someone in authority (President, plant manager, the higher the better) we schedule about 50%**

Developing good clients

- **Management involvement**
- **Think about the funding of projects from day ONE**
  - Where will money come for a project?
  - How are capital projects managed?
  - Is there a history of using 3rd party financing?

Pre Assessment Activities

- **Begins when client has been identified and a date has been agreed upon**
- **Assemble the team – three unique jobs:**
  - Lead Student [required]
  - Safety Officer [required]
    - Talk to plant about safety concerns, steel tip shoes, ear plugs, etc
    - Lookout for team on assessment
  - Equipment Officer [recommended]
    - Most important job is putting the equipment away on return
      - HUGE issue
      - Breakage of equipment is major hassle

Pre-assessment information

- **Goal is to get as much info as possible before going to a plant**
  - This can be difficult, clients may resist giving too much info before a face-to-face meeting
    - Is this for real or a school field trip?
  - Energy bills are key
- **Allows insight into team assembly and equipment to bring**
  - Knowing timing of shift changes can be useful
- **Determine special needs for the assessment and any confidentiality or nondisclosure agreements which will need to be signed**

Pre-assessment information

- **Don't forget – if it is a no-go, best to do it before you drive**
  - Plant does not qualify
  - Plant will not be in operation during visit
  - Plant has rules which will prohibit a good assessment

In-house meeting with the team

- **Have day-before pre-assessment meeting**
  - Early morning starts makes same day meetings undoable
  - Brief student team by lead student or others
    - Great teaching opportunity
  - Get special safety issues and general awareness
  - Process description
    - What has worked for similar plants
      - Past Experience
      - IAC Database
      - Plant Problems
  - Equipment issues
    - Prelaunch data loggers
    - Check batteries
  - Check DOE Tools, cds, handouts to give to clients

Students need to be told

- **Leather-soled shoes if possible**
- **No Tee shirts that could offend**
  - Some centers buy shirts
- **No language that could offend**
- **Think before setting things down in the plant**

The site visit

- **Normally consists of**
  - Intake meeting
  - Plant tour
  - Post tour debriefing
  - Assessment team brainstorming
  - Measurements and data gathering
  - Exit Interview

The site visit (cont)

- **General goals**
  - Allow management to see potential for
    - Energy projects that make economic sense
    - Developing green attitude throughout chain
    - Using outsiders to generate and support good ideas

The site visit (cont)

- **Pre-visit issues**
  - Much teaching can be done during drives
  - Additional assignments for team
    - Scribbler
      - Assistant Scribbler
- **Be on time – but if you are early walk/drive around the plant**
  - Lots of ideas can come from looking at the outside

Safety

- **Best to come with equipment that shows you understand safety**

Safety (cont)

- **Safety needs to be #1**
  - It is not ok just to talk about it – team needs to understand it
  - We have a great safety record - only one injury in 40+ years
    - Was a faculty member
- **We wear hard hats even if not required**
  - Good way to find your people in a plant
  - Shows workers you are visitors
- **We buy students their own safety glasses – they have to replace if lost**
- **Often plants have their own safety rules**
  - Can be a deal killer which is why you need to talk about this before the assessment
- **Insurance**
  - We never bring guests on assessments
    - Always paid workers so they are covered under workman comp

Intake meeting

- **Primary purpose is to review plant operations and the use of energy consuming equipment**
  - Plant floor is too noisy for this
  - Can be time consuming – don't rush this part
    - Normally management wants to get out there and show you things!
- **Explain the IAC program, AMO, EERE and other programs, products and services available to them**
  - Make it clear that this is funded by DOE
  - Students are a critical part of the program
    - Include that students are paid

About Confidentiality

- **We protect all information about our visit to the client except**
  1) Data from the assessment is contained in a database without referencing the company name
  2) A company must be willing to have itself identified as having had an assessment
  3) A copy of the assessment report is sent to Rutgers for Q/A
     - We are not required to keep the reports
- **Clients can restrict our access to certain parts of their plant for proprietary issues**
  - But don't encourage that; normally there is little "new" out there
- **Most important data? How busy are you?**
  - Business volume will predict how you hand pricing

Intake Meeting (cont.)

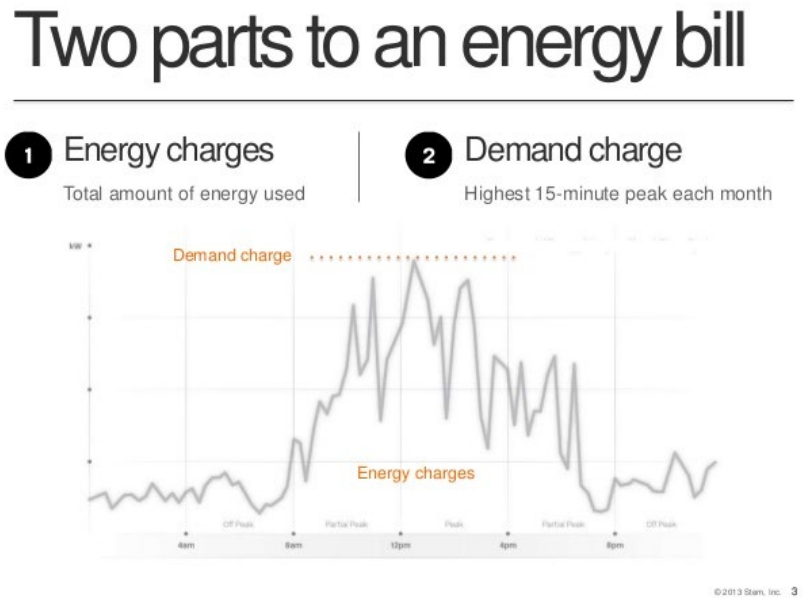
- **This is the time to establish a rapport with the manager**
  - Understand that opportunities you see may be viewed as criticism
  - Spend a little time showing your credentials
  - You are going to ask these folks to spend money on your ideas
- **My approach: Don't let students conduct the interview**
  - Now is the time to assert your expertise
  - Not expertise in their process, but in our process
  - This assessment style is the "gold standard"
    - – copied around the world
- **Others centers allow students to lead interview – Your call**

