

Bradley University

Industrial Assessment Center



**Energy Efficiency, Waste Minimization,
and Productivity Enhancement**

Today's Agenda



- About Bradley University
 - About the Bradley IAC
 - BU IAC personnel
 - Research interests
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Bradley University

Peoria, Illinois



- Independent, private, coeducational institution founded in 1897, located on an 85 acre campus
- Approximately 5,300 undergraduate and 800 graduate students
- More than 100 undergraduate and 14 graduate programs in five colleges

Bradley University

College of Engineering and Technology



- Approximately 800 students
 - Six ABET-accredited programs in four departments
 - Civil Engineering and Construction
 - Electrical and Computer Engineering
 - Industrial and Manufacturing Engineering and Technology
 - Mechanical Engineering
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Bradley University

College of Engineering and Technology



- Home to NIST Manufacturing Extension Partnership (MEP) for downstate Illinois – Illinois Manufacturing Extension Center (IMEC)
 - IMEC offices located next door to BU IAC
 - Strong interaction between BU IAC and IMEC
 - Cross referral of clients
 - Joint assessment visits
 - Cross-training of personnel
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Bradley University

Department of Mechanical Engineering



- 262 undergraduate and 64 graduate students
 - 12 faculty members; D. Paul Mehta, chair
 - ABET accredited
 - Engineering Practicum program provides students on site experience at companies such as:
 - Caterpillar Inc.
 - Deere & Company
 - The Boeing Company
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IAC Background



- Sponsored by the Department of Energy.
 - One of 26 Centers throughout the country.
 - Initiated October 1, 1993.
 - >70% of BU IAC employees possess Bachelors or Masters of Mechanical Engineering.
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Bradley University IAC Personnel



Dr. D. Paul Mehta - Director



Dr. David Zietlow - Assistant Director



Dr. Dean Kim - Assistant Director

Martin Wiesehan - Staff Engineer

Lead Student – Jordan Stiebel

IAC Clients



- Gross annual sales of <\$100 million
 - Energy Consumption: \$100K < \$2M per year
 - Employees: <500 people
 - Standard Industrial Code: 2000-3999
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Industries Served by BU IAC



- Lumber & Wood Products
 - Paper Products
 - Petroleum
 - Plastics
 - Printed Matter
 - Rubber Products
 - Scientific Equipment
 - Textiles
 - Transportation
 - Apparel
 - Chemicals
 - Concrete
 - Electrical/Non-Electrical Machinery
 - Metal Fabrication
 - Farm Machinery
 - Furniture
 - Glass or Ceramic Products
 - Leather Goods
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Bradley University

Industrial Assessment Center



- Established in 1993
 - Completed over 330 assessments
 - Issued over 2,500 energy, 500 waste, and 300 productivity recommendations
 - Over \$45 million in savings recommended
 - Implementation rate (in \$) of 62% over last four years
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Bradley University Industrial Assessment Center



Performance Summary - Bradley University Industrial Assessment Center - 2002-2006

			Recommended	873	928,976	6,628,901	131	768,740	98	7,841,243	1,102	15,592,510
94	Fiscal Years 2003 thru 2006	90	Implemented	448	478,387	3,377,180	72	466,746	45	5,693,665	564	9,647,575
			% Implemented	51.3%	51.5%	50.9%	55.0%	60.7%	45.9%	72.6%	51.2%	61.9%
				Energy			Waste		Productivity		Totals	
Audits	Fiscal Year (September - August)	Imp Upload Accepted	Status	# of AR's	MMBTU's Saved	\$ Saved	# of AR's	\$ Saved	# of AR's	\$ Saved	# of AR's	\$ Saved
20	2005-06	17	Recommended	154	133,563	1,575,669	9	122,933	7	2,050,558	170	3,749,160
			Implemented	73	71,523	758,553	2	42,797	3	1,728,340	78	2,529,690
			% Implemented	47.4%	53.6%	48.1%	22.2%	34.8%	42.9%	84.3%	45.9%	67.5%
22	2004-05	22	Recommended	187	138,616	1,397,910	18	315,271	17	2,925,046	222	4,676,614
			Implemented	109	74,468	767,594	10	216,706	9	2,672,664	127	3,656,964
			% Implemented	58.3%	53.7%	54.9%	55.6%	68.7%	52.9%	91.4%	57.2%	78.2%
25	2003-04	24	Recommended	258	260,438	1,639,572	44	330,536	29	1,282,679	331	3,253,249
			Implemented	143	180,469	1,147,226	32	207,243	17	704,434	192	2,059,365
			% Implemented	55.4%	69.3%	70.0%	72.7%	62.7%	58.6%	54.9%	58.0%	63.3%
27	2002-03	27	Recommended	274	396,359	2,015,750	60	314,568	45	1,582,960	379	3,913,487
			Implemented	123	151,927	703,807	28	109,313	16	588,227	167	1,401,556
			% Implemented	44.9%	38.3%	34.9%	46.7%	34.8%	35.6%	37.2%	44.1%	35.8%

