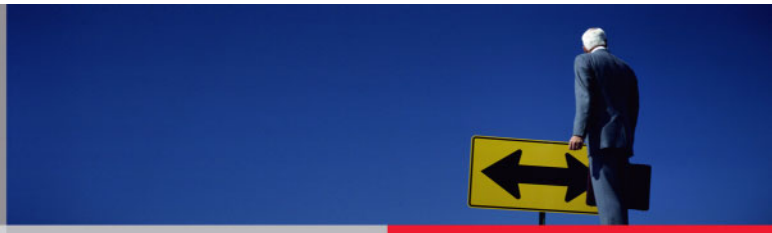
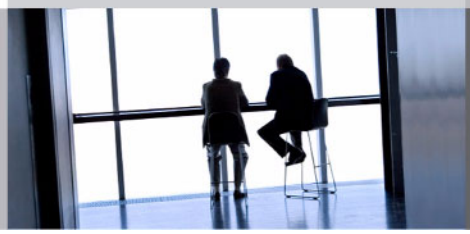
Energy Efficiency Incentives for the Data Center: Assessment and Measurement





Redguides
for Business Leaders

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- Obtain financial incentives to study and implement data center energy efficiency projects
- Measure and verify energy savings to improve decision making and validate project ROI and payback
- Receive Energy Efficiency Credits to publicly document your company's commitment to sustainability

Executive overview

There are many reasons why companies consider undertaking energy efficiency projects. Use of energy by the global population, particularly the burning of fossil fuels, has a negative impact on the environment; reducing energy consumption is one way to limit the damage. Being environmentally responsible is a reward in itself, but beyond that, being “green” enhances a corporation’s image by reflecting the environmental concerns of clients, vendors, employees, and the broader public.

But the most compelling reason to use energy efficiently is financial. Reduced energy consumption results in reduced energy costs, which is critical given today’s volatile energy markets. And, beyond the direct savings achieved by buying less power, there are many financial incentives offered by government entities, non-governmental organizations, and power utilities to encourage adopting wise energy practices. Some of these incentives take the form of payments to help defray the costs of modifying buildings, retooling production methods, and purchasing more efficient equipment, just to name a few. Other incentives include tax deductions and credits, as well as access to grants and loans to finance energy efficiency projects. There is even a category of incentives that allow companies to publicly register energy efficiency certificates, which can then be sold, traded, or retired.

Exploiting the available incentive programs can improve your ROI for energy efficiency projects, but navigating the vast number of programs and disparate reporting and compliance requirements they entail might seem overwhelming. And, to take advantage of these programs, companies are often required to measure and document energy efficiency gains. IBM® has real-world expertise in identifying incentive opportunities, quantifying energy use reductions, and reporting energy savings in compliance with program requirements. This IBM Redguide™ document is an introduction to the services we provide to help companies plan, implement, and claim the incentive rewards for energy efficiency projects.

One of the best places to look for potential energy savings in many companies is in the data center. IT functions tend to have extremely high demand for power, not only to run the actual IT equipment, but also to handle outsized demand for cooling, airflow management, losses in power distribution, and so forth. Furthermore, with escalating energy prices, the cost of power takes up a greater portion of the IT budget.

IBM is a global leader in data center efficiency, continually improving such things as hardware design, server and storage virtualization capabilities, and services to our clients to help them design and operate their IT functions in ways that limit energy consumption. This guide includes a case study illustrating how we applied this knowledge in our own data centers, thereby reducing our energy usage and qualifying IBM for incentive money, while also developing the methodology we offer to help our clients with their energy efficiency projects.

Introduction

The most valuable form of energy today is actually the energy not used, the so-called "negawatt." Energy efficiency is rapidly becoming recognized as the least expensive and quickest way for the world to meet its growing demand for energy while reducing overall impact on the environment. On average, investing in energy efficiency costs about 2.5 cents per kWh, an amount roughly equal to one-third of the cost of power generated from a new power plant. The implications of these figures are enormous: according to a recent study by McKinsey & Company, energy efficiency measures could reduce energy use by up to 23% by 2020, equal to a total savings of $1.2 trillion in the United States alone.[1]

At the same time, corporations worldwide are facing volatile energy prices and growing market demand for sustainable products and services. Many leading companies are evaluating measures to reduce their impact on the environment, with the objective of improving corporate image, reducing costs, and mitigating risk from impending and enacted policy changes, such as carbon "cap and trade" legislation in the U.S. and the Carbon Reduction Commitment ("CRC") in the U.K. IBM has led the way in partnering with such clients, focusing on opportunities for energy efficiency through improved server hardware design, streamlined software and virtualization capabilities, data center design and operations best practices, and other initiatives such as smarter buildings.

IT functions tend to be one of the biggest consumers of energy in most companies, with data centers drawing an especially large portion of that power. Typical IT in a data center uses up to 30 times more energy than a typical office building. Furthermore, the growing demand for computing, Internet, and online services results in even more dramatic increases in energy consumption. Energy costs, which used to be a relatively insignificant line item in the IT budget, have grown dramatically over the past decade, and some projections have them growing to as much as half of the average IT budget in the coming years. As a result, many data center and building facility managers are seeking to create a measurable reduction in their organizations' energy consumption and carbon footprint. These efforts will not only save money by lowering their energy bills, but can also benefit from a broader effort that leverages taxes, utility, and stimulus incentives opportunities to fund efficiency projects for both facilities and IT.

In this publication, we explore the financial grant and incentive opportunities available in the United States and Canada that can provide funding to bridge the financial gap that prevents many energy efficiency initiatives from moving forward, allowing clients to become "green" while enjoying the benefit of reduced costs and mitigating corporate risk exposure. We also provide a description of the standard process used to document energy efficiency gains through the creation of unique, serialized energy efficiency certificates, so that clients can claim the green benefits relating to energy efficiency projects with the uniformity and transparency required by outside stakeholders.

As the benefits of energy efficiency are being touted by international standards organizations, policy makers, and environmental groups worldwide, new incentive programs are rapidly being developed in other areas of the world as well. This guide can be used by audiences outside of North America to advance energy efficiency initiatives through the dissemination of best practices and the enablement of better information gathering about local, country-specific, and regional program offerings.