Intake Meeting (cont)

- **Learn about management strategies**
  - Product yields can be tricky
    - Yield as normalized to “Benchmark”
  - Internal versus external scrap rates
- **Examine “burden” or overhead accounting**
  - Processing costs should be distributed to those who consume them.
  - Internal business units, set up to allow local accounting can ignore energy and waste costs
- **Look at potential for SMART**

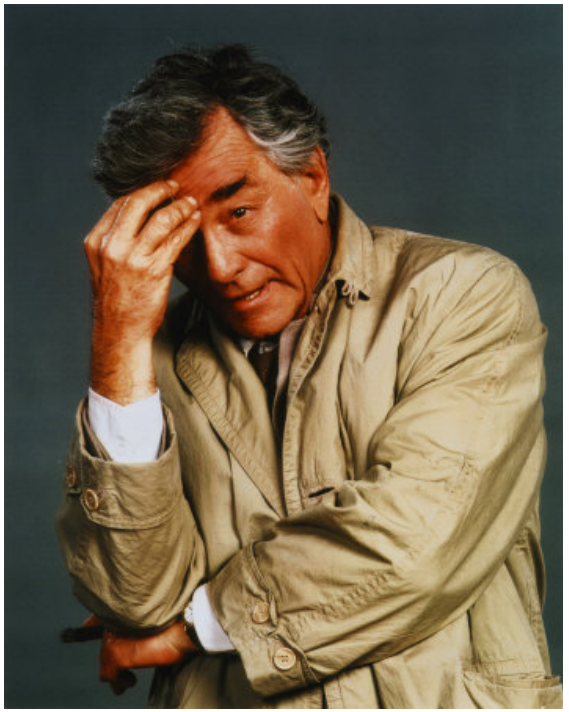
Intake Meeting (cont)

- **Discuss energy procurement**
  - What rate schedules or tariffs are they on?
  - Do they pay demand charges, power factor penalties etc.
  - Are they using curtailable natural gas? Why or why not…
- **Sometimes plant folks don't know important stuff**
  - "What is a demand charge"
- **Can they participate in a demand reduction program?**



Being Dumb

- **Why can someone who is new to a plant or process be of use?**
  - Or
- **Why don't you get a 30 year expert in your process to do the assessment?**



Being "Columbo" makes a plant rethink their set ideas

What may seem to be a waste of time can produce major improvements!!!

Intake Meeting (cont)

- **Near the end of the intake meeting:**
  - Ask management for a diagram of the facility
    - Often a map for fire safety is good enough
    - Hard to remember after a few days
  - Discuss the plan for the rest of the day
    - Plant tour is fine – but they should know you need time to work
  - Have management give you a space to work
    - Often where you are doing the intake meeting
    - Indicate that normally the team spend time on their own brainstorming
- **Always have some "leave behinds"**
  - Center brochure
  - Info on Cybersecurity
  - Other DOE/Center/University activities of Interest

Plant tour

- **Let management do it any way they wish – they have given plenty of tours**
- **First chance to see if management knows what is on the plant floor**
  - Don't be surprised if things are different than you were told in the intake meeting (Usually a great lead!)
- **Hard to hear**
  - If the team is large, it is best to assign one person to ask questions of the plant manager
    - Too often different people ask exactly the same question
  - Some teams like radios so that all can hear

- **Normally we move from <u>raw goods</u> through process to <u>finished goods</u>**

Plant tour (cont)

- **Working tour – looking for problems, opportunities**
  - General plant cleanliness
  - Attitude of workers
  - Unattended equipment
  - Maintenance issues
  - Hot, uninsulated surfaces
  - Loud stuff that should not be that loud
  - Control systems – use of manual overrides!!!
  - Note how much inventory is on hand
    - (raw materials, in-process, and finished)

- **We always collect "best practices" Can be tough in some places – easy in most**
  - Anything they are doing well
  - List during this outtake meeting and in any reports

Time Management is Essential

- **During assessments – we have only one day**
- **Training.. Training.. Training**
  - Using senior students to train new ones
  - The better trained, the more efficient the teams
- **Bigger staffs should make things easier**
  - Can go the other way

The site visit (cont)

- **Debrief and brainstorming**
  - Normally by this time it is best to get away from management so your team can catch up
  - Lunch away from the plant is a good idea
  - Stupid question time
    - You are trying to impress management – save dumb questions until you are by yourselves
- **We start by everyone sharing general observations from the tour**
- **Then we normally we develop three lists**
  - Potential Ideas for savings (if written up, we call them assessment recommendations – “ARs”)
  - Measurements or data needed to evaluate those ideas
  - Questions for management

