IETC 2012

34TH INDUSTRIAL ENERGY TECHNOLOGY CONFERENCE

Abstracts

Hosted by:
Energy Systems Laboatory
The Texas A&M Unversity System
Louisiana Department of Natural Resources

Abstracts
2012 Industrial Energy Technology Conference

Session 1: Energy Conservation in Plant Equipment

PG&E'S RETRO-COMMISSIONING MEASURES FOR INDUSTRIAL FACILITIES

Francois Rongere, Siva Sethuraman, and Robert Barret
Pacific Gas & Electric

Pacific Gas & Electric Co. (PG&E) has a long history of promoting Energy Efficiency and other Demand Side Management programs. Recently, PG&E has introduced two retro-commissioning measures in their Industrial Products portfolio that address facilities with steam and air leaks. Industrial process plants using steam as a medium for heat transfer lose a significant quantity of steam to various types of leaks. The repair and maintenance of these leaks is the basis of this measure. Industrial facilities typically do not engage in routine leak fixes as they do not affect safety or performance significantly. This retro-commissioning measure defines the savings to be gained from locating, identifying, documenting, quantifying and repairing leaks in pipes, seals, valves, connectors and other non-steam trap equipment in a steam distribution system. PG&E provides incentives to customers that repair steam leaks and maintain performance of these steam systems.

Compressed air systems are one of the largest users of electricity in an industrial facility. Leaks can be a significant source of wasted energy; A typical compressed air system that has not been well maintained will likely leak 20% of its total compressed air production capacity. Nevertheless, this loss is generally overlooked because it has no impact on production or safety. To identify these energy savings opportunities (leaks), compressed air leak detection surveys utilize the very latest ultrasonic survey handguns known as ULDs (Ultrasonic Leak Detectors). PG&E's Compressed Air System Leak Repair program is designed with the goal of incentivizing customers to repair air leaks; obtaining verifiable, cost-effective and long-term electric energy and demand savings.

Note that Initial facility surveys are typically offered as a service to customers in both cases. Survey information provides customers with location and estimated leakage rate of all the leaks. Based on this survey information, the customer will fix all or part of the identified leaks. Once the repair is completed by the customer and verified by PG&E, a new baseline is established to account for the performed repairs. Incentives are paid as a function of the energy savings realized.

Understanding and Reducing Energy and Costs in Industrial Cooling Systems

Michael R. Muller, Michael B. Muller, and Garan Gunn
Center for Advanced Energy Systems
Rutgers University

Industrial cooling remains one of the largest potential areas for electrical energy savings in industrial plants today. This is in spite of a relatively small amount of attention paid to it by energy auditors and rebate program designers. US DOE tool suites, for example, have long focused on combustion related systems and motor systems with a focus on pumps and compressors. A chilled water tool designed by UMass was available for some time but is no longer being supported by its designers or included in the government tool website. Even with the focus on motor systems, auditing programs like the DOE's Industrial Assessment Center program show dramatically less energy savings for electrical based systems than fossil fueled ones. This paper demonstrates the large amount of increased saving from a critical review of plant chilled water systems with both hardware and operational improvements. After showing several reasons why cooling systems are often ignored during plant energy surveys (their complexity, lack of data on operations etc.), three specific upgrades are considered which have become morereliable and cost effective in the recent past. These include chiller changeouts, right sizing of systems with load matching, and floating head pressures as a retrofit. Considerations of free cooling and improved cooling tower operations are shown as additional 'big hitters". It is made clear that with appropriate measurements and an understanding of the cooling system, significant savings can be obtained with reasonable paybacks and low risk.

OBSTACLES AND OPPORTUNITIES: TURBINE MOTORIZATION IN REFINERIES TODAY

Hua Feng, Ph.D., Jingjing Liu, P.E., Xiang Liu, Ph.D., Mushtaq Ahmad, and Alan Deng
Nextant, Inc.

Steam turbines have been widely used in oil refineries for driving pumps, compressors and other rotary machines. However, in recent years, the authors of this paper have seen substantial turbine motorization projects completed or being planned in the refineries. This paper discusses the key aspects that should be considered in evaluating the feasibility of motorization projects. Based on the literature review and a refinery survey conducted by the authors, the key factors include the critical level of the related equipment, the potential energy savings and capital cost, the steam and power balance in the related area, and the reliability in the refinery's power supply. Based on the authors' experience, the utilities' energy efficiency incentive programs in California also influence the decision-making process for turbine motorization projects. Therefore, this paper includes a description of the utilities' guidelines for fuel substitution projects. In particular, the utilities' three-prong requirements on net source-BTU energy savings, cost effectiveness, and avoidance of adverse impacts to the environment are discussed. Two real life case studies are presented to demonstrate how the above criteria should be applied for determining if a motorization opportunity is economically viable. A discussion on suggested features is also included for prescreening turbine motorization project candidates for better energy and environment economics such as venting of exhaust steam from a back pressure turbine and oversized design of the existing turbine and pump.

Session 2: Energy Technology Program Analysis

U.S. DEPARTMENT OF ENERGY (DOE) INDUSTRIAL PROGRAMS AND THEIR IMPACTS

Steven Weakley and Scott Brown
Pacific Northwest National Laboratory

The U.S. Department of Energy's (DOE's) Industrial Technologies Program (ITP), within the Office of Energy Efficiency and Renewable Energy, has been working with industry since 1976 to encourage the development and adoption of new, energy-efficient technologies. ITP's cost-shared research, development and demonstration (RD&D), technology transfer, and information-sharing efforts have helped industry not only use energy and materials more efficiently, but also improve environmental performance, enhance product quality, and increase productivity. Pacific Northwest National Laboratory (PNNL) annually reviews and analyzes the benefits of ITP programs and documents these benefits in the DOE *Impacts* report to help ITP determine the impact of its programs. PNNL contacts vendors and users of ITP-sponsored technologies that have been commercialized, estimates the number of units that have penetrated the market, and conducts engineering analysis, in conjunction with the vendors/users, to estimate energy savings and other non-energy benefits associated with the technologies. Estimates of air pollution and carbon emission reductions are then determined (based on the fuel savings and process changes that have environmental benefits). In addition, PNNL investigated the status of emerging technologies, which are expected to result in a commercialized product within 2-3 years. This paper will discuss the results of the PNNL 2010 review.