[1] Unlocking Energy Efficiency in the U.S. Economy, McKinsey and Co.

Incentive programs

As energy efficiency has risen to the forefront of clean energy practices and sustainability initiatives, federal and state governments, state-funded organizations, and power utilities themselves have designed numerous programs to encourage the implementation of energy efficient measures by providing financial assistance to drive down project payback periods and increase returns on investment (ROI). These programs have recently received substantial funding from the *American Reinvestment and Recovery Act of 2009*, which contains numerous provisions aimed at promoting clean energy in order to spur economic growth and energy independence in the United States. The intent of incentive programs is not to pay for the total cost of the proposed project; rather, the goal is to provide adequate financial subsidy in the early phases of project implementation to drive decision-making that is beneficial to everyone in the long run. Since many organizations have fixed payback periods or ROI hurdles that must be met for project approval, the subsidy will often allow key decision makers to green-light projects that might otherwise be delayed or disallowed altogether. Figure 1 offers a glimpse at the variety of programs available that can improve ROI.

Incentive programs are structured differently depending on the state or region of the country in which the energy efficiency project is located; factors that impact the aggressiveness of the program include program funding, overall electric demand, peak utilization demand, and unused capacity of the grid and local generating facilities. Programs in energy-constrained areas of the country will often pay up to half of the cost of qualifying measures where energy use is reduced by a substantial amount, and some aggressive programs will cover 100% of equipment costs.

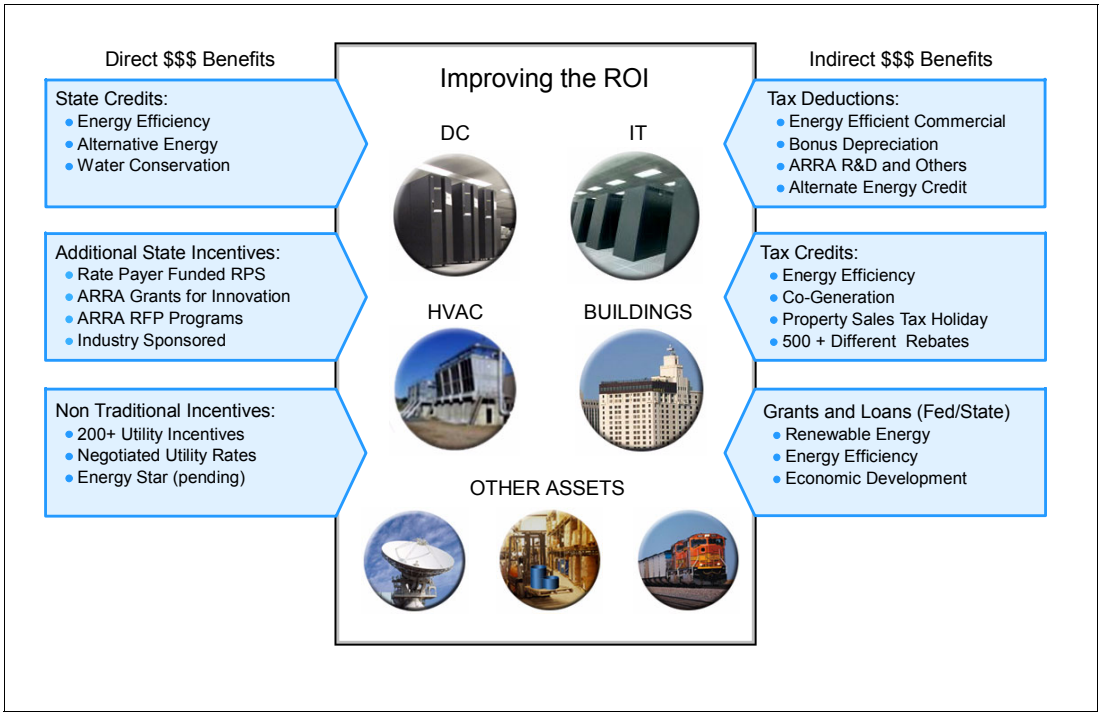

Figure 1 Incentive programs offer direct and indirect benefit dollars

Program availability

Programs are available from many different governmental entities, non-governmental organizations (NGOs), and local agencies. The Database of State Incentives for Renewable Energy (DSIRE) http://www.dsireusa.org tracks incentive programs, providing quick descriptions of many available programs and their target customers or goals, along with links to each sponsoring entity. However, it should be noted that programs change rapidly and new incentive programs might be developed in a given area without inclusion in DSIRE. In addition, some projects might provide enough savings that the local sponsoring organization is willing to develop new programs to accommodate the planned measures and ensure that the project moves forward. IBM always encourages its customers to reach out to their electric provider to understand what programs or accommodations might be available to address planned electric efficiency projects.

Program structures

Most incentive programs are funded, at least in part, by the rate payers themselves. Figure 2 shows the anticipated growth in this funding over the next 10 years. Typically, each electric account in a service territory pays a “system benefits charge” (SBC) or similar fee on their monthly electric bill. In most cases, the program parameters will require that the customer have regularly paid the SBC in order to be eligible for incentives. This sometimes impacts larger clients who have negotiated rates with the local utility, in which case they may avoid the SBC and hence eliminate themselves from eligibility for most incentive funding.