Debrief and brainstorming

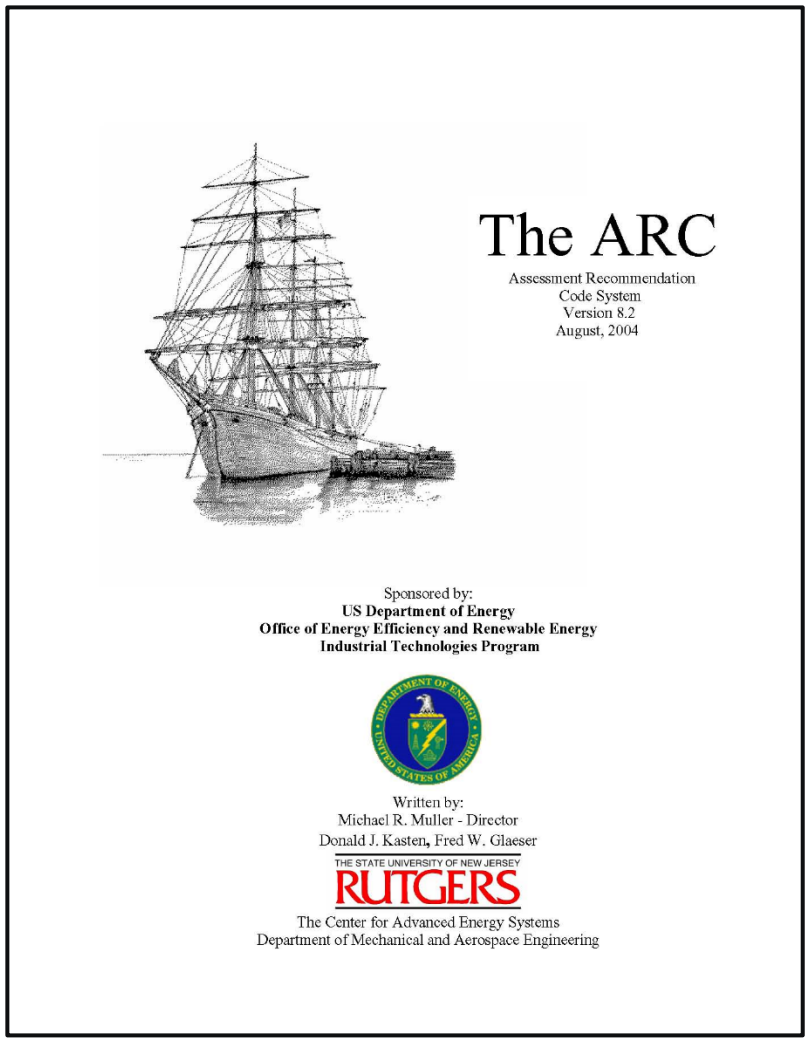
- **Different students manage each list**
- **There should be more ideas than you expect to write up**
  - 20-25 is not unusual
- **Develop an action plan for the rest of the day**
  - Assign team members specific tasks
    - Some personal preference as how this is to be done
      - We recommend against making any students “specialists”
      - Decisions on which recommendations to write up normally comes later
    - Pair Team members for efficient data gathering
  - Make plans to meet back at a central spot at a given time

The site visit (cont)

- **Use notes from all team members as a source of generating ideas**
  - Common practice to let newest student go first and work through the team in reverse order of their experience
  - No bad ideas at this point
- **Management sometimes insists on being present for this, but normally this is a bad idea**
  - Too much turf
- **Take as much time as possible with this step**

Brainstorming

- After the lists are generated, go around again!
  - Best ideas come after awhile
- We bring other resources to help with ideas
  - Use the ARC manual
    - Our recommendation coding system – but a nice resource to have in the plant
  - Use the database
    - Online access by phone if necessary



Measurements and data collection

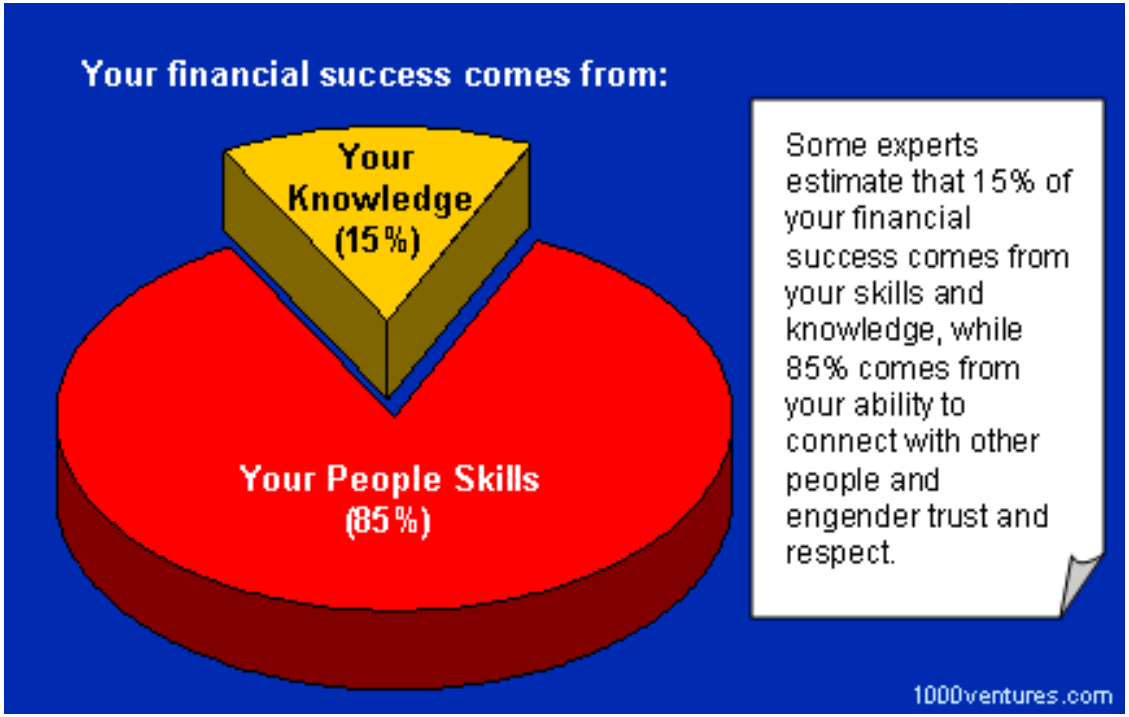
- **Key to program success**
  - Useful for payback calculations
  - Shows plant something they have not seen
- **Much of the work involves counting and collecting nameplate data you will need later**
  - Data sheets for common systems helps make sure data gets collected
  - We use them for lighting, compressed air, cooling towers, and HVAC

