# Maximizing The Benefits of an Energy Efficiency Program

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CCES is an experienced firm dedicated to help buildings turn climate change, energy, sustainability, and environmental compliance to your advantage, realizing tangible financial gains. We have experience in all technical and policy areas.

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# Learning Objectives

1. Learn the basics of energy usage and demand
2. Learn what the wide-ranging benefits are of implementing a smart energy efficiency program
3. Learn how to perform a good energy audit
4. Learn how to write a proper energy audit report.

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# Introduction

Energy is a growing cost center for most buildings, likely to rise faster than other costs in the future.

Improving energy efficiency has many financial benefits for a building owner. There has literally been a revolution in energy technology in just the last few years, making efficiency affordable. This not only saves direct costs, but reduces other costs and raises asset demand/value, too.

The 1st step is to perform a thorough energy audit. This webinar will explain the basics of one's energy profile and approaches for a successful energy audit.



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# Why Address Building Energy Concerns

## *Making The Monetary Case*

- **$$$$:** Actions that reduce your electricity and fuel usage will save you a lot of $$$, given the rising cost and limited supply of energy.
- **Value:** If you save $100K/yr in energy costs, that's $$ in your pocket. What is equivalent in renting space? Easier to save energy or get higher rents?
- **Example:** DuPont spent $200 million in energy upgrades in the 1990's. Cost savings in 2012: >$300 million.

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# What is Energy Efficiency?

- Energy is needed in all processes, whether it is electricity for lights, elevators, fans, etc., oil or gas usage to keep space comfortable or to heat water.
- Since energy is a fixed need, being more efficient means using less to continue functioning properly and reliably. Energy efficiency saves money to the bottom line and also makes tenants more satisfied, raising the demand for your space.

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# Energy Audit

- Energy audit is a comprehensive, technical bldg. evaluation
  - How much energy is used in different areas and in different times,
  - How energy is used functionally (lighting, comfort, elevators, etc.),
  - How can the building's operations continue to function reliably while using less energy.
- It should be led by an experienced licensed engineer or professional, such as a Certified Energy Manager (CEM) or Certified Energy Auditor (CEA).
- Many incentive and rebate programs require a complete energy audit using ASHRAE methodology.

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# First Step In Performing An Energy Audit: Get To Know Facility And Energy Needs

- Before starting, understand your operations (Residence? Retail? Office? Manufacturing?); its unique energy needs.
- What energy does building need? Electricity, oil, gas, etc.
- Particular times when more or less energy is needed?
- Example: I did energy audits of about a dozen schools, and learned that two of them also contained residences for staff (clergy). That changed the way I had to evaluate those buildings.

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# Get Building's Utility Bills

- Obtain 24 months of recent utility bills plus invoices of all oil deliveries to understand actual historic usage. If there are multiple meters, get readings of them all, even low-use ones.
- Ask whether there have been recent changes to the building.
- Study the bills, graph usage.
- Track maximum peak electric demand, a growing issue in many places, as more utilities also bill for high peak demand.

