Course: ENPM 654 Energy Systems Management  
Semester: Summer, 2016  
Days: Tuesdays from 31 May through 19 August 2016  
Time: 6:00-8:40PM  
Location: JMP room 2216 and via DETS to remote sites and online.  
Instructor: Dr. B. Valentine.  
Phone: (571) 33-7447  
Email: bgvalentine@verizon.net

Course Description

(ELMS website)

Prerequisites: A Bachelor’s degree in Mechanical, Civil, Electrical or Chemical Engineering; students with other degrees, please discuss your undergraduate preparation with the instructor. The course ENME 489N- Special Topics in Mechanical Engineering; Residential and Industrial Energy Audit – is helpful although not required.

Office: 2146 Martin Hall by appointment. Send me an email, arrangements can be made anytime. Students from the remote campuses can call me on the telephone anytime.

Student learning goals: The course is designed to provide the necessary background for the student to assume the role of Energy Manager in a modern industrial or commercial operation. An Energy Audit of a commercial operation provides information about current supply and use of energy in a commercial operation; and the Energy Manager uses that information together with knowledge of various options to develop and execute an Energy Performance plan. Course topics include an overview of Energy Auditing, introduction to Energy Management software that will be used throughout the course, overview of energy use in a commercial setting including sources and prices, analysis of various systems and subsystems used in industrial operations including motors and drives, pumps, compressed air, steam, electrical supply, and control systems. Additional topics including economics, management theory, regulatory policy, and international standards for Energy Management will also be covered.

Course Schedule and Due Dates: See attached schedule.

Expectations for Students: Class attendance is expected. Written assignments will be submitted on line and on time. A course project will be assigned, and this project will involve energy modeling of a UMCP campus building, given seasonal energy loads.

Grading procedures:
- Homework assignments: 25%
- Final Exam (take-home): 20%
- Course Project: 55%
Textbook

The textbook will be available in the bookstores and can be downloaded as an e-book from a number of vendors.


Course Outline

Week 1

Tue 5/31/16
Course Overview
- Overview of topics to be covered in the course
- Overview of homework assignments
- Overview of building energy auditing leading to the course project
- Assignment of course project and software to be used

Introduction to Energy Management
- The role of the Energy Manager in business and industry
- Overview of present Energy Manager responsibilities within a broad cross-section of US industries
- Position of the Energy Manager within a business framework
- Expectations of today’s Energy Managers
- US and International organizations supporting and certifying Energy Managers

HW #1 Assigned

Tue 06/7/16
Industrial Utilities: Electric Power
- Electricity suppliers
- Transmission and distribution requirements
- Electricity rates: contract, peak loads, purchase agreements, rebates
- Electricity metering
- Electricity billing
- Introduction to electrical power efficiency

Industrial Utilities: Natural Gas
- Sources of natural gas
- Natural gas suppliers and distribution
- Natural gas pricing and billing
- Natural gas efficiency of use
Tue 6/14/16
Industrial Utilities: Water
  - Overview of water use in various industries
  - Regulations for water use
  - Water accounting
  - Water discharge
  - Introduction to water treatment methods

Industrial energy systems: Power consumption and efficiency
  - Turbines
  - Boilers
  - Heat exchangers: air
  - Heat exchangers: liquid
  - Motors and drives
  - Pumps
  - Chillers
  - Cooling towers

HW #2 Assigned

The 6/21/16
Industrial energy systems: System efficiency analysis
  - Combustion
  - Steam and condensate
  - Compressed air

HW #1 Due

Industrial and commercial buildings: Design for efficiency
  - Analysis of the building envelope
  - HVAC and its analysis

HW #3 Assigned

The 6/28/16
Industrial and commercial buildings: Design for efficiency
  - The building electrical system and load requirements
  - Lighting analysis
    - Codes and standards
    - Optimal day lighting
    - Retrofit to new lighting technologies
  - Building insulation
  - Indoor air quality

HW #2 Due

Tue 7/5/16
Energy management control systems
  - Overview of measurement and controls
  - Measurements: Temperature, humidity, air quality
- Network architectures: Wireless
- Network architectures: Electrical
- Control hardware
- Control software
- Control strategies
- Control commissioning
- Strategies for control system modernization

HW #4 assigned

Interim project report due

The 7/12/16
Thermal energy management
- Waste heat recovery overview
- Technologies for waste heat recovery
- Recovery efficiency
- Thermal energy storage
- Seasonal variation
- Economic analysis

Overview of Industrial Waste Management
HW #3 due

Economic analysis: General considerations
- The time value of money
- Methods to evaluate returns on investments
- Selecting the best investments for efficiency improvements
- Introduction to the analysis and use of financial statements
- Taxes and their management

Tue 7/19/16
Management considerations
- Evaluating effective energy management
- General reporting requirements
- Contracting for technical needs
- Proactive and preventative maintenance
- Energy Manager’s role in meeting regulatory requirements

HW #4 due

Distributed energy generation
- Cogeneration systems: Fuel cells, micro turbines, others
- Renewable energy systems: Selecting the proper system
- Integration of distributed generation with purchased utility energy
- The effects of electric utility deregulation
- Industrial case studies

HW #5 assigned
Tue 7/26/16
Achieving the highest Energy Management standards
- LEED and green buildings
- US building ratings
- International building performance ratings
- Costs to achieve the ratings
- Case studies

- DOE certified software for pump, motor, steam, compressed air systems
- Other US system software
- Other International software
- Requirements for certification of applied use in industrial energy management

Tue 8/2/16
Energy Management in specialized industries
- Hazardous materials industries
- Semiconductor and electronics component industries
- Waste management industries
- Special fabrication industries
- Pharmaceutical and medical product industries
- Defence and aerospace contracting industries
- Case studies

HW #5 due

Tue 8/9/16
The road to achievement of Energy Management standards
- Case studies of ISO 50001 implementation
- Case studies of business sustainability implementing energy management standards
- Regulatory policy in the implementation of ISO 50001
- Final exam assigned take home

Tue 8/16/16
Summary and review of important course topics

Final exam to be returned Friday, August 19, 2016