Measurements and data collection

- **You need to make sure you have enough information to analyze potential projects and predict paybacks!!**
  - Annoying to everyone if you have to call the company time after time because you are missing data
  - Can be challenging at the start, it will get easier
- **If you are done early, don't leave the plant**
  - Use this time to start working on the report
  - Sometimes you might have additional questions that you come up with that could be easily answered

People skills will be needed

- **Many of our recommendations are remedial in nature**
- **Good ideas come from all parts of the plant – need to harvest them all!**
- **Students chatting with plant folks can reveal a ton**



Wrap-up Meeting

- **Schedule a wrap-up meeting at a convenient end of day time**
  - I think 30 minutes is plenty
  - Other centers make it a longer meeting
- **Tell them what you are working on**
  - Good way to avoid writing something up that they are against
    - Waste of time for everyone!
- **First chance to sell ideas**
  - Always best to sell in the first person (“here is what I would do”)
- **If I am dirty or sweaty, good – shows that I have seriously studied their operation**

Wrap-up Meeting

- **Start with the best practices you have seen**
- **Present the list of project ideas your team has identified**
- **Ask plant personnel to prioritize the opportunities your team identified – what recommendations do they feel as being valuable to them?**
  - Ask if they have tried any of the ideas and the outcome of the project
- **Some centers use students to make the pitch and/or prepare powerpoint presentations**

Ideas

- **Your ideas may get push back**
  - "Not how we do things here"
  - Recommendations can be remedial – someone is already supposed to be doing this stuff
  - Turf
- **Often ideas come out which are new to management**
  - These are the best outcomes – but will often not be implemented!!!
  - When others make a similar recommendation, it will happen
- **My goal – make sure that management understands the idea**
  - On going back to plants I often find that some of my best recommendations were not well understood

Be sensitive if you can

- **If you and the plant disagree**
  - Best to listen – no one wants to see a project written up which management has already vetoed
  - Sometimes I do it anyway – if I think that eventually they will come around and I want my report to be the first
- **Don't write up projects which the plant is already planning to do**
  - They resent you taking credit
  - Exception: sometimes your writeup can help get projects going which they already know are good

End of the Assessment

- **Inform them that you will follow-up with them periodically and that the report would be sent to them within 60 days.**
- **Inform them about the implementation follow-up**
  - Formal review of the actions as a result of the report
  - Usually 9 months to a year after assessment

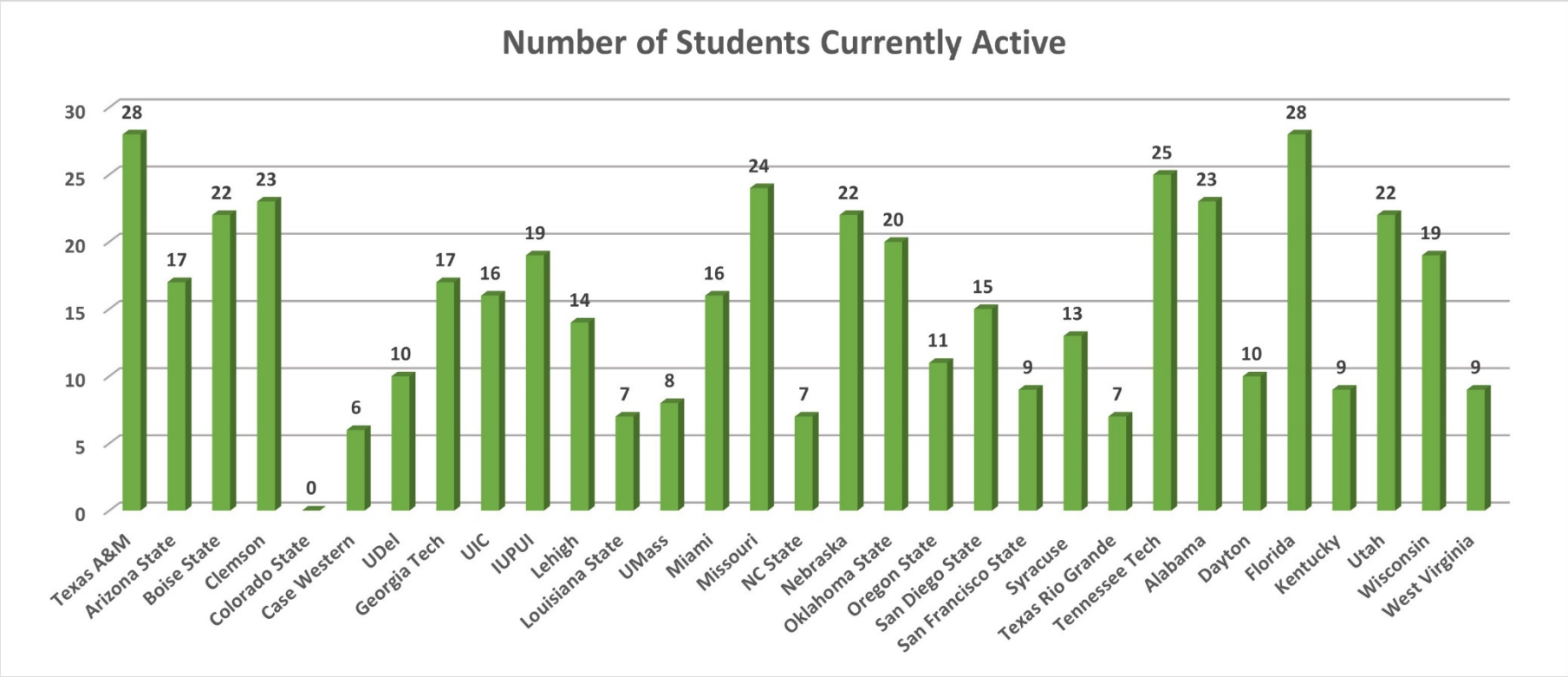
The site visit (cont)