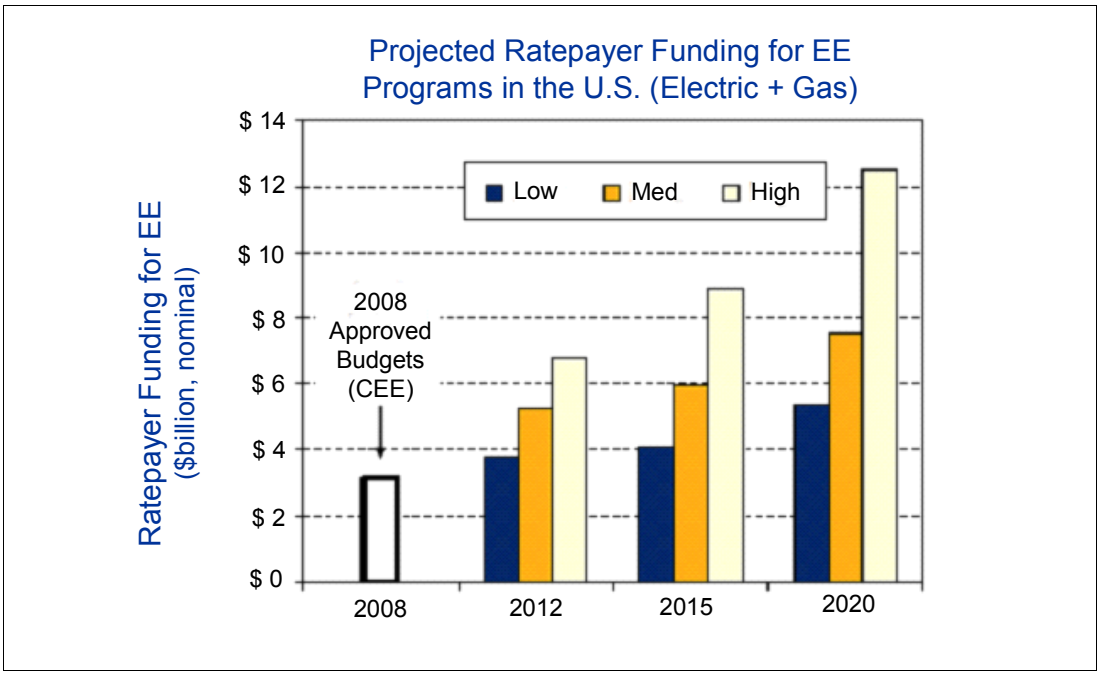

Figure 2 Ratepayer funding will continue to promote energy efficiency projects

Limits to incentive amounts are common, but vary widely. Most programs will provide a fixed incentive cap per project, per site, or per customer, or some combination of the three. Often, program administrators will prepare a cost-benefit analysis consisting of a simple payback analysis or the more comprehensive total resource cost test (see http://www.energywisepa.org/category/fact-sheet-categories/fundamentals-energy/total-resource-cost-test/total-resource-cost-test for more information) to compare the costs of the project with anticipated annual savings. Projects that pay back in too short of a

time frame may be ineligible for incentive funds because they would likely move forward without the additional financial incentive; likewise, projects that take too long to pay back (for example, more than 10 years) might be disallowed because the benefits attributable to reduced electric demand do not outweigh the initial cash outlay for both project and incentive.

Incentive programs are generally structured so that eligible projects fall into one of two categories:

- **Pre-qualified incentives:** Often referred to as “prescriptive” incentives or “rebates,” these programs provide a fixed dollar amount for common energy efficiency or conservation measures, such as the replacement of lights with more energy efficient CFL bulbs, or the replacement of a motor with a higher efficiency model. Applications for pre-qualified incentives generally consist of summary information about the site and project, completion of a standard form detailing the measures to be implemented, and purchase orders or other documentation that specify project costs. These incentives can also be obtained retroactively in many cases, usually with a limit of one year looking backwards.

  Some of the common energy efficiency measures eligible for pre-qualified incentives from many incentive programs are shown in Figure 3.

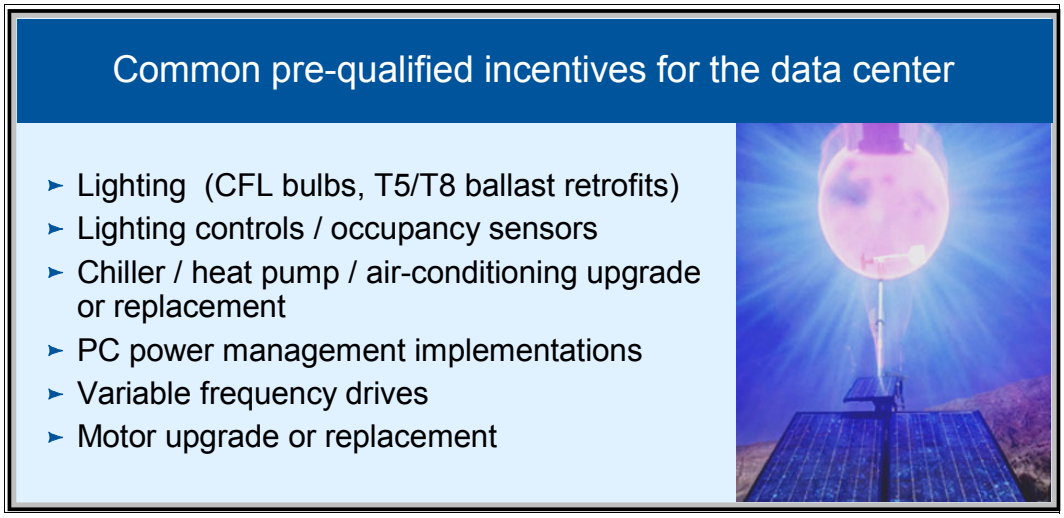

Figure 3 Simple measures can produce big energy savings as well as incentive dollars

- **Custom incentives:** Sometimes referred to as “performance” incentives, these programs provide the customer with more flexibility to design and implement complex projects that will permanently reduce electric demand, but where the energy savings cannot easily be quantified. In order to qualify for custom incentives, the customer must generally design a measurement and verification (M&V) plan to document the process used to estimate the energy savings up front (to reserve program funds), as well as the steps taken to validate the savings once the project is complete (to receive program funds). Many times the program will require site visits before and after the project work is completed in order to verify the systems, check assumptions, and meet with facilities personnel to understand the project in more detail.

  It is very important to note that in most cases, custom incentive programs require the applicant to apply and receive approval for projects before purchase orders are executed to move the project forward.