ENERGY MANAGEMENT SYSTEMS ISO 5001-ENGAGE
BEST-IN-CLASS-PRACTICE FOR ENERGY SAVINGS

David Vigil
Bureau Veritas Certification

Energy Efficiency has become a focus of many companies in recent years. With this in mind ISO has developed a standard to provide a framework for any organization to benefit from energy efficient processes; ISO 50001:2011. In the following report the background of the standard, benefits implementation and some explanations of the requirements will be provided. The conclusion will explain why implementation can be enhanced by taking another step and certifying the Energy Management System (EnMS).

MEPs AS AN ENERGY EFFICIENCY CHANNEL

Chad Gilless, Enernoc, John Wallner, NEEA, Cecilia Arzbaecher, Enernoc and Cheryl Fretz, Fluid Market Strategies

Though the Small-to-Medium Industrial (SMI) sector accounts for 42% of US manufacturing energy use, this sector has historically been a difficult group to engage in energy efficiency. The Northwest Energy Efficiency Alliance (NEEA) has begun expanding approaches in the SMI sector through a number of efforts. NEEA's most recent effort is the Manufacturing Extension Partnership (MEP) Support Project. This paper provides an overview of the MEP Support Project, including results and findings from engagement with Idaho TechHelp, Oregon Manufacturing Extension Partnership, Montana Manufacturing Extension Center and Impact Washington, as well as Impact Washington's partner, the Washington State Department of Ecology. The paper also outlines the core energy savings approaches deployed. Finally, the paper provides recommendations on how to engage MEP consultants as energy agents for the benefit of the SMI sector in the Northwest region as well as in other parts of the country.

Translating Strategies into Realities: A Superior Energy Efficiency Program for Industrial Facilities

Fahad S. Al-Dossary, Saudi Aramco.

Saudi Aramco Gas Operations (GO) created energy efficiency strategies for its 5-year business plan (2011-2015), supported by a unique energy efficiency program, to reduce GO energy intensity by 26% by 2015. The program generated an energy savings of $ 8.8 MM, equivalent to 5% energy intensity reduction in 2011 as compared to 2010 level. The program works through a structured process, pre-set energy targets, installations of online energy management tools, and implementation of key high impact energy efficiency initiatives and completion of energy conservation projects. The long-term fruit of the program was recognized as a best practice to be adapted by most of Saudi Aramco facilities. The generation of innovative energy saving ideas under implementation resulted in potential energy savings of $23 MM. This paper confirms what many others in the industry have found, the opportunity is significant. The author illustrates GO organization crafted a structured energy efficiency program and innovative approaches to unlock the full potential of higher standards of energy efficiency performance. Gas Operation energy efficiency program will ideally translates energy intensity strategies into realities and transforms the missed opportunities into practical tactics for capturing the millions of dollars of savings potential that exist across GO facilities.

Session 3: The Future of Electric Power

POWER RELIABILITY AT BASF CORPORATION

Thomas R. Theising
BASF Corporation

Quality is defined not as what the supplier puts into the product but what the customer gets out and is willing to pay for. Power quality problems present themselves in a variety of fashions, many of which cause process interruptions. Process interruptions lead to supply interruptions to the customer. An oft-interrupted supply can be viewed as an unreliable supply.

INDUSTRIAL ENERGY CONSERVATION WITH SMART GRID TECHNOLOGY

Thomas Wilson
PCS UtiliData

Many experts and analysts in the electric utility industry have pointed out the value of Volt/VAR Optimization (VVO) to the utility industry and its customers. VVO has the potential to save up to 3% of the total energy generated in the United States and Canada. A subset of VVO can be used by industrial facilities to save similar amounts of energy. This paper will discuss the application of Smart Grid VVO technology in the Industrial Sector (IVO or Industrial voltage optimization) and the special requirements that are required to successfully implement voltage optimization in an industrial environment. The paper will discuss several IVO projects and both the energy conservation results and the operational results. As IVO is a relatively new technology in industry it will also discuss potential the paper will discuss potential applications in industrial facilities and conservation results that can be expected in different industries.

Coal Retirements: Defining the Need and the Efficiency Opportunity

Anna Chittum
American Council for an Energy-Efficient Economy

For decades, major areas of the United States have relied heavily on coal for electricity generation. Abundant and relatively cheap, coal has powered large swaths of the Southeast, Midwest, Mid-Atlantic and western United States. Aging equipment and increased environmental compliance needs are changing the economic paradigm for many coal-fired plants. Faced with rising fuel prices and requirements for major investments in pollution control equipment, some utilities expect to retire significant coal generation in the next few years.

This paper will target eleven states that appear to be losing coal generation in the near future. It will discuss the likely amount of generation retirement in each state, based on several publicly available estimates. It will then discuss the role that energy efficiency and combined heat and power (CHP) might play in supplying reliable energy resources in areas that will be facing high amounts of generation retirement. Finally, this paper will discuss the types of policies and regulatory changes that could help encourage the alternative energy efficiency and CHP scheme discussed herein.