- **Post Assessment Activities**
  - After even one or two assessments, it becomes clear that anything not not written down will be forgotten
  - Equipment needs to be stowed carefully – but the team is exhausted…
    - Good reason to have equipment officer
  - Aggressive analysis and report writing plan needs to be developed
    - Often plant management is energized by the site visit so you must act quickly


Q & A

The IAC Student Experience

Breakdown: 75% undergraduate 25% graduate



Role of the student in the IAC

- Communicate with clients
- Participate in assessments
- Identify energy saving measures at a plant
- Write recommendations with focus on implementation
- Analyze energy bills, rate structures, and energy usage
- Understand needs of energy end user

Students gain job experience

- **Develops students written and oral communication skills**
- **Emphasizes team work skills and benefits of group work**
- **Exposes students to office environment**
  - Punctuality
  - Meeting deadlines
  - Following guidelines
- **Gives students responsibilities**
  - Independent research and problem solving
  - On site tasks
  - Recommendation and report writing

Diversity is a plus

- **Our program gathers students from various disciplines**
  - IACs housed in Mechanical, Aerospace, Electrical, Industrial, Manufacturing, Computer Engineering Departments
- **Centers themselves bring together students with various focuses**
  - Students enrolled in BS, MS, MEng, PhD and MBA programs
- **A major effort is WE^2 (women in energy engineering)**

IACs enhancing engineering school curriculum

- **The IAC's continue to impact their home universities with improvements to the student experience and curricula**
- **Graduate programs are plentiful:**
  - Master's degree program in Energy Conversion and Thermosciences at Colorado State University
  - Master's program in Clean and Renewable Energy by the University of Dayton.
- **Most programs match theory with practical experiences**

Advancing the deployment of an accredited energy engineering degree

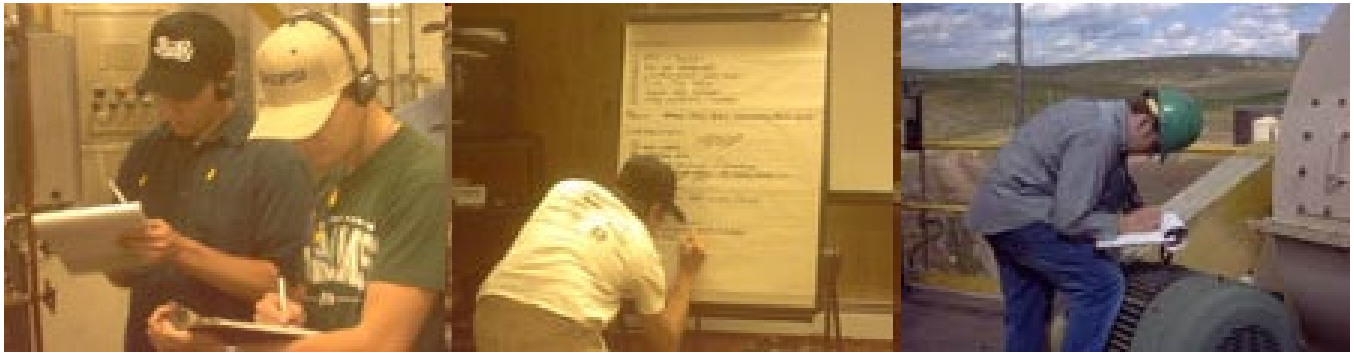
- **IACs have shown the tremendous value of both identifying and training students in energy engineering**
  - But workforce needs dwarf the number of students we can supply
- **DOE recognizes this and is committed to seeing an increase in ABET accredited energy engineering programs at engineering schools**
- **IACs are involved in articulating**
  - The rationale
  - The multidisciplinary components
  - Integration with other engineering programs
  - Identifying professional societies to endorse them

How do we train students to be leaders in the energy field?