**Tip:** Be very careful of units: kWh, therms, etc. Easy to get confused. Convert all to a common unit: kBtu.

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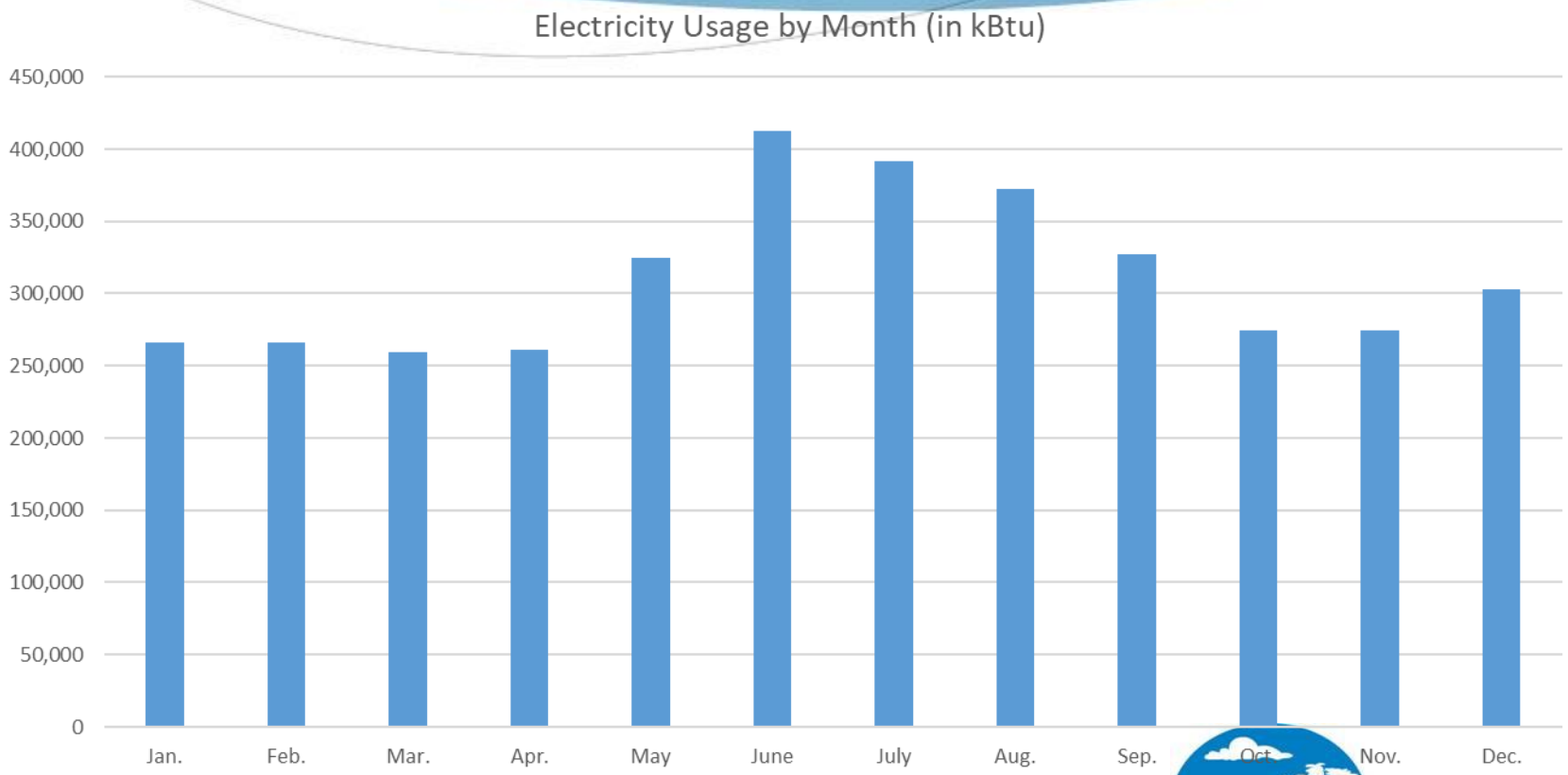
# Electricity Usage by Month

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# 3 Levels of Energy Audits – from ASHRAE

Level I –

- Simple walkthrough of building
- Rough estimate of energy usage for operations
- Preliminary determination of energy conservation measures (ECMs) to reduce energy use.

Useful to determine which areas to focus on in terms of energy upgrades and which ones not.

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# 3 Levels of Energy Audits – from ASHRAE

Level II –

- More thorough walkthrough of building
- Collect specific data (nameplates, lighting counts)
- Estimate more accurately energy usage of different operations; determine energy conservation measures (ECMs) with some accuracy, estimating potential costs, savings, payback, and ROI.

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# 3 Levels of Energy Audits – from ASHRAE

Level III

- Most thorough site visits of building
- Collect all relevant energy physical data of building
- Perform energy modeling to determine more accurately heat loss
- Determine ECMs with most accurate estimate of potential costs, energy usage, demand, and cost savings, payback, and ROI.

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# Collecting Data

Start with 24 months of recent electricity / gas / oil bills and graph out usage over time. At site, collect:

- Nameplate information about HVAC equipment. # of units, make/model #s, schedule, purpose (steam, DHW, cooling, etc.). **Tip:** Record model #s; most have relevant information online.
- Windows. Either count windows and size or estimate total window area compared to total outer wall area. Record # of panes.
- Take pictures. Your energy auditor is probably smart. But make sure auditor takes pictures of everything relevant. You never know what may be forgotten or need to discuss a subtlety. When in doubt, take more pictures!

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# Collecting Data

- Lighting count. Determine types and numbers of all lights in the building, even in remote areas, like closets or attics. Record the types of fixtures (number of lights/fixture) and ballast information. Separate counts by function (lights in different offices, warehouses, hallways, basement, etc.)
- Ask questions – of multiple people. Besides the Facility Manager, make sure other managers and users in the building contribute. Even a great Facility Manager may not know everything about functions in the building.