  Among the typical activities associated with custom incentive program applications are:

  – Documentation

  – Energy savings analysis/calculations

- Calculation methods
- Commissioning plans
- Operations and efficiency assumptions
- Manufacturer data (cut sheets)
- Monitoring data, if available
- Modeling data

Custom incentive programs typically pay a fixed price per kilowatt-hour (kWh) of annualized energy savings, up to a fixed percentage of incremental project costs. Total incentive funds paid might also be capped at the project, site, or company level, and installed technologies must often meet or exceed federal or state minimum standards, for example, ENERGY STAR minimum efficiency, or industry best practices such as policy guidelines developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) for HVAC projects.

Figure 4 identifies some of the common energy efficiency projects that might qualify for custom, self-directed incentive programs.

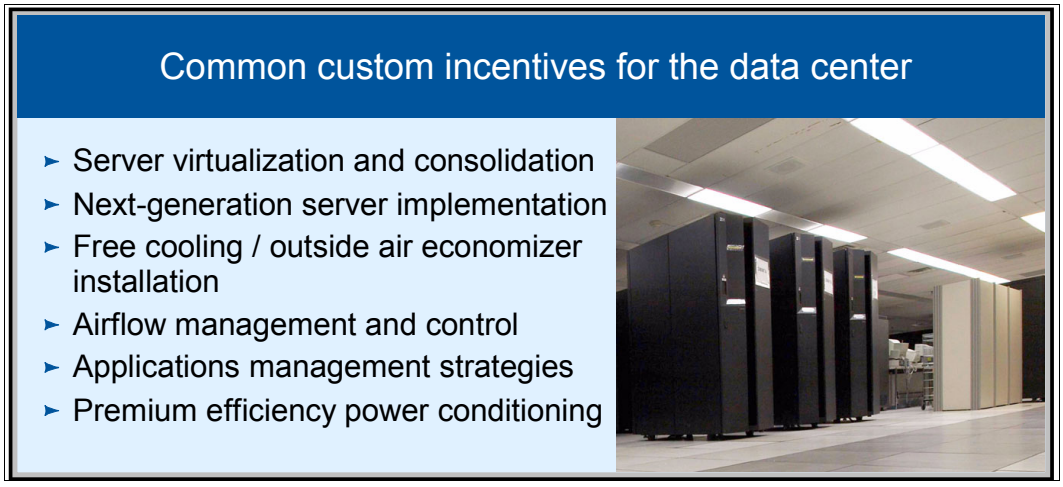

Figure 4 There are many opportunities to design custom incentives

- **Federal tax deductions:** Energy efficiency projects that meet specific target guidelines might be eligible for federal tax deductions in addition to those available from local and state programs. For example, the *Energy Policy Act of 2005* (EPACT) established a program to provide tax deductions for commercial buildings that implement lighting, HVAC, and building envelope improvements. Candidate projects must meet fairly stringent requirements and project scope is often limited, but the benefit to the customer is a one-time tax deduction that can be used in the year of implementation. EPACT provides a tiered benefit structure, up to $1.80 per square foot, based on the overall square footage of the building area that is improved and the efficiency achieved in relation to standard reference buildings implementing industry best practices.

Qualifying projects

Facilities and IT personnel consider all manner of energy efficiency projects in order to reduce costs related to the properties or systems they manage. In the data center, projects that focus on HVAC systems, or improvements to the building itself (insulation, window tinting, and so forth) are comparable to projects undertaken in any commercial building. As such, there are

usually well-defined incentive programs available for these projects, since programs targeted at commercial buildings tend to be fairly mature compared to more IT-focussed ones.

Projects addressing computing resources, airflow management, and the overall scope of services provided in an energy efficiency audit in the data center often fall into the areas of "uncategorized" projects for which a custom incentive project is the most appropriate. The next sections describe some of the more common measures that customers might consider in the course of implementing energy reductions in the data center.

Assessment

In the data center environment, the output from energy assessment projects might include recommendations for retrofits or replacement of cooling or IT equipment, server virtualization projects, temperature set point adjustments, and air flow management. Assessments are differentiated from retrofits or implementation in that recommended measures are not actually installed – instead, the output of the assessment activity is a list of recommended measures, costs to implement, and projected energy savings and payback period for the project.

The most commonly used terms to describe energy assessment activities have the following definitions:

- **Energy Audit:** An energy audit seeks to identify and analyze energy use patterns, allocate energy use to the major building systems (plug loads, lighting, ventilation, air distribution, chiller plant, and so forth), and identify systems or processes that have potential for energy savings via operational improvements or capital investment. During the course of an audit, personnel gather data on building systems and equipment through on-site observations and measurements, conversations with building operators, and review of drawings. Typical outputs of an energy audit are a list of energy conservation measures (ECMs), corresponding projections of the potential energy and cost savings from each ECM, and budget cost estimates necessary to implement each measure so that simple payback calculations or other financial analysis can be performed.
- **Feasibility Study:** The primary goal of the feasibility study is to assist customers in making more informed energy decisions at their facilities. This service might include equipment replacement or upgrade recommendations, comprehensive energy analysis in campus-type settings, or energy-related design assistance through computer-assisted building modeling.

Some other common assessment activities conducted in the data center are illustrated in Figure 5.