FUTURE OF THE NORTH AMERICAN ELECTRICITY MARKET

David Visneau
Champion Energy Services

Session 4: Clean Power and Energy Research Consortium 1

INTRODUCTION OF CLEAN POWER AND ENERGY RESEARCH CONSORTIUM (CPERC)

Ting Wang
University of New Orleans

LSU Turbine Innovation and Energy Research Center (TIER)

Sumanta Acharya
Turbine Innovation Energy Research (TIER) Center
Louisiana State University

EXPLORING BIOFUELS AND HYDROGEN FOR COMBUSTION ENGINES

Sumanta Acharya, Srinibas Karmakar, Shengrong Zhu and Baine Breaux
Turbine Innovation & Energy Research (TIER) Center
Louisiana State University

ADVANCED COOLING CONCEPTS IN TURBOMACHINERY

Sumanta Acharya, Krishnendu Saha, Del Segura, James Post
Turbine Innovation & Energy Research (TIER) Center
Louisiana State University

BLADE TIP AERODYNAMICS AND HEAT TRANSFER IN ROTATING BLADES

S. Acharya, O. Tamunbore, C. Drewes, and B. Hood
Louisiana State University
Turbine Innovation & Energy Research (TIER) Center

OUTPUT POWER AUGMENTATION BY EMPLOYING GAS TURBINE INLET FOGGING/OVERSPRAY AND DISCUSSION OF ASSOCIATED ISSUES

Jobaidur Rahman Khan and Ting Wang
Energy Conversion & Conservation Center
University of New Orleans

Co-Gasification of Coal and Biomass in IGCC Systems with Carbon Capture and Supercritical Steam Bottom Cycle

Henry A. Long, III and Ting Wang
Energy Conversion & Conservation Center
University of New Orleans

INVESTIGATION OF THE PERFORMANCE OF A SYNGAS QUENCH COOLING DESIGN AND WATER-GAS SHIFT MODELING IN COAL GASIFICATION IN AN ENTRAINED-FLOW GASIFIER

Xijia Lu and Ting Wang
Energy Conversion & Conservation Center
University of New Orleans

Session 5: Equipment Efficiency Improvements

AMMONIA CONTROL
Doug Dittburner
Cadbury's
Scott Rouse
Energy@Work

Cadbury, part of Kraft Global is a chocolate manufacturing plant that produces various chocolate products including mini eggs, Mr. Big, etc. Cadbury's secret will not be revealed however. Recently, the local TV station did a tour of the factory to see how the chocolate process worked: http://video.citytv.com/video/detail/641647357001.000000/cadbury-chocolate-factory/

In early 2010, Cadbury's Managing Chief Engineer, Mr. Doug Dittburner, identified an Ammonia System Control project that presented an opportunity to substantially improve electrical efficiency.

A Measurement & Verification (M&V) Plan was developed to ensure that the project met eligibility requirements for Conservation and Demand Management (CDM) incentives. The first step was to develop an energy consumption baseline and engage the local distribution company: Toronto Hydro Electric System (THES) to ensure that both the pre and post on site inspection reviews met the requirements for both system configurations. THES was very supportive and assisted with advice, historic interval data and coordination of real time monitoring of the main electrical meter.

THES pre-inspection reviewed the project scope before work started along with the metering capability proposed and the M&V plan. The M&V plan used the International Performance Measurement and Verification Protocol (IPMVP) Option B.

The ammonia system control project was installed, system configuration was optimized and THES advised Cadbury that the project met the requirements and produced a savings of 2,927,835 kWh. The incentive was capped at 50% of the project cost, including the M&V requirements for a total incentive of $250,000!

Attendees for this session will learn the following:

1. The importance in establishing a M&V Plan to an accepted standard
2. Case study of the ammonia control project
3. Finally, the benefit of engaging the utility for both the financial incentive and third party verification

These lessons are equally applicable to every project and uses the philosophy:

- Understand Right
- Use Right
- Buy Right

(and in that order!)

The project continues to maintain the savings.

A NOVEL APPROACH TO HEAT TRANSFER ENHANCEMENT USING TRAPEZOID SHAPED SPIRAL STRIPS TO PROMOTE TUMBLE AND SWIRL IN A SLOT SHAPED CHANNEL USED IN HEAT EXCHANGERS

Del Segura, M.S., P.E.
Sumanta Acharya, Ph. D.
Louisiana State University

Heat transfer results for a given slot shaped channel with a 3:1 aspect ratio are presented using various configurations of a trapezoid shaped spiral wound strips to enhance swirl and tumble motion in the channel. The Reynolds numbers investigated range from 10,000 to 50,000 and are based on the characteristics of the fluid at the channel inlet. The ratio of absolute temperatures between the wall and fluid are on the order of 0.8 to 0.9. A combination of thermochromic liquid crystal techniques and thermocouples were used to create a temperature vs. time map. Duhamel's superposition theorem was then used to determine the local heat transfer coefficients (h) and heat transfer enhancement factors (Nu/Nu_o). In one series of testing a straight center inlet with a radiused entry was used to reduce entry effects.

In a second series of test a 90 degree inlet geometry was used to enhance turbulence at the entry. Three combinations of helical strips were tested using a single, double, and pentuple spiral design. The pitch of the helix remained constant in all tests at 0.75" (18 mm) as well as the height of the strip at 0.0625" (1.6 mm), yielding a p/e (pitch/rib height) ratio of 12. The resulting flow in the channel creates a tumble motion as the main channel fluid encounters the strips and a swirl motion as the fluid is directed through the spiraling helix. Many studies involving heat transfer using swirl enhancement have been presented in literature using round passages with wire spring inserts or twisted tapes, typically used in heat exchangers. In turbine aero foils, particularly in the mid-span region, rectangular channels with various configurations of trip strips are used to enhance heat transfer. The results of the tests presented in this paper show local heat transfer enhancement (Nu/Nu_o) values greater than seven and subsequent average values for the entire channel greater than three at the higher Reynolds numbers along with relatively low normalized friction factors.

