ENRG 53 - Utility Rates, Benchmarking & Financial Analysis

COURSE DESCRIPTION: Utility rate types and charges. Building benchmarking tools such as EnergyStar Portfolio Manager and LBNL's Energy IQ. Methods for estimating costs, and calculating the financial benefits of recommended energy efficiency projects.

36 Hours (27 lecture, 9 lab)

LEARNING OUTCOMES:

- Compare tariff and rate schedules used by utilities to determine customer energy bills
- Use multiple tools to analyze billing data for commercial buildings
- Assess the impact of building type, climate and occupancy patterns and tenant use on commercial building energy use
- Use benchmarking tools to compare the Energy Use Intensity of buildings of similar type and climate, and illustrate typical energy use patterns of specific facility types
- Determine the cost of various energy efficiency measures, and calculate the value of them using various metrics

COURSE TOPICS:

I. Utility rate structures
   A. How California Public Utilities Commission (CPUC) sets rates
      1. Utility company costs for generation, transmission, distribution of electricity
      2. Utility company fair rate of return
      3. Testimony, public input
      4. Baseline allocation
         a. Energy allowance for basic needs
         b. Billed at lowest rate
         c. Average consumption by climate zone, season
      5. Tiered rates over baseline based on percentage over baseline
   B. Utility billing rates and tariff schedules
      1. Time Varying Pricing (TVP)
         a. Part of CA's statewide energy plan
         b. Replaces flat rate structure
         c. Charges based on amount and time of energy consumption, most expensive during times of greatest demand, such as hot summer afternoons
            a. Peak hours are most expensive (weekdays noon – 6pm)
            b. Part peak hours less expensive (weekdays mornings and evenings)
            c. Off peak hours least expensive (nights, weekends, holidays)
         d. Economic motivator for consumer behavior change
      2. Peak demand events
         a. CA's power needs forecasted based on weather & power use data
         b. Peak Days declared by California Independent Systems Operator Corp (ISO) when demand threatens to outpace supply
         c. ISO calls on utilities to reduce power use
         d. Typically 1-4 hours long between 11am & 7pm, often during hot afternoons
         e. Utilities anticipate 9-15 event days per year

        f. Occasionally caused by electric grid emergencies or maintenance outages
    3. Peak Day Pricing (PDP)
        a. Rate option for customers with over 200kW load
        b. Participants have lower power costs most of the year
        c. Large surcharge on energy use during peak event
C. Typical audit recommendations based on TVP
    1. Turn off all non-essentials during peak hours, peak events
    2. Pre-cool spaces
    3. Minimize equipment use during peak hours, peak events
    4. Adjust schedules of people and equipment

II. Building energy consumption benchmarking
A. Starting point for energy efficiency by establishing baseline energy use intensity for a building or facility
B. Assists building owners/operators make informed decisions about energy use and efficiency
    1. Operational effectiveness
    2. Planning
    3. Investment priorities
    4. Identify underperforming facilities
    5. Compliance with SF's Existing Commercial Buildings Energy Performance Ordinance
    6. Compliance with AB1103 disclosure rules as of Jan 2014
C. EnergyStar Portfolio Manager
    1. Interactive online energy management tool
    2. Free
    3. Based on national statistics
    4. Statement of Energy Performance (SEP) for each building
        a. EnergyStar label and EPA score
        b. LEED Existing Buildings Operations & Maintenance (LEED-EBOM) requirements
        c. Supports real estate transactions
        d. Documentation for energy service contracts
        e. Marketing
D. LBNL's Energy IQ
    1. Free
    2. Based on California statistics

III. Energy and economics
A. Engineering economics
    1. Definition: systematic evaluation of economic merits of proposed solutions to engineering problems
    2. Principles
        a. Multiple possible solutions for each problem
        b. Assess alternative solutions consistently
        c. Uncertainty is always present
B. Project cost concepts: all costs must be accounted for to compare alternative solutions
    1. First cost: installation of project
    2. Operation & maintenance (O&M): cost to operate and keep equipment in good working order
    3. Life cycle cost: first cost plus O&M for life of the project
C. Design economics
    1. Consideration of cost over whole life of project, not just capital costs
    2. Energy efficient equipment may have higher capital/first cost, lower O&M over life of project