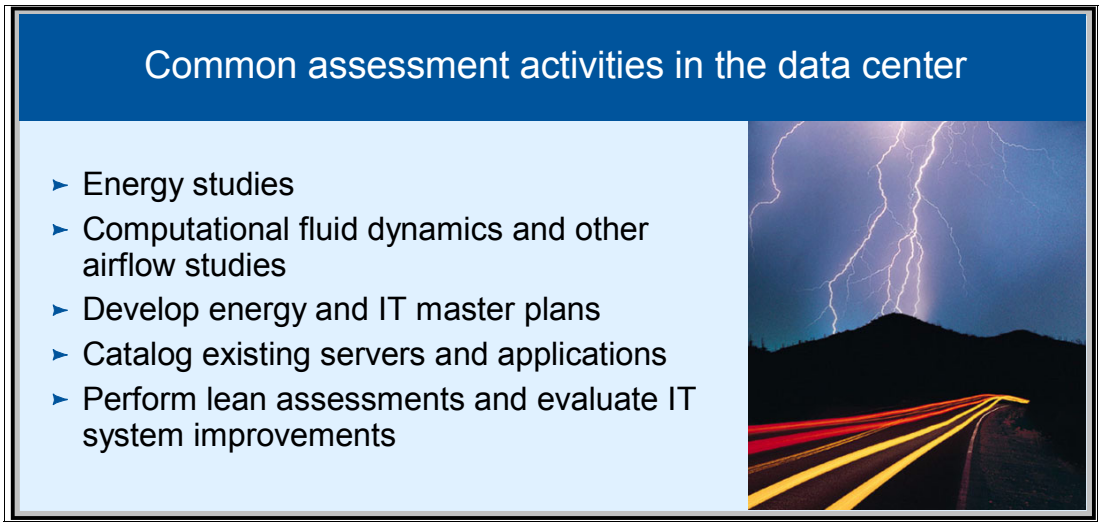

Figure 5 Understanding your current environment is a great place to start

Note: In many cases, up to half of the cost of the energy audit can be recovered through financial incentives that are provided to encourage the identification of energy savings opportunities. In addition, energy audit providers will often shoulder the burden of applying for and managing the incentive application process.

Implementation

Energy efficiency implementation projects result in physical changes to existing energy using systems. Myriad projects are conceivable to reduce energy usage across corporate, commercial, and industrial environments, but in the data center these activities can be broken down into a small number of categories, including improvements to reduce cooling load, to minimize power distribution losses, or to consolidate and streamline computing capacity and IT load.

Some of the commonly used terms to describe energy efficiency implementation activities are defined as follows:

- **Retro-commissioning:** Retro-commissioning projects are undertaken to verify that all installed systems are integrated properly, perform as designed, and meet the operational needs of the staff and system resources on site. Ancillary activities may include training for personnel who are responsible for building operations and maintenance. The primary goals of such projects are to improve system performance and energy efficiency while at the same time maintaining or enhancing occupant comfort and indoor environmental quality. Retro-commissioning activities that are eligible for incentives focus specifically on energy efficiency, such as the verification of proper control strategies, sequences of operations, and operations and maintenance plans.
- **Retrofit:** Energy-efficiency retrofits include any improvements to existing structures or systems that provide an increase in the overall energy efficiency of the building. Common measures implemented include upgrades to lighting, implementation of building controls, and upgrades to HVAC systems, such as installation of variable frequency drives. Retrofit projects might also focus on demand-side management systems, allowing end users to control their energy use in a more efficient manner.

Among the common data center retrofit measures that often qualify for financial incentives are those identified in Figure 6.

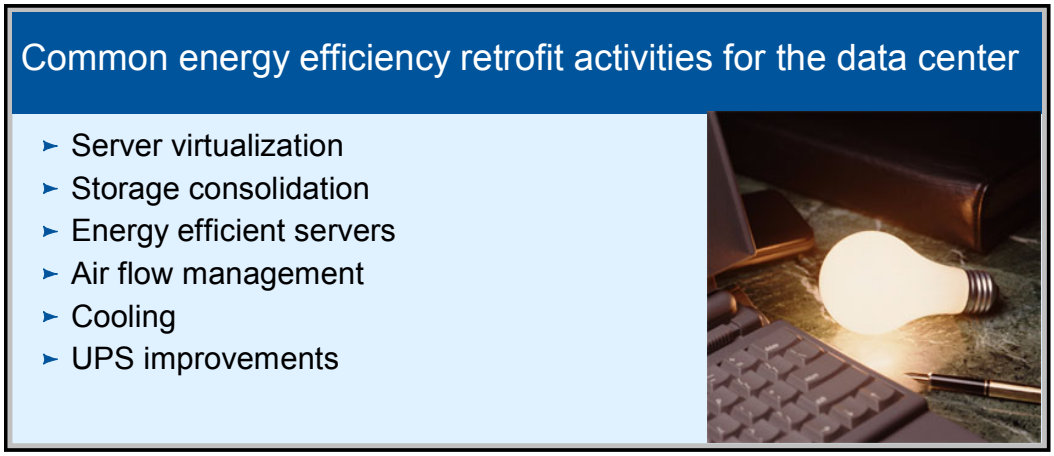

Figure 6 There are many ways to save energy in most existing data centers

- **New construction / Major renovation:** Incentive programs often provide substantial funding, and in many cases technical assistance, for construction of new buildings or new spaces within existing buildings, as well as for major renovations of existing facilities where energy efficiency improvements are added. The intent of these projects is to encourage permanent transformation in the design and construction of buildings by offsetting the costs for incremental improvements. Some programs might require implementation of minimum Leadership in Energy and Environmental Design (LEED) techniques or installation of Energy Star equipment.

  Common data center construction or renovation measures that often qualify for financial incentives are shown in Figure 7.

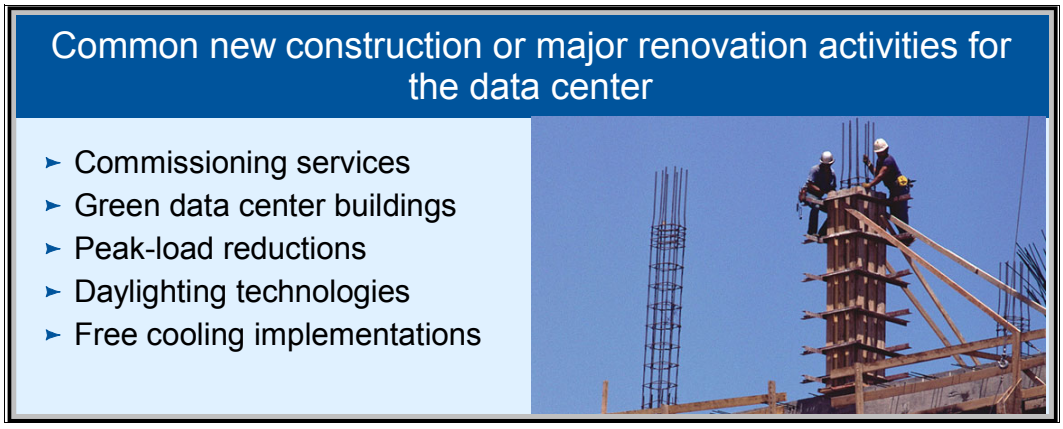

Figure 7 Plan for energy efficiency from the beginning

Application process

Programs differ substantially in terms of project eligibility, incentive amounts, and overall funding, but the application process is essentially the same in many areas. All projects require an initial application with high-level details of the work planned, as well as general information such as site address, utility account numbers, and contact details. The funding entity will review the application and associated savings estimates and work with the customer to gather additional detail. For custom incentive programs, this may include site inspection to

review the work planned and validate the current state of the systems to be improved. Upon approval, the program issues a purchase order or confirmation of the approved amount, at which point the work can proceed. Once complete, the final application is submitted and validation of the proposed changes, including possible follow-up site visits, might be required.