Optimal Sequencing of a Cooling Tower with Multiple Cells

Zhiqin Zhang, PhD, PE
Jingjing Liu, PE
Nexant Inc.

This paper evaluates the energy savings potential of multi-cell cooling tower optimal sequencing control methods. Annual tower fan energy usage is calculated for a counter-flow tower with multiple variable-speed fans. Effectiveness-NTU tower model is employed to predict the cooling tower performance at various conditions. Natural convection when the fan is off is accounted by using an assumed airflow rate. The energy savings at five cities representing different typical climates are studied using typical meteorological year data. The results show that, if the tower capacity can be increased by 50% and 100% by running extra tower cells, the annual total fan power usage can be reduced by 44% and 61%, respectively. A cumulative saving percent curve is generated to help estimate the annual total savings percent when extra cooling tower capacity is available during only part of a year.

SAVING MILLIONS WITH STEAM TRAP SURVEYS

James Nipper
Petro Chemical Energy

How Aerogel Insulation Saves Operating Costs

Monica Chauviere
Monicorr, Inc.

Session 6: Superior Energy Performance and ISO 50001 Implementation

SUPERIOR ENERGY PERFORMANCE AND ISO 50001

Paul Scheihing
U.S. Department of Energy Advanced Manufacturing Office

DEMONSTRATION OF SUPERIOR ENERGY PERFORMANCE AND ISO 50001

Edward H. Hardison III
Georgia Tech Enterprise Innovation Institute

AUDITING TO ISO 50001 AND SUPERIOR ENERGY PERFORMANCE
Robert Auerbach
DEKRA Certification, Inc.

ENHANCED SUSTAINABILITY THROUGH ENERGY MANAGEMENT SYSTEM IMPLEMENTATION

Stephen E. Cannizzaro
General Dynamics-Ordinance and Tactical Systems

HAYNES INTERNATIONAL'S PATH TO SEP AND ISO 50001

Greg Morrow
Haynes International, Inc.

Session 7: American Chemistry Council Award Winners 1

EASTMAN CHEMICAL'S CORPORATE ENERGY PROGRAM

Sharon Nolen
Eastman Chemical Company

HEAT EXCHANGER NETWORK TOOLS, OPTIMIZATIONS AND MAINTENANCE

Matt Neely
ExxonMobil Chemical

SITE ENERGY IMPROVEMENT EFFORT FOR AN OLEFINS PLANT

Jeff Chang
Chevron Phillips Chemical Company LP

OLEFINS IMPROVES ENERGY EFFICIENCY OF FLARING OPERATIONS BY 45%

Nicolas Munoz
The DOW Chemical Company

LyondellBasell Energy Conservation Efforts

Sumit Chatterjee
LyondellBasell Industries Inc.

Session 8: Clean Power and Energy Research Consortium 2

A COMPARISON STUDY OF THERMAL INSULATION PROPERTIES OF GADOLINIUM ZIRCONATE ($Gd_2Zr_2O_7$) AND YTTRIA STABILIZED ZIRCONIA (YSZ)

S. Akwaboa, P. F. Mensah, and R. Diwan
Southern University at Baton Rouge, Louisiana

INVESTIGATION OF ROLE OF GD2ZR2O7 POWDERS IN IMPROVING LIFE OF THERMAL BARRIER COATINGS

S. Nandikolla, P. F. Mensah, and R. Diwan
Southern University at Baton Rouge, Louisiana

USE OF LOCAL LOUISIANA CULTIVAR OF GAMAGRASS FOR BIOETHANOL PRODUCTION

Raj Boopathy
Nicholls State University

THE COST OF PRODUCING FERMENTABLE SUGARS FOR BIOFUELS FROM SWEET SORGHUM (SORGHUM BICOLOR) AND ENERGY CANE (SACCHARUM SPP.)

D. F. Day and L. R. Madsen II
Audubon Sugar Institute, Louisiana State University Agricultural Center.

TORREFACTION OF BIOMASS FOR USE AS AN ALTERNATIVE POWER PLANT FEEDSTOCK AS COMPARED TO COAL

Prashanth Buchireddy, John Guillory,and Mark E. Zappi
University of Louisiana at Lafayette
Ben Russo and Keith Crump
Cleco Corporation, Louisiana

Evaluation of Methane Production from Novel Waste Streams using Advanced Digestion Methods

Mark E. Zappi, Ramalingam Subramaniam, Rakesh Bajpai, Daniel Gang, and Stephen Dufreche,
University of Louisiana at Lafayett
Ben Russo and Keith Crump
Cleco Corporation, Louisiana

REDUCING THE COST OF MICROBIAL LIPID PRODUCTION FROM CARBOHYDRATE RICH WASTE STREAMS

Ramalingam Subramaniam, Sherif Rahman, Stephen Dufreche, Mark E. Zappi, and Rakesh Bajpai
University of Louisiana at Lafayette

Session 9: Reducing Energy Usage in Large Plant Systems

HEAT INTEGRATION AND HEAT RECOVERY AT A LARGE CHEMICAL MANUFACTURING SITE

Keith A. Togna
Honeywell Performance Materials and Technologies

The Honeywell chemical plant located in Hopewell, Virginia includes processing units that purify raw phenol, react the phenol with hydrogen to form crude cyclohexanone, and purify the crude cyclohexanone. In order to reduce energy usage, two opportunities for heat recovery and heat integration were identified. A feasibility study and economic analysis were performed on the two opportunities, and both projects were implemented.

The first project utilized the heat contained in a distillation process overheads stream to preheat the raw material entering the distillation process. This was accomplished via a heat exchanger, and reduced the utility steam requirement by 10,000 pph.