IV. Cost estimation
    A. Provides information for decision makers on whether to implement various recommended projects
    B. Factors in selection of cost estimation and project valuation method
        1. Stage of construction or project implementation process
        2. Total project or client financial scope
        3. Critical need for facility to have continuous operation (hospital, data center)
        4. Project complexity
    C. Time value of money
        1. $1 worth more in the present than in the future
        2. Money invested today earns returns in the future
        3. Prices may rise in the future
    D. Discount and interest rates
        1. Discount rate: the percentage by which future amounts are discounted so they can be compared with present amounts
            a. Complex calculation
            b. Excel NPV function
        2. Present value: today's value for a future amount that has been discounted
        3. Net present value (NPV): present value of a project less the project cost
        4. Interest rate: percentage charged for use of money over time
    E. Benefit/cost ratio
        1. Project benefits (savings) divided by project costs
        2. Simple payback = time it takes for project savings to equal project costs
        3. Return on investment (ROI) = measure of financial benefit of project, usually compared to other potential projects
    F. Other elements of project & asset evaluation
        1. Depreciation converts cost of asset to expense over its useful life
        2. Depreciation reduces taxable income
        3. Price changes
        4. Replacement analysis
    G. Risk, capital and other factors
        1. Breakeven analysis
            a. Point in time when total project costs = total project savings
            b. Same as payback period
        2. Sensitivity analysis
            a. Question the sensitivity of breakeven analysis
            b. Re-run breakeven analysis with different scenarios (increased energy costs, lower savings, higher installation costs, etc)
        3. Probabilistic risk analysis (PRA)
            a. Systematic methodology to evaluate risks with complex engineered or technological entities
                a. What can go wrong?
                b. What and how severe are the potential adverse consequences?
                c. How likely are these to occur?
            b. Feasible detrimental outcome of activity characterized by 2 quantities
                a. Magnitude (severity) of possible adverse consequences
                b. Likelihood (probability) of occurrence of each consequence
                c. Expressed numerically
                d. Total risk is expected loss
                e. Usually controlled in licensing processes

4. Capital budgeting process
    a. Company's planning process for investing in long-lived assets
    b. Basis for decision analysis for purchase/investment
        a. Simple payback (least sophisticated)
        b. NPV (more reliable)
        c. ROI (more reliable)

TYPES OF ASSIGNMENTS:

- Calculations from sample utility bill data, and plotting energy consumption using Excel
- Written comparisons of energy bills using different utility schedules
- Identify potential energy efficiency measures (EEMs) by looking at utility use data
- Identify cost savings opportunities from utility use data, such as scheduling people or equipment
- Compare first cost and lifecycle cost of various projects using sample data
- Calculate potential financial impacts using different financial metrics, such as simple payback, net present value

TEXTBOOKS & RESOURCES:

http://www.energystar.gov

http://wwwenergyiq.lbl.gov

Rates/Tariffs
http://www.cpuc.ca.gov/PUC/energy/Electric+Rates/utiltariffs/
http://www.cpuc.ca.gov/NR/rdonlyres/6AF20251-011C-4EF2-B99D-74CA315A4C40/0/RatesFAQ0710_3.pdf
http://www.pge.com/tariffs/

"Electricity consumers are divided into classes of service or sectors (residential, commercial, industrial, and other) based on the type of service they receive. Sectoral classification of consumers is determined by each utility and is based on various criteria such as:

- demand levels
- rate schedules
- distribution voltage
- accounting methods
- end-use applications
- other social and economic characteristics

Utilities typically employ a number of tariffs. The alternative tariffs reflect consumers' varying consumption levels and patterns and the associated impact on the utility's costs of providing the service."

Electric Schedules (PGE)
http://www.pge.com/tariffs/ERS.SHTML#ERS
Includes PDFs w/explanations of rate and qualifications.

Gas Schedules (PGE)
http://www.pge.com/tariffs/GRS.SHTML#GRS
Includes PDFs w/explanations of rate and qualifications.

TVP/PDP
http://www.pge.com/mybusiness/energysavingsrebates/timevaryingpricing/
http://www.pge.com/pdp/

Information on the CPUC
http://www.cpuc.ca.gov/PUC/aboutus/

Investor-Owned Utilities
http://www.forbes.com/sites/williampentland/2011/09/18/investor-owned-utilities-asleep-at-the-switch-or-above-the-law/
Opinion piece, but interesting read

http://www.energyvortex.com/energydictionary/investor_owned_utility_%28iou%29__private_utility_private_power_company.html
Dictionary Definition

Muni/Public Utilities
http://www.merriam-webster.com/dictionary/public%20utility