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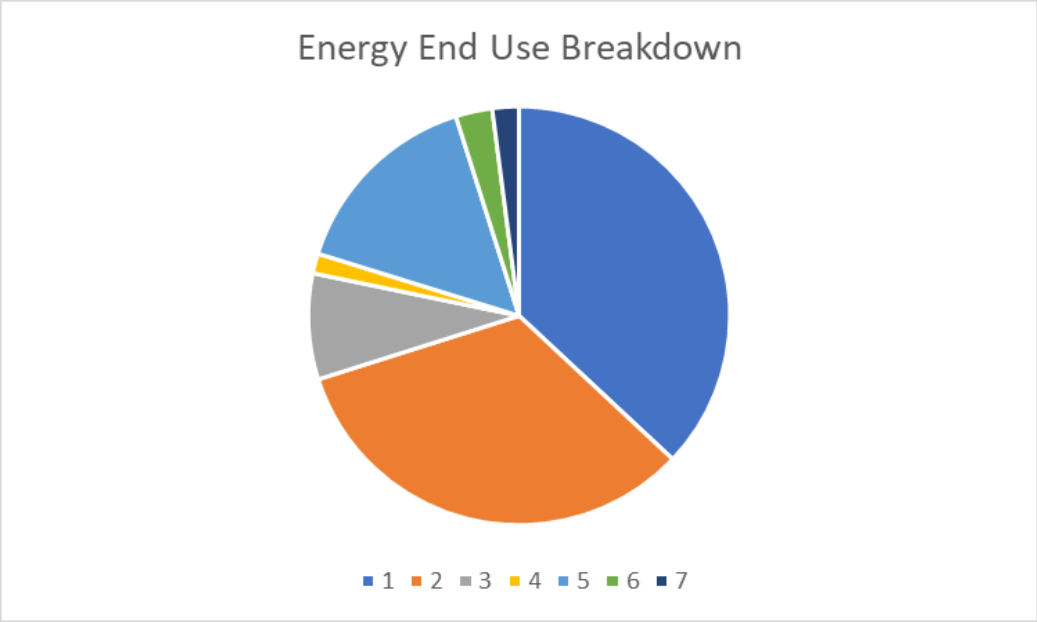
# Determine Energy Use By Function

Determine energy distribution by function, such as:

- heating (DHW vs space),
- cooling,
- lighting,
- elevators and conveyors,
- plug load,
- ventilation.

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# Determine Energy Use By Metric

- To better compare (benchmark) the energy efficiency of different buildings, obtain summary of production parameters. For example,
  - X kWh electricity / sq. ft. office space
  - Y therms nat. gas / unit
  - Z kBtu of total energy / thousand widgets produced
- See ENERGY STAR, a joint EPA/DOE venture, allows energy efficiency comparison of buildings in different categories (residences, offices, retail, schools, etc.).

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# Determine Where Energy Upgrades Make Sense

Focus on outliers, areas where energy costs are very high and/or are higher than average.

**Develop "Energy Conservation Measures" (ECMs)**

- Focus on highest energy-using proceses in building.
- Technologies proven to reduce energy for that function.
- Research utility/govt incentives to defray upfront costs.
- Look into whether building is a candidate for renewable energy (solar, wind, geothermal, etc.)

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# Lighting

- Lighting is a good “low hanging fruit”. **LED lights** use less than one-third the electricity compared to incandescents and less than half the electricity of most fluorescents and produces a whiter, gentler light.
- To determine electricity saved by LEDs develop a spreadsheet to list the number and wattage of existing lights and list replacement LEDs and their wattages to determine total reduction in usage and demand.

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# Lighting

- **De-lamping**. Many fixtures contain 2 or 4 bulbs (lamps). Are so many lamps necessary? Might areas be overlit? Opportunity to “right light”. Consider replacing bulbs with LEDs and fewer in number. Or have fewer fixtures.
- **Controls**. Occupancy and vacancy sensors turn lights off automatically when area is not in use. Very useful in certain areas not used often (warehouses, multi-family residence hallways/stairwells). Controls also exist for daylighting, turning off lights nearest windows when sun shines in and turn them back on later.

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# Building Envelope

- **Insulation:** Keeps out cold air in winter, hot air in summer, allowing reduced usage of HVAC. ASHRAE 90.1 lists R-values to insulate wall, basement and attic.
- **Windows:** Windows are “weakest link” of envelope. Check that windows are flush to walls and they are double-paned, properly caulked, and not damaged.