The second project utilized the heat generated by the hydrogenation reaction (in the form of waste heat steam) to preheat the feed material in an adjacent process. This was accomplished via a heat exchanger, and reduced the utility steam requirement by 8,000 pph.

These two energy projects required $1.1 million of capital and saved $1.0 million in utility steam annually.

DEVELOPMENT OF A SOFTWARE SYSTEM TO FACILITATE IMPLEMENTATION OF COAL AND WOOD CO-FIRED BOILERS

Bhaskaran Gopalakrishnan, Christopher D. Gump, Deepak P. Gupta, and Subodh Chaudhari
West Virginia University

Coal and wood co-fired boiler technology has improved significantly over the years. The term "co-firing", when used by members of the biomass or utility communities, has come to mean mixing a modest amount of clean, dry sawdust with coal and burning the sawdust coal mixture in a large, coal-burning, utility boiler. This paper discusses the development of a computer software system that interacts with the user and allows coal-wood co-fired boilers to be sized, priced, implemented, and operated properly. Information about the equipment that is required for the boiler replacement project is provided. Along with these features, the software would allow the user to determine energy and cost savings that would be available upon installation as compared to other types of boilers. The paper outlines how these savings are realized, and the steps that must be taken to ensure the proper operation of the boiler to achieve these savings. A sensitivity analysis has also been performed on the implementation of coal-wood co-fired boilers in order to determine the key factors influencing the project payback period. The key factors that are considered in the analysis are the boiler size, the annual operating hours, and the current fuel cost. Additional analysis has been done on the boiler size and the annual operating hours. This analysis allows the users to determine if their current facility falls into the feasible range for implementing a coal-wood co-fired boiler system.

HEAT TRANSFER, THERMAL-FLOW AND COMBUSTION ANALYSIS OF A PETROLEUM COKE CALCINER

Ting Wang
University of New Orleans

Improving Energy Efficiency with Cogeneration Technology

David P. O'Brien
ExxonMobil Gas and Power Marketing

THE REAL 'TRUTHS' ABOUT STEAM AND MANAGING YOUR PROCESS

Darrell Robert
Wal-Tech Valve

Session 10: Energy Use Analysis

CAPTURE UTILITY SAVINGS USING ENERGY MANAGEMENT AND REPORTING SYSTEMS (EMRS)

James E Robinson PE, P.Eng., CEM, CEP
DES Global, LLC

Energy Management and Reporting Systems (EMRS) have proven effective in reducing powerhouse cost. These cost reductions are provided through effective management of equipment operation, fuel allocation, combustion optimization, and generation management by a real time closed loop control system. A recent finding is that the application of consistent operating rules across all operating shifts increases reliability and the reduction of unscheduled outages. This paper presents an automated calculation methodology to identify and capture those savings.

TPC Group's Energy Savings through Simulation Modeling of Plant Utility Systems

Sarah Haynes
TPC Group
Todd J. Willman
EPI Engineering

TPC Group Houston Operations is evaluating the potential expansion of several existing production units as well as building new production units. The need was identified to assess the capacity of existing utility systems including steam, condensate, compressed air, nitrogen, natural gas, fuel gas, cooling water, and firewater systems. Simulation models of each utility system were developed and tuned to match existing plant data in order to identify available capacity of each system and understand current limitations. This detailed modeling work resulted in greater than $500,000 in avoided capital cost from the original base case design.

The analysis also provided significant insight into energy savings opportunities throughout the current plant operations. All plant utility systems were modeled and evaluated. The end result of the studies provided identified cost reduction opportunities of >$5MM, of which some have already been implemented. This paper will discuss specific examples of the analysis and show corresponding results in both the steam and water systems.

Introducing an Online Cooling Tower Performance Analysis Tool

Michael B. Muller, Michael R. Muller, and Prakash Rao
Rutgers University

Cooling towers are used extensively for numerous industrial, residential, and commercial applications. Yet despite how common their uses, operators often do not know how to properly evaluate and optimize their performance. This is due to the complex and variable nature of all of the factors that can influence performance; fan speed, wind speed, sump temperature, heat load, ambient temperature, relative humidity, etc. This can be overwhelming for a regular operator resulting in many cooling towers being set to a default operating condition and forgotten This paper will introduce a web-based cooling tower analysis tool being developed to help users understand and optimize operational efficiency. The calculations, evaluations, and models will be discussed in detail to highlight important design considerations and issues. This will include how the Merkel Theory, psychometric properties, tower types, and historical weather data are incorporated into the analysis.

ENERGY EFFICIENCY OPPORTUNITY CALCULATOR FOR SMALL AND MEDIUM SIZED MANUFACTURERS

Kathey Ferland, Texas Industries of the Future

In 2010 Texas Industries of the Future at the University of Texas at Austin and its partners released the Energy Efficiency Opportunity Calculator for Small and Medium Sized Manufacturers version 2. The purpose of this software tool is to provide managers or engineers at small or medium-sized manufacturing plants with a list of questions and a calculator so that they can quickly assess whether and where they have opportunities for energy and cost savings at their facility. Case studies of energy project implementation have shown that many facilities can achieve energy cost savings of up to10-15% with little capital investment. The purpose of this tool is to assist these engineers or managers to identify where their 15% of energy cost savings might be found. The calculator will estimate the potential savings based on the user's inputs for 16 energy use and cost reduction projects commonly identified at manufacturing plants, from reducing compressed air leaks to improving controls. The software is available for download at http://texasiof.ces.utexas.edu/tools.htm

THE EASIEST AND FASTEST RETURN ON ANY COST SAVINGS PROJECT YOU WILL EVER DO
Darren Woodruff
Petro Chemical Energy