The Ideal Student Experience

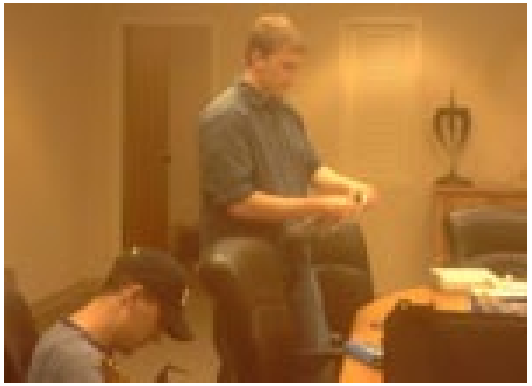
Start students early on

- **Students typically are employed by a center for 1 year**
- **Longer employment period would allow for mastery of skill set**
- **Start employing students early on**
  - Even before they have had core classes (i.e. thermodynamics, heat transfer)



Develop leaders by giving leadership roles

- **Currently, each assessment has**
  - Lead student
  - Lead safety engineer
  - Equipment manager
- **Added responsibilities given to senior students**
  - Bigger role in AR identification
  - Assign more difficult ARs (i.e. renewable energy, CHP, etc)
  - Correspond more with client
  - Incentivize with higher pay



Developing leaders: student mentors

- Senior student teams with one junior student
- Senior student can explain science behind a recommendation
  - Often students learn better from each other than from professors
  - Senior student solidifies knowledge by being able to teach

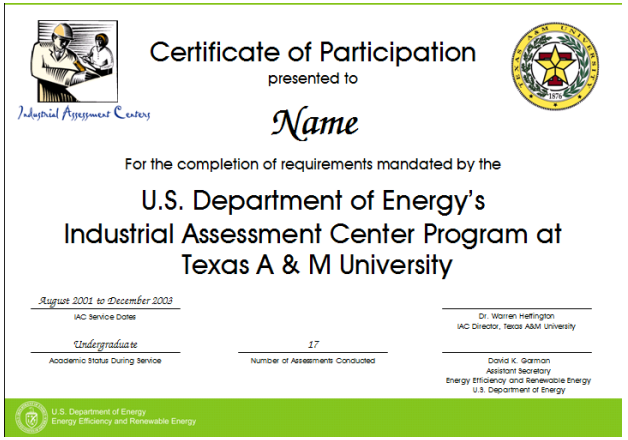
Develop wide skill set in each student

- **Tempting and easy to make students specialist in one system (i.e. lighting, compressors)**

- **Ideally, students would have worked with all systems**
  - Gives students wider perspective, larger skill set and makes them better trained for post graduate employment



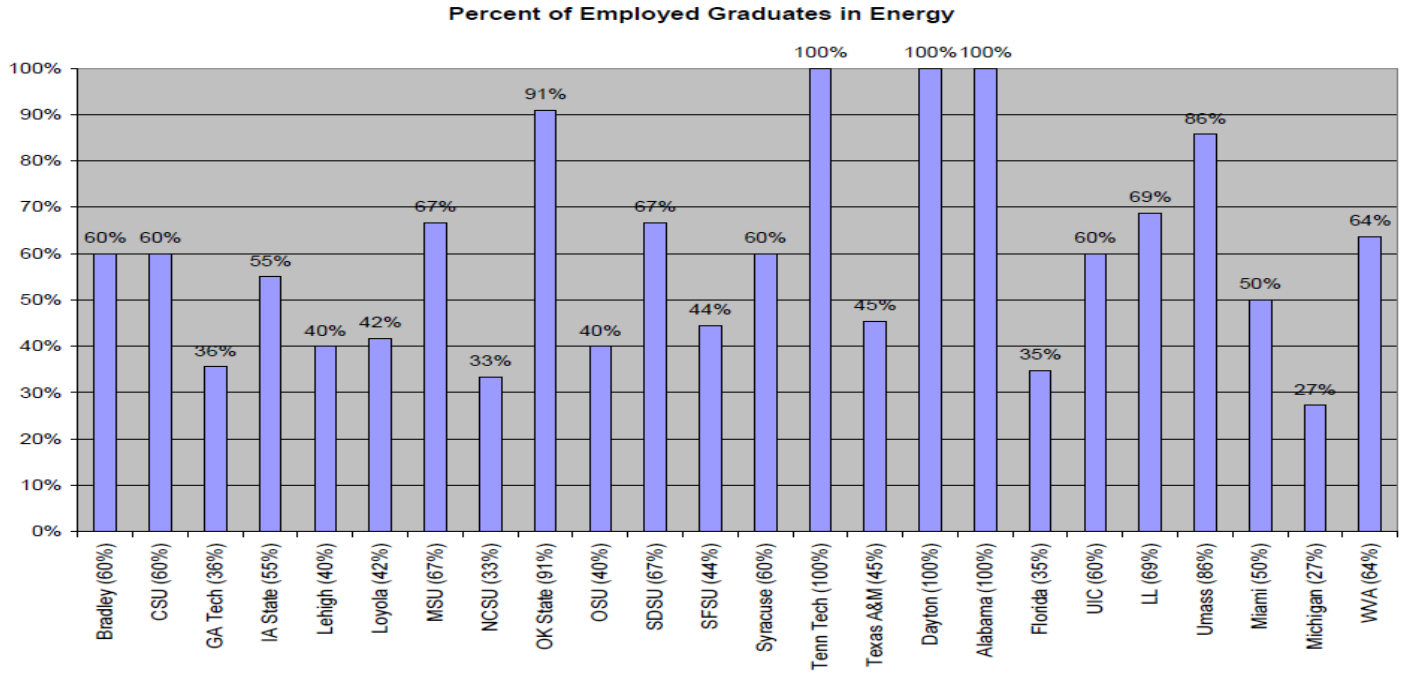

Reward students


Certificate of Participation
presented to
Name
For the completion of requirements mandated by the
U.S. Department of Energy's
Industrial Assessment Center Program at
Texas A & M University
August 2001 to December 2003
IAC Service Dates
Undergraduate
Academic Status During Service
17
Number of Assessments Conducted
Dr. Warren Heffington
IAC Director, Texas A&M University
David K. Garman
Assistant Secretary
Energy Efficiency and Renewable Energy
U.S. Department of Energy
U.S. Department of Energy
Energy Efficiency and Renewable Energy