**Tip:** Building envelope upgrades often have a long payback, making them hard to “sell” internally. But if you combine with a lighting project, payback may be strong and project can be approved more easily.

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# HVAC

- **Boilers:** Units can provide heat for decades if maintained right. Ensure pipes leading to/from boiler are insulated. Ensure units are annually inspected, cleaned, and tuned.
- **Air Conditioning:** Commercial roof-top units have an EER or efficiency rating. These days, units with EER near 17 are available. If existing one is <9, new unit may be feasible. Ensure units/thermostats are inspected yearly.

**Tip:** A problem with older HVACs is that they were designed when energy was cheap and, thus, over-designed. Evaluate whether a smaller unit can do just as well.

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# Be Strategic

Low hanging fruit (“single”) is good. But consider a “home run”! A signature project that may pay back later, but will looks good. Example is renewable power.

- Building develops its own electricity from renewable sources, such as solar, wind, geothermal, etc.
  - Feasible? Is your roof or parking lot optimal to capture solar or wind?
  - Is there space to install geothermal for heating and cooling comfort?
- The source of energy is free (solar, wind, etc.). The only cost would be that of the renewable energy system itself. If logistics work out, the payback can be reasonable.

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# Develop A List of ECMs

Each ECM should be described thoroughly (how it works) and should include the following:

- its capital and installed cost,
- lifetime (number of years it is anticipated to be functional),
- amount of energy and cost expected to be saved per month/year,
- payback (number of years for savings to equal installed capital cost plus any O&M costs), and
- return on investment (ROI), annual percent gain by money spent on the ECM technology over its lifetime.

Make sure each ECM has a reasonable payback (not, say, 15 years).

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# Energy Audit Report

Auditor needs to prepare report to building manager summarizing energy audit. It should include:

- Description of facility (size, location, functions, other facts)
- List of current equipment and major users of energy
- Summary of recent energy usage, including graphs
- Breakdown of energy usage by physical area (office, warehouse, manufacturing, etc.) and function (lighting, heating, cooling, etc.)
- ECMs, both technical and economic evaluation
- Final ultimate energy usage and savings (including costs) if all or most likely ECMs are implemented.

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# Benefits of Energy Upgrades

## *Making The Monetary Case*

Why do an audit and be more energy efficient? There are many reasons. As discussed earlier:

- **$$$$:** Actions that reduce your electricity and fuel usage will save you a lot of $$$, given the rising cost and limited supply of energy.
- **Value:** One-time energy upgrade will save you $$ for many years. Renting property, you have to do year after year in some cases and hope you have good tenants.

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# Benefits of Energy Upgrades

## *Raise The Demand For Your Property*

- **Demand To Rent:** More and more renters are looking at energy efficiency and other “green” metrics in deciding on rentals. Demonstrating energy efficiency puts you in the right place to raise demand for your space and, therefore, revenue.
- **Asset Value:** Reducing energy costs and being “green” are attractive features should you wish to put your property on the market. Demonstrating lower energy costs provides the confidence to buyers that it is a high-quality property.

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# Benefits of Energy Upgrades

## *Reduce O&M Costs and Efforts*

- **Fewer Repairs:** Most technologies that are more energy efficient are longer lasting, too, reducing your O&M costs and allowing you to assign your O&M crews to other tasks that tenants see and demand.
- **Example:** LED lights are generally warrantied for 7 years (sometimes more). Typical fluorescents burn out every year or 2. That means much fewer trips up and down the ladder for your crew, allowing them to do other tasks and reducing the risk of accidents (falling off those ladders).

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# Benefits of Energy Upgrades

## *The Green Building Revolution*

- More people are interested in being associated with something “green” and certifiably so.
- Features can be built into buildings to minimize our environmental impact and improve health. **“Better performing buildings”**
- USGBC: LEED, WELL Programs
- Energy savings: 30%  GHG reduction: 35%
- Water cost savings: 35-50%
- Waste cost savings: 50-90%

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# Summary

An energy audit:

- Enables facility to understand its current energy usage and costs
- Provides a breakdown on what areas facility uses the most energy, such as heating, cooling, production, lighting, etc.
- Provides multiple ECMs, strategies to reduce energy usage in an economically profitable manner, allowing building owner/manager to review and decide which ones to implement and in what order
- Provides information to make budgetary commitment to upgrades
- Provides a “road map” to reduce energy responsibly without impacting operations.

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**“The best way to predict the future is to invent it.”**

- Alan Kay

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# Thank you.  Questions?

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