***Session 11: American* Chemistry Council Award Winners 2**

EXXONMOBIL BEAUMONT CHEMICAL PLANT STUDY OF STEAM AND CONDENSATE SYSTEMS FOR THE ENTIRE PLANT

May-Ru Chen and Frank Roberto
ExxonMobil Chemical Company

BASF Corporate Energy Management Program

Thomas Theising
BASF Corporation

UTILIZATION OF A FORMERLY INCINERATED SODIUM NITRITE BEARING PROCESS STREAM

Chris Poirier, Lioba Kloppenburg, and Tom Guggenheim
Sabic

Carus Corporation Manufacturing Operations Energy Conservation Efforts

Dan Hartsough
Carus Corporation

FURNACE ENERGY AND ENVIRONMENTAL STRATEGY

Mark Rooney
ExxonMobil Chemical Company

Session 12:Characterizing Energy Conservation Savings

Session 12: Characterizing Energy Conservation Savings

REAL-TIME UTILITIES OPTIMIZATION FOR REFINERIES
INCORPORATING HYDROGEN SUPPLY STREAMS

Tyler Reitmeier
Soteica Ideas & Technology, LLC

CRITICAL SUCCESS FACTORS IN ACHIEVING ENERGY REDUCTIONS IN INDUSTRIAL ORGANIZATIONS - A CASE STUDY

Paul Hughes
ABB Limited

Recent research commissioned by ABB has identified that while over 2/3rds of executives surveyed viewed energy efficiency as a critical factor for their organizations, only 1/3rd have made energy efficiency investments over the last 3 years. This paper examines the factors; financial, organizational and technical behind this barrier to action and outlines, with reference to a case study, an approach which successfully overcame them, resulting in delivered savings of several million dollars.

OPPORTUNITIES AND BARRIERS IN THE IMPLEMENTATION OF ENERGY EFFICIENCY MEASURES IN PLASTIC MANUFACTURING

Amit Kanungo and Ching Yong
DNV KEMA Energy & Sustainability

The plastic industry in the U.S. employs approximately 9% [1] of the manufacturing work force and consumes approximately 6% [1] of the total energy used by the U.S. industries. According to the Department of Energy (DOE), manufacturers of plastic and other resins are consuming nearly 1,070 trillion Btu [1] of energy in their operations every year, valued at $6.0[1] billion.

As escalating energy prices continue to be a concern for industry, many plastic manufacturers are striving to reduce their energy consumption to stay competitive. An alternative to reduced energy consumption is to put in place an energy efficiency strategy. However, while most plastic manufactures are aware of the energy efficiency opportunities in their facilities, the implementation of these opportunities face certain market barriers. These barriers are identified as customers lack the information about energy efficiency technologies, and have limited capital funding to implement the energy efficiency measures. Additionally, it is hard to identify the energy savings opportunities and difficult to quantify their impacts.

The purpose of this paper is to discuss the various energy efficiency opportunities in plastic manufacturing and address the market barriers in implementing them. We will identify the energy savings opportunities in plastic manufacturing that can be introduced to reduce energy consumption and decrease production costs, thus giving the customers more competitive edge in both the regional and global markets. We will also discuss various popular energy efficiency measures, the energy savings associated with each measure and their projected simple payback. In terms of policy implication, this paper will discuss various strategies of mitigating potential market barriers in implementing energy efficiency measures on plastic manufacturing industries.

MANUFACTURING ENERGY AND CARBON FOOTPRINTS

Sabine Brueske
Energetics Incorporated
Tom Lorenz
U.S. Department of Energy
Energy Information Administration

Significant opportunities exist for improving energy efficiency in U.S. manufacturing. A first step in realizing these opportunities is to identify how industry is using energy. Where does it come from? What form is it in? Where is it used? How much is lost? Answering these questions is the focus of this paper and the analysis described herein.

Manufacturing energy and carbon footprints map energy consumption and losses, as well as greenhouse gas emissions, for the fifteen most energy intensive manufacturing sectors, and for the entire U.S. manufacturing sector. Analysts and decision-makers utilize the footprints to better understand the distribution of energy use in energy-intensive industries and the accompanying energy losses. The footprints provide a benchmark from which to calculate the benefits of improving energy efficiency and for prioritizing opportunity analysis. A breakdown of energy consumption by energy type and end use allows for comparison both within and across sectors.

Session 13: Case Studies

A REVIEW OF EMERGING ENERGY-EFFICIENCY AND CO2 EMISSION-REDUCTION TECHNOLOGIES FOR CEMENT AND CONCRETE PRODUCTION

Ali Hasanbeigi and Lynn Price
Lawrence Berkeley National Laboratory.

Globally, the cement industry accounts for approximately 5 percent of current man-made carbon dioxide (CO_2) emissions. Development of new energy-efficiency and CO_2 emission-reduction technologies and their deployment in the market will be key for the cement industry's mid- and long-term climate change mitigation strategies. This paper is an initial effort to compile the available information on process description, energy savings, environmental and other benefits, costs, commercialization status, and references for emerging technologies to reduce the cement industry's energy use and CO_2 emissions. This paper consolidates available information on eighteen emerging technologies for the cement industry, with the goal of providing engineers, researchers, investors, cement companies, policy makers, and other interested parties with easy access to a well-structured database of information on these technologies.

CASE STUDY OF OPTIMAL BYPRODUCT GAS DISTRIBUTION IN INTEGRATED STEEL MILL USING MULTI-PERIOD OPTIMIZATION

Kimmo Mäkinen and Toni Kymäläinen, ABB

Energy constitutes about 20 % of the total production cost in an integrated steel mill, and therefore energy efficiency is crucial for profitability within the environmental policy context .An integrated steel mill generates high calorific value byproduct gases at varying rates. The differences between gas generation and consumption rates are compensated with gas holders. However, under certain circumstances the imbalances can lead to the flaring of excessive gas or require the purchase of supplementary fuel This presentation describes a steel mill energy management system with sophisticated monitoring, planning, and optimization tools. It models the complex energy interconnections between various processes of the mill and determines the optimal trade-off between gasholder level control, flare minimization, and optimization of electricity purchase versus internal power generation. The system reduces energy cost, improves energy efficiency, manages carbon footprint, and provides environmental reporting features.