Figure 8 illustrates typical program activity flow.

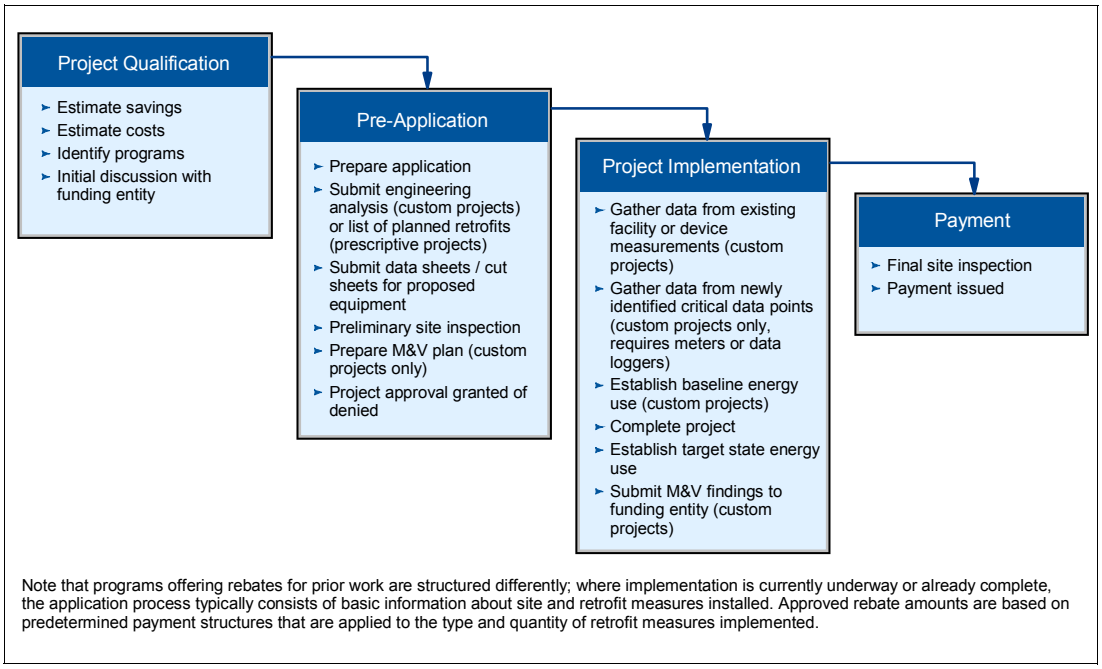

Figure 8 Typical phases of an energy savings program

Measurement and verification

Measurement and verification (M&V) is the process of systematically documenting and validating energy savings resulting from an energy efficiency project. The purpose of M&V is to provide a common approach to calculating energy savings in order to make investment in energy efficiency more reliable and profitable. From the perspective of the organization providing incentive programs, the intent is to confirm that the applicant claiming energy reductions has accurately measured the energy use of involved systems, and that claimed reductions are real, permanent, and additional. In addition, clients can use the outputs from the M&V process to create and publicly register energy efficiency certificates, described in the next section, to authenticate energy savings claims for the benefit of external constituencies.

Energy savings are determined by comparing measured energy use or demand before and after implementation of energy efficiency measures. The basic equation used is:

Energy Savings = Base year Energy Use - Post-Retrofit Energy Use +- Adjustments**

** Adjustments can consist of changes to baseline or post-retrofit conditions, such as weather, occupancy, or equipment operations.

Measurement and verification is normally guided by the principles of the International Performance Measurement and Verification Protocol ((IPMVP, or sometimes called the MVP), a protocol first published in 1996. The protocol contains methodologies compiled by a

technical committee comprised of industry experts and national organizations from more than 25 countries. More detailed information on IPMVP can be found at the following link:

http://www.evo-world.org/index.php?option=com_content&view=article&id=272&Itemid=504&lang=en

M&V process flow

The IPMVP provides the flexibility to establish an M&V plan that is cost-effective relative to the cost of measures implemented, while at the same time achieving the goal of reliability. The process commences with the gathering of operating data and energy measurements from the current, pre-retrofit system. Personnel must then design, install, and test new measurement equipment, if required for the final M&V plan. Once complete, the team can design the energy savings program, documenting both the design intent and the methods that will be used to demonstrate achievement of the design intent. This will be the primary input to the creation of the M&V plan.

Once the energy efficiency measures have been implemented and commissioned to meet the design intent, operating data and energy measurements are gathered once again in the post-retrofit system. These measurements are then used to compute the overall energy savings for each measure implemented, which will be reported to the incentive program.

Typical process flow for the M&V process is illustrated in Figure 9.