**Bradley University
Industrial
Assessment Center**

Year	Number of Reports	Value of Recommendations		Value of Implementations	
		MMBtu	Dollars	MMBtu	Dollars
FY 2007	13 (#317 - #329)	through 7/11/2007			
		88,862	1,316,159		
FY 2006	20 (#297 - #316)	133,563	3,749,160	71,523	2,529,690
FY 2005	22 (#275 - #296)	138,616	4,676,614	74,468	3,656,964
FY 2004	25 (#250 - #274)	260,438	3,253,249	180,469	2,059,365
FY 2003	27 (#223 - #249)	223,023	3,878,948	56,666	1,250,315
FY 2002	25 (#198 - #222)	164,902	2,721,052	29,826	441,562
FY 2001	22 (#176 - #197)	150,245	3,733,699	92,136	1,476,134
FY 2000	25 (#151 - #175)	89,329	6,971,758	62,353	4,713,199
FY 1999	25 (#126 - #150)	102,157	3,867,710	68,498	2,575,184
FY 1998	25 (#101 - #125)	107,452	2,788,427	46,525	839,025
FY 1997	25 (#76 - #100)	121,872	3,768,196	45,152	1,368,724
FY 1996	30 (#46 - #75)	115,637	1,626,156	57,818	705,999
FY 1995	30 (#16 - #45)	104,083	793,041	33,850	275,266
FY 1994	15 (#1 - #15)	160,699	814,759	30,908	197,186
Total	329	1,960,878	43,958,928	850,192	22,088,613



BU IAC Impacts On Education



- Over 100 students have been employed.
 - Students gain valuable experience.
 - Increases students' chances for employment.
 - Salaries offered were higher.
 - Improves quality of in-class instruction.
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BU IAC Cost Saving Ideas...

= Good Investments



- No Out-of-Pocket Cost to the Manufacturer.
 - Analysis is performed by Faculty and Students and paid for by the Department of Energy.

 - Manufacturers Achieve...
 - Internal Rate of Return (IRR) typically greater than 50% after taxes.
 - \$1 invested = \$3 in energy cost savings
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Areas of Focus



- Significant Energy Savings
 - Boilers, Compressors & Motors
 - Lighting
 - Significant Waste Reduction (Pollution Prevention)
 - Cardboard and Pallets
 - Spent oils and water
 - Significant Productivity Improvements
 - Opportunities for Automation
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Example Assessment

Recommendations



- Energy Reduction
 - Preheat Boiler Intake
 - Cogeneration (Combined Heat Power)
 - Waste Minimization
 - Bale and Sell Cardboard
 - Metals Recovery
 - Productivity Enhancement
 - Update Time Clocks
 - Process Automation
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Today's On-Site Audit



- Facility Tour
 - Raw Materials to Final Product
 - Identifying Areas for Improvement
 - Basic Documentation
 - Brainstorming Session
 - Data Collection & Measurements
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Assessment Recommendation Process



IAC
Industrial Assessment Center
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- Identify Potential Companies Using Harris Directory, Referrals, or Field Visits
- Obtain Pre-audit information from client
- Obtain Energy Bills*: Electricity, Water, Gas, Propane, Oil
- Review Rate Structures
- Enter Data in Utility Bill Spreadsheet
- Analyze bills* for EARs

- Follow-up questions* with Plant Manager
- Write AR's
- Finalize Report.

30 days	Plant Visit	60 days	3-6 months
Pre Audit - Bill Analysis	On Site Data Collection	Report Building	Implementation

- Introduction with Plant Manager
- Tour Facility*
- Brainstorm Opportunity Areas
 - Energy, waste and productivity
- Review Major Findings with Plant Manager
- Data Collection & Measurements
- Consolidate Initial Findings*

Send completed report to client

•Follow-up

Report Details



- Executive Summary
 - General Background
 - Energy Summary
 - Assessment Recommendations
 - Specific
 - Presented in terms of Engineering & Financial Calculations
 - Measurable
 - Related Energy and Dollar Savings
 - Action Oriented
 - Return on Investment
 - Timely
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Bradley University IAC

Research Interests



Published with consistency in variety of distinguished journals, proceedings, and transactions:

- Mehta, D. Paul. “Impact of 1973 Oil Embargo and 2005 Katrina on Energy Efficiency.” **Industrial Energy Technology Conference, New Orleans, LA, May 8-11, 2007.**
 - Mehta, D. Paul and Amol Nayak. “Recent Trends in Oxy-Fuel, Air-Fuel, and Hybrid Combustion Technologies.” **2007 ACEEE Summer Study on Energy Efficiency in Industry, White Plains, NY, July 24-27, 2007.**
 - Mehta, D. Paul. “Optimization of Heat Treatment of Machinery Components.” **9th International Conference on Trends in the Development of Machinery and Associated Technology. (TMT 2005), Antalya, Turkey, Sept. 26-30, 2005.**
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Research Interests



- Mehta, D. Paul. “High Temperature Heat Recovery Through Waste Heat Boilers” **4th International Conference on Heat Transfer, Fluid Mechanics, and Thermodynamics. (HEFAT 2005), Cairo, Egypt. September 19-22, 2005.**
 - S. M. Najafi, D. Paul Mehta, and David C. Zietlow. “An Analysis of Data at an Industrial Assessment Center for Improving Energy Efficiency”. **Proceedings of the American Council on Energy Efficient Economy (ACEEE) Conference. West Point, N.Y. July 20-22, 2005.**
 - Mehta, D. Paul. “Recovery Strategies for Low Temperature Heat Sources.” **Proceedings of the 25th World Energy Engineering Congress. Atlanta, GA. October 9-11, 2002.**
 - Mehta, D. Paul. (with Albert Thumann) **Energy Engineering Handbook Prentice-Hall, Fifth Edition 2001.**
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Research Interests



- Actively involved with the national agenda on energy engineering education, including development of two courses
 - **ME 536 – Industrial Pollution Prevention -**
provides hands-on experience in Industrial Waste Minimization
 - **ME 537 – Building Energy Management –**
provides hands-on experience in energy audits

 - Co-author of **“Handbook of Energy Engineering”**
– Prentiss-Hall 1991
 - Increasingly popular use by those preparing for the Certified Energy Manager (CEM) examination conducted by the association of Energy Engineers (AEE)
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