ENERGY CONSCIOUS PRODUCTION SCHEDULING AND CONTROL IN DISCRETE MANUFACTURING

Yan Lu
Siemens Corporate Research
Mohsen A. Jafari, Rutgers University
Faryar Jabbari, University of California, Irvine

In manufacturing plants, significant savings can be achieved through energy management. In many cases energy contributes to over 25% of the overall plant operating costs and is often upwards. The ability to cut even a modest percentage on energy consumption can result in significant reductions in the plant operating costs. Energy consumption can be reduced in a number of ways, including adopting energy management practices and advanced technologies; choosing the right equipment with the right size and capacity; running equipment under optimally adaptive operating conditions; adopting energy conscious production planning, scheduling strategies and practices; and ensuring that equipment are maintained properly.
This article will focus on the production scheduling and production control, and will focus on strategies that reduce energy consumption while production requirements are met in quantity, quality and due dates. The article will present a generic simulation model of a discrete manufacturing plant with energy-intensive operations. We model the production process and characterize the energy consumption of machines and operations. Based on the production energy model, we examine alternative production schedules and control strategies and quantify their impact on energy usage. Finally, an optimization algorithm is generated to optimize manufacturing plant energy savings and minimize peak load under constraints. The optimal strategy (ies) will then be dissected to further investigate optimal supervisory control and process monitoring alternatives. This will be concluded by prescribing appropriate sensory, monitoring and feedback technologies to ensure process visibility and optimality criteria for production control are met at all times. Finally, a cost and benefit analysis will be developed and demonstrated to estimate the lifecycle costs and return on investment. The results and outcomes

of this paper will provide a roadmap for industry as how to initiate and run an energy management plan in their manufacturing facilities.

Session 14: Audit Practices

FACILITIES MANAGEMENT 2.0: A STRATEGY FOR THE 21ST CENTURY

Christopher Russell
Energy Pathfinder Management Consulting

A new management philosophy is needed to reverse decades of "doing more with less." Facilities can be seen not as a cost center, but as a profit center.

Empowerment of facility managers can be leveraged by the value harvested from energy waste. When waste is converted to cash flow, facility managers become a source of capital as well as the means for future-proofing facilities against the volatilities imposed by energy markets and regulations. This presentation outlines a radical paradigm shift that sees energy efficiency not as "projects," but as an investment process. The new strategy proposed by this presentation is equal parts behavioral, organizational, and financial. The discussion will especially resonate with the emerging generation of energy engineers.

ENERGY AUDIT EQUIPMENT

Jim Phillips, P.E., CEM, CEA, GBE
Independent Energy Alternatives, Inc.

The tools (equipment) needed to perform an energy audit include those items which assist the auditor in measuring the energy used by equipment or lost in inefficiency. Each tool is designed for a specific measurement. They can be inexpensive simple tools or expensive technically complex or multifunctional tools. In general, tools are needed which measure light, temperature and humidity, electricity, air flow, heat loss, and general energy information.

FINANCING ENERGY EFFICIENCY FOR SMALL AND MEDIUM-SIZED ENTERPRISES

Daniel Trombley, Casey Bell, and Neal Elliott
American Council for an Energy-Efficient Economy

Small and medium-sized enterprises (SME) face a number of barriers to energy efficiency: lack of knowledge of energy-efficient technologies and practices; lack of a trained workforce; and difficulty obtaining capital and making a financial case for energy efficiency projects. Numerous programs offer assistance to overcome these barriers, although most focus on the technical issues to overcome the first two. This focus reflects the fact that the majority of people in the energy efficiency sector come from a technical background, not financing. Fortunately, this trend is changing with more people and programs addressing this third barrier: obtaining financing and making the business case for energy efficiency improvements.

This paper will address project financing for SME, a sector that faces unique challenges to accessing capital. It is aimed at energy efficiency program administrators and other service providers seeking to bridge the gap between project identification and implementation. The paper will discuss the key barriers to obtaining project financing for SME, reflecting original research and interviews with both firms seeking financing and financial service providers. This paper will also discuss the many different options for financing, including both public (federal and state/regional) and private opportunities.

Session 15: Process Steam Issues

WHAT TO DO ABOUT COLD TRAPS…AND WHY?

James R. Risko
TLV Corporation

Increased emphasis on energy costs has helped sites reduce system cost through the diagnosis and repair of leaking or blowing steam traps. Appropriate maintenance response by site personnel is significant action to lower energy use and GHG emissions generated by steam production.

However, in every steam trap survey to determine the current state of health for the steam trap population, there are always a significant amount of steam traps determined to be "Cold" or "Low Temp" ("cold traps"). In addition, sometimes site personnel implement a practice to convert "Leaking" traps into cold traps by closing the inlet stop valve to immediately stop the energy leakage. They may label those traps as "Valved-Out" or "Out of Service," but those trap stations were typically designed to drain condensate from the system. So, the correct designation would be that the trap station is "Cold," regardless of the cause.

It can be astounding that many sites are not convinced of what actions or priority to take to prevent and repair cold traps, even while intrinsically understanding that there is something wrong with having cold traps that can not drain condensate from a steam system. It often is simply because sites may not be inherently aware of the potential dangers of uncorrected cold traps or the significant safety, reliability, and energy benefits of addressing them. Although safety is always the main priority, it cannot be understated that there are significant reliability and energy benefits to prioritized repair of cold traps.