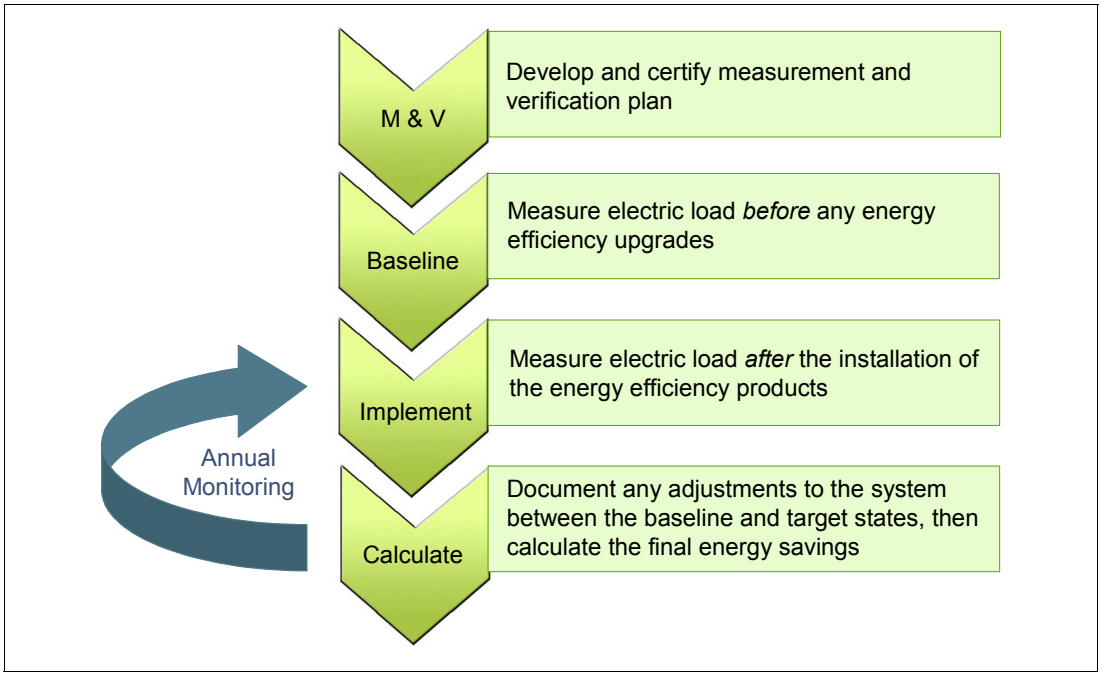

Figure 9 High level view of the M&V process flow

Electrical measurements and calculations

The underlying protocol for measurement and verification specifies a number of methods for verifying energy use, including:

- Utility or fuel supplier invoices or meter readings.
- Special meters isolating a retrofit or portion of a facility from the rest of the facility.

- Separate measurements of parameters used in computing energy use. For example, equipment operating parameters of electrical load and operating hours can be measured separately and factored together to compute the equipment's energy use.
- Computer simulation that is calibrated to some actual performance data for the system or facility being modeled, for example, DOE-2 analysis for buildings.
- Agreed assumptions or stipulations of system or equipment parameters that are well known.

In the specific case of data centers, M&V typically involves direct measurements taken from electric circuits and equipment installed as part of an overall energy efficiency or retrofit project. In larger, more complex projects, M&V activities are normally required in order for the incentive program to release funds. Specific tasks that are required might include:

- Review of utility bills
- Records of energy measurements
- Calculations of energy savings
- Review of single-line drawings
- Installation of metering devices
- Review of the procedures in place for taking energy readings and calibrating devices
- Review of equipment spec sheets

Energy efficiency credits

Unlike renewable energy projects, which provide standard mechanisms for metering renewable energy system output and allowing the system's owners to claim, trade, or retire environmental benefits relating to the project, energy efficiency projects have long suffered from a lack of standards for monitoring and reporting. Energy Efficiency Certificates (EECs) have been created to address this issue. EECs, sometimes referred to as Energy Savings Certificates, or ESCs, are unique, serialized commodities representing exactly one megawatt-hour of electricity saved over a one year period. In addition to electric savings, they encompass the environmental attributes (CO_2, SO_2, NOx, and other harmful emissions) derived from reducing electricity use, given the fuel mix used to power local electric generation facilities.

An EEC is a unique and traceable commodity certifying that each MWh is a real and permanent reduction that has been documented and verified by an independent third-party auditor. EECs can be traded in both regulated compliance markets and emerging voluntary markets (similar to carbon emissions trading schemes), or they can be "retired" to help meet corporate greenhouse gas reduction goals. Depending on the type of project they relate to, EECs are normally audited on a quarterly or annual basis because energy use, and related energy reductions, are normally not constant over time. Audits consist of a formal assessment conducted using established, internationally recognized protocols, and in general, third-party, independent audits conducted by individuals external to the facility being audited are encouraged in order to ensure objectivity throughout the audit process.

Benefits

The primary issue organizations face when reporting energy usage and energy savings is that external constituencies, including consumer advocacy groups, environmental activists, and industry competitors, often require documented proof of claims made. Third-party measurement and verification provides the mechanism to compare a company's established process against standard protocols and methodologies for measuring permanent energy reductions, ensuring reported data is accurate, complete, and unbiased. In addition, rapidly

shifting protocols, as well as a lack of oversight in environmental attribute markets, make third-party verification instrumental to the transparency and integrity of environmental or sustainability claims. Finally, the rigorous process of third-party measurement and verification to support the creation of EECs ensures that the reported data is of sufficient quality to meet all current and anticipated governmental or regulatory policies, so that companies can demonstrate pre-compliance if and when measures such as cap and trade are enacted. Figure 10 illustrates some of the advantages of using a third-party verifier.

A McKinsey report, "How Companies Think About Climate Change," showed that more than 60% of executives think climate change is strategically important. Nearly 70% see it as important for managing corporate reputation and brands. Energy Efficiency Certificates provide these executives with the proof they need to demonstrate that their claims relating to energy efficiency are backed by internationally developed standards and transparent reporting mechanisms.

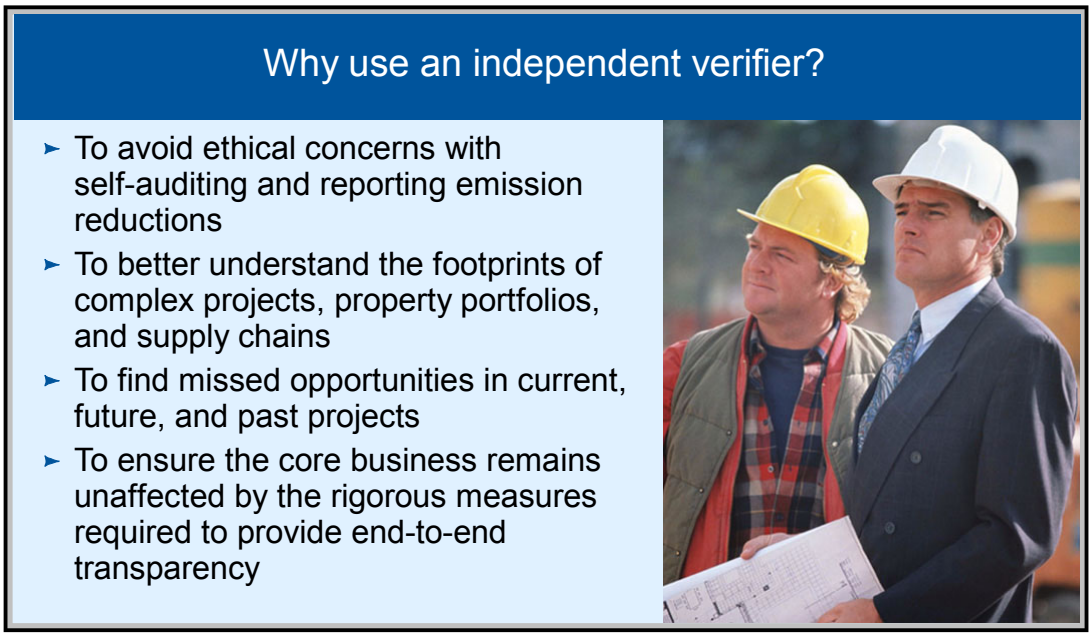

Figure 10 Make the most of your energy efficiency projects by engaging expert assistance

The primary benefit of third-party verification is that companies avoid ethical concerns related to self-reporting. In addition, third-party auditors can often report and register certificates that can be retired on a certified environmental registry. Environmental registries provide a significant benefit in that they allow public access to reports and documents substantiating an organization's sustainability claims. Specifically, each registry will provide:

1. A unique and traceable serial number, vintage year, and a unique project location for each certificate created
2. Publicly viewable reports to demonstrate transparency to shareholders, consumer advocacy groups, and other stakeholders
3. Guarantee as to the security of all transactions, including retirement of the certificates or trades to third parties
4. Protection against double counting of claims
5. Documented proof of pre-compliance to implemented carbon cap and trade policy

Markets

Markets for EECs take two forms in the U.S. today: compliance markets, where EECs must be purchased by electric providers to meet their mandated renewable portfolio standard (RPS) goals; and voluntary markets, where companies and individuals can purchase or retire EECs to offset their overall energy use and carbon footprint. Additionally, there are numerous international markets developing in countries such as the U.K., Italy, and India. The state of Connecticut has a compliance market that requires electricity providers to source 4% of their electricity load from energy efficiency measures. If they do not meet this requirement, they are forced to pay a costly penalty. This has created a viable and active trading market for EECs that provides a very substantial, recurring revenue stream to companies that have completed efficiency measures and thoroughly measured and documented related energy savings. More than 20 other U.S. states have specific energy efficiency goals in their renewable portfolio standards. This will likely lead to new compliance trading markets in the near future. In fact, as of this writing, many large companies, including IBM, DuPont, Kohl's Department Stores, and Wal-Mart Stores, purchase renewable energy credits in voluntary markets in order to offset their carbon footprint and meet stated carbon reduction goals. As markets for EECs mature, it is very likely that these same companies will begin to create, trade, and retire EECs from their own ongoing energy efficiency projects.

Case study

Neuwing Energy Ventures (Neuwing) was engaged by IBM in 2009 as an independent, third-party auditor tasked with reviewing the Measurement and Verification (M&V) procedures used by IBM in order to validate energy efficiency gains in multiple IBM data center locations in the U.S. and Canada. As part of this effort, Neuwing collected available data to quantify, certify, register, and market or retire Energy Efficiency Certificates for verified MWh reductions, beginning with work commencing in 2008 and continuing through the end of 2009. As a natural extension of this work, Neuwing agreed to research, evaluate, apply for, and manage available incentives for energy efficiency gains, including grants and rebates available from federal and state governments as well as local utilities.

Incentives and grants

IBM's efforts to become a global leader in data center efficiency have resulted in significant server virtualization and consolidation work in internally-owned or internally-operated data centers. As part of its incentive management work, Neuwing identified state and utility programs that would pay significant incentives for server consolidations planned in 2010 and 2011. To date, IBM has been approved for U.S. $1.6 million to enable server consolidation projects in the company's Poughkeepsie, NY, and Boulder, CO, data centers, ensuring a meaningful difference in project payback periods and allowing significant additional work to take place over the course of the 2-year project period.

Energy efficiency certificates

As of the end of 2009, Neuwing validated and registered over 1000 MWh of energy reductions in IBM data centers for server virtualization and consolidation work completed in 2008 and 2009. This same work is projected to save over 3500 MWh per year ongoing. A subset of these EECs was generated from work conducted in energy efficiency compliance markets; these certificates are planned to be sold beginning in Q1 2011 and continuing for a 10-year period or as long as the efficiency gains last.

Payback

Based on project costs incurred in 2009 to complete the audit work in all data center locations, project payback for the creation of EECs and management of the incentive

application and related measurement and verification documents is anticipated to occur in early 2011 when initial payment for the first incentive is received. In addition, EECs for a free cooling project sold in a compliance market will create additional revenue streams starting in Q1 of 2011, assuming approval by the Department of Public Utilities in Connecticut.

Project findings

The pilot project within IBM resulted in a number of lessons learned and the development of best practices to track energy efficiency gains from ongoing server consolidation work. The following activities are recommended to ensure a successful project:

- Create a formal methodology to capture the data required for M&V of server virtualization and consolidation work.
- Establish a standard for reporting on physical machine configurations, such as the number of processors and cores installed, which are meaningful to energy draw calculations.
- Record system information and power draw relating to attached storage devices and networking equipment, which is projected to increase documented energy savings by 40 - 60%.
- Create a centralized datamart for project work that will provide a static view of projects undertaken to date. Benefits of doing this include:
  - Data standardization / validation / de-duplication on import.
  - Ad-hoc reporting on energy project results, including both MWh reductions, cost savings, and carbon