- **Currently, students receive a certificate after completing a minimum number of assessments**
  - In 2020 we awarded 153 certificates
  - 32% of the students in 2020 departed with a certificate
- **There is a yearly student research competition**
  - Students propose assessment inspired research
- **Video competition to help with training**

After graduation: IAC in the workplace

- **61% have energy or energy efficiency responsibilities**
- **50% have productivity improvement responsibilities**
- **38% have waste minimization responsibilities**




Q & A

Center Metrics and Resources

For the last section I get some help ☺

Kelly Baber is a Senior Mechanical Engineer at CAES – coordinates much of our quality assurance activities for the IACs and will talk about the report critiquing process

Michael B. Muller is the principal at Analytical Energy Solutions and manages data and supports the web presence for the IAC program. He will talk about the database, program metrics, and other useful resources

RUTGERS CAES
THE STATE UNIVERSITY OF NEW JERSEY
CENTER FOR ADVANCED ENERGY SYSTEMS

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

How to Assemble a Team and Run a Center

The meeting will start in:

Critiquing Process

Purpose of Critiquing

- **To ensure the readers can understand all suggestions**
- **To clarify any misunderstandings**
- **To ensure all values are reasonably and correctly calculated**
- **Not to question the center's understanding of a technical topic**
- **Swap critiquers**

Submission

- **Enter Internal Information & Data**
- **Upload Report**
- **Await a Returned or Approved Critique**
  - <5 days

Assessment	Status	Days Waiting
RU0174	Uploaded	0

	Pending	Average Response Time	<<-- Most recent [Days to respond] Oldest -->>
AS	-	0.5	1 0 0 0 1 0 0 0 0 0 0 0 1 1 0 3 2 0 0 0
GT	-	3.1	0 3 0 1 2 1 1 0 2 1 7 12 8 3 0 4 3 4 1 8
RU	1	2.1	4 0 1 5 3 5 3 0 2 7 1 0 1 0 0 7 1 0 1 0
LS	-	0.8	1 1 0 0 0 1 0 0 2 0 0 1 0 0 0 1 0 0 8 0
MA	-	1.3	0 3 0 0 0 2 1 0 0 0 0 0 5 5 6 0 1 0 0 3
NC	-	3.4	3 0 4 5 1 0 0 4 0 23 9 0 6 0 1 8 2 2 0 0
NL	-	4.9	0 14 16 1 2 6 8 0 2 8 2 7 6 2 6 1 8 7 1 1
SU	-	1.4	0 4 0 3 1 0 0 4 1 3 2 0 4 0 3 0 0 3 0 0
UA	-	1.3	0 0 4 0 0 0 0 0 0 4 0 2 1 0 6 0 7 0 1 0
UU	-	1.2	1 4 3 2 0 0 0 0 1 2 0 0 1 0 2 6 1 0 0 1
WV	-	0.1	1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0

Critique Status: **Being Critiqued**,

General Information Update

SIC 8221 | Colleges And Universities	
NAICS 221330 | Steam and Air-Conditioning Supply	
Annual Sales ($)	$1,502,711 per year
# of Employees	750
Plant Area (sqft)	186,185 sqft
Principal Products	Some product description here
Annual Production	17,071 Units
Annual Production Hrs	8,760 hrs
Air Compressor HP	40 hp
Max Compressed Air Pressure(PSIG)	150 psig

Assessment

Faculty Participants	Stud
LEAD: Dr. Directors Name	LEA
Assistant Director Name	SAFET

Plant Energy Usage Update

Source	Usage	Unit	Yearly Cost	Unit Cost
Electricity Usage	4,467,242	kWh	$279,307	$0.063
Other Energy	17,071	MMBtu	$155,416	$9.104
TOTAL:			$434,724	

Plant Water/Waste Usage Update

Source	Usage	Unit	Yearly Cost	Unit Cost
Water Usage	7,318	Tgal	$23,263	$3.179

Energy Usage for RU0174

	Consumption		Cost
Electricity Usage	4467242	kWh	279307.4

Water/Waste for RU0174

	Consumption		Cost
Water Usage	7317.99	Tgal	23263.16
Water Disposal	0	Tgal	0
her Liquid (non-haz)	0	gal	0
her Liquid (haz)	0	gal	0
lid Waste (non-haz)	0	lb	0
lid Waste (haz)	0	lb	0
aseous Waste	0	lb	0

Save All Energy/Waste Information

Recommendations + Add Recommendation

#	ARC	Description	Savings	Cost	Payback			
1	2.7142	UTILIZE HIGHER EFFICIENCY LAMPS AND/OR BALLASTS	$29,504	$139,394	4.7	Update	↓	Delete
2	2.1223	INSTALL SMALLER BOILER (INCREASE HIGH FIRE DUTY CYCLE)	$24,060	$178,852	7.4	Update	↑↓	Delete
		Payback is Greater Than or Equal 5 Year			7.43			
3	2.7135	INSTALL OCCUPANCY SENSORS	$21,297	$130,130	6.1	Update	↑↓	Delete
		Payback is Greater Than or Equal 5 Year			6.11			
4	2.4239	ELIMINATE OR REDUCE COMPRESSED AIR USAGE	$744	$200	0.3	Update	↑↓	Delete
5	2.4111	UTILIZE ENERGY-EFFICIENT BELTS AND OTHER IMPROVED MECHANISMS	$476	$1,925	4.0	Update	↑	Delete
		APPROXIMATE TOTAL (understanding savings potentially overlap)	$76,081	$450,501				

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Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

Industrial Assessment Center

Energy Conservation & Waste Management Assistance for Industry
A U.S. Department of Energy Sponsored Program

XYZ, The State University of ZYX

Assessment Date:	June 9, 2016
Location:	Atlantis
Report Date:	August 9, 2016
Principal Products:	Metal Heat Treating
SIC/NAICS Number:	3398/332811

Authors

Captain Morgan:	Director (Principal Auditor)
Davey Jones:	Assistant Director
Leif Erikson:	Graduate Student Engineer (Student Lead)
Smitty Jensen:	Undergraduate Student Engineer (Safety Coordinator)
Edward Teach:	Undergraduate Student Engineer

Report Number: XY0492 (Sample Report)

Sponsored by Poseidon, King of Seas

Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

XYZ, The State University of ZYX
Center for Energy Efficiency Studies
XY Industrial Assessment Center
Town Address, NJ 08854

RUTGERS/CAES

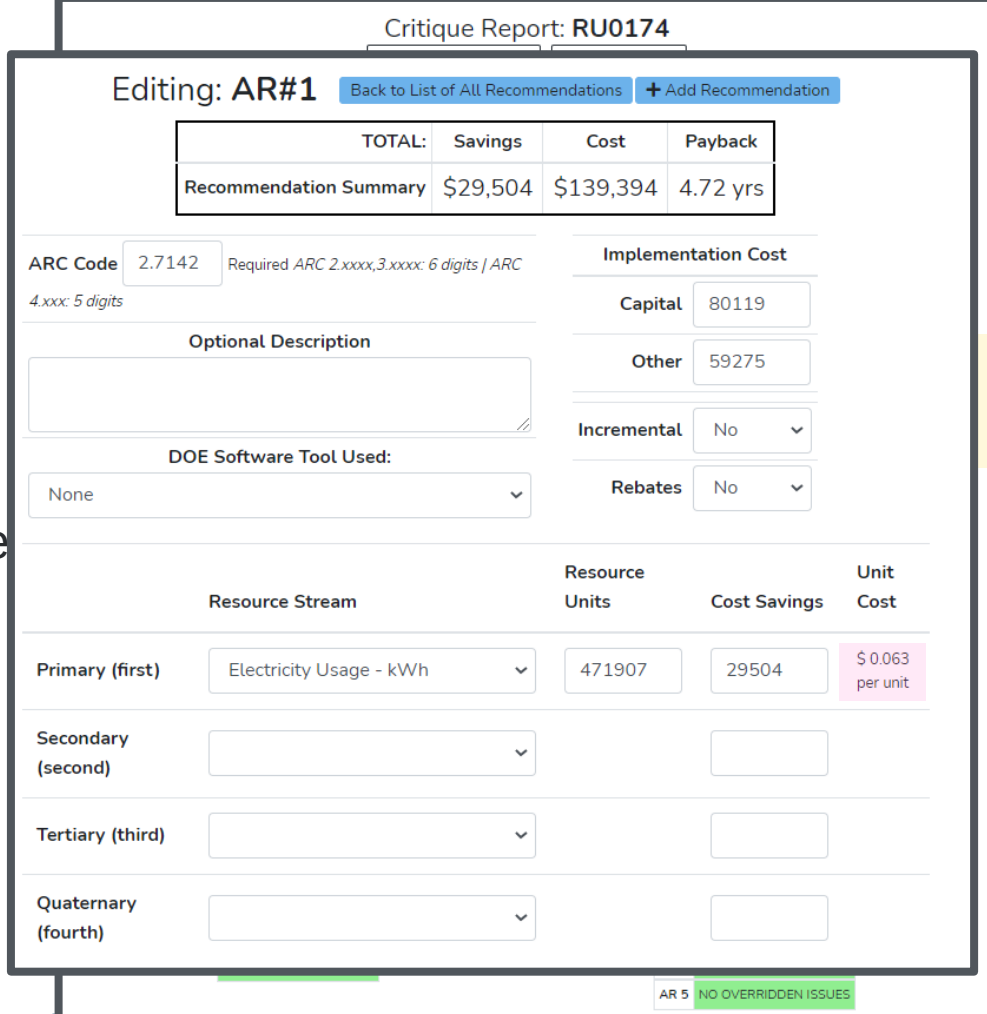
Industrial Assessment Center
U.S. DEPARTMENT OF ENERGY

Required Sections

- Cover Page
- Disclaimer
- Preface
- Table of Contents
- Executive Summary
- Plant Description
- Process Description
- Best Practices
- Energy Cost Analysis
- Major Energy Consuming Equipment
- Energy Management / Additional Resources
- Assessment Recommendations
- Other Energy Efficiency Measures / Additional Recommendations

Critiques

- **Comments vs. Observations**
- **Flags**
  - Manual Flags
  - Auto-flags
    - Breaks a direct Report Guideline
      - NAICS/SIC Code
      - Electricity bill limits
      - Plant size thresholds
      - Payback length limits
    - Database value discrepancies



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WV	-	0.1	1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0

Questions?

IAC Database

Michael B. Muller