The proactive response to cold traps in a steam system is not always achieved, often because the real benefits of such a response are not understood. Therefore, this presentation will focus primarily on "WHAT TO DO ABOUT COLD TRAPS…AND WHY?" for effective and energy-efficient management of the condensate discharge locations (CDLs). There will be several tables to help sites value the impact and importance of cold traps in their systems, using readily available historical data.

WHY PRESSURE REDUCING VALVES (PRV'S) ARE COSTING YOU MONEY

Andrew Downing
Dresser-Rand

Throughout many manufacturing facilities, colleges, commercial sites or industrial complexes, pressure reducing valves (PRV's) provide a cheap, reliable method to produce low pressure steam from a high pressure source in order to meet a process requirement or heating load. This simple method of expanding steam in a PRV creates no work and supplies the same heat content available in the high pressure steam at a more manageable low pressure. What if you could produce the same low pressure steam while saving hundreds of thousands of dollars on your electric bill and taking only a minimal hit in the available heat content? Why let steam down and get no benefit from it, when putting it through a low pressure steam turbine coupled to a generator would produce the heat you need for process with the byproduct of onsite electrical generation.

This paper analyzes the costs, concerns and benefits of replacing a pressure reducing valve with a Steam Turbine Generator set including illustrations of what the marginal fuel increase would be in order to take advantage of the added benefits of clean, cheap and reliable onsite power production.

Session 16: *Future Methods for Energy Efficiency*

INTELLIGENT EFFICIENCY: THE NEXT GENERATION OF ENERGY EFFICIENCY

Daniel Trombley and Maggie Molina
American Council for an Energy Efficient Economy

Information and communication technologies (ICT) and their enabling technologies are responsible for a significant portion of energy efficiency improvements in the past decade. Sensors and controls, the internet, and semiconductor technologies have already changed the way we use energy and interact with other people: how we work, shop, and have fun. But that is only the start. As highly efficient technologies begin to interact with each other and respond in real time to their environment, there will be a structural change in how we use energy.

This paper explores the next generation of energy efficiency: what we call *intelligent efficiency*. Building on recent work in this area, this paper will define intelligent efficiency and provide specific case studies to illustrate its impact. This paper will focus on the manufacturing sector, but examples include commercial building energy management, industrial automation, and transportation infrastructure. This paper will discuss how these technologies work together synergistically to reach new levels of efficiency, allowing us to not only save energy, but to improve the economy and create jobs. Finally, the paper will identify barriers and policy solutions to intelligent efficiency achieving even greater savings and economic benefits.

COMBINED HEAT AND BIOPOWER PRODUCTION USING MSW FROM US MILITARY FACILITIES – A DIRECT THERMAL COMBUSTION APPROACH

Frank E. Yeboah, Abolghasem Shahbazi, Osei A. Yeboah, Frank Holcomb, Peter A. Sam and Harmohindar Singh
Noth Carolina State A&T University

In 2010, the US Department of Defense (DOD) generated about 24,010 metric tons (26,467 short tons) of municipal solid wastes (MSW) at one of its facilities. Unfortunately, most of these wastes are disposed of at landfills located several miles away. MSW can be difficult to dispose of because of the large volumes that may be involved. In addition, lack of sufficient land areas as well as the environmental consequences resulting from the landfill can make the handling and disposal of MSW problematic. A typical solution for addressing the issue of MSW is to combust it to extract the energy contained in it as well as to reduce the volume of waste to be discarded. Given the fact that the DOD operates several hundreds or thousands of such military facilities including, Forts, Bases, Barracks, Camps, etc. world-wide, its environmental footprints of operating these facilities could be far-reaching. It is, therefore, pertinent that means be found to convert the waste materials into energy (heat and power) so as to reduce the quantity of wastes to be disposed of as well as to minimize the environmental degradation associated with wastes disposal. The DOD consumed about 30,000 GWH of electricity in 2006. Part of this energy could be easily generated from the MSW that are produced at its facilities. The questions that may be asked, however, are how much wastes are there at the facilities? What are the characteristics of these wastes? How much energy could be generated from the wastes? This paper characterizes the MSW from DOD facilities as well as assesses the potential for converting MSW into combined heat and biopower using the direct combustion approach. In addition, the economic viability of the process based on life-cycle cost analysis will be examined.

ISO 50001 VERSUS SUPERIOR ENERGY PERFORMANCE: MAKING SENSE OF EACH FOR YOUR SITUATION

Chad Gilless
Enernoc
David Goldstein
NRDC
Leigh Holmes and Kim Brown
Enernoc

For years, utilities and governmental agencies industrial facility energy efficiency programs have been challenged by facility staff working around optimized equipment as well as completed measures not performing as planned, persisting as long as planned, or producing repeat projects. Strategic Energy Management (SEM) has been a growing response to these challenges, where the project approach to energy savings is replaced with a lasting facility energy management programs that produce business cultures that proactively drive projects, that make staff aware of the importance of energy efficiency, and that wraps all of this into an effort that corporate leaders can support. The most significant SEM developments of the last few years have centered in the ISO 50001 energy management system international standard as well as in the ISO related ,US Department of Energy-developed Superior Energy Performance (SEP) program.For the past several years, EnerNOC, NRDC and SES have contributed to the creation of the ISO50001 energy management system standard. In addition, our teams have worked with the SEP pilots, and have directly supported and interacted with industrial energy managers as they have applied these tools to their facilities. This paper will provide a brief overview of what is common and distinct between ISO and SEP ,including what elements are important to both facility and corporate energy managers. This paper will also put forth core information as well as essential usage guidelines for utility and government program managers who are considering leveraging ISO and SEP to support their efforts. Finally, this paper will suggest additional areas to further

develop to ease ISO and SEP integration into programs and achieve maximum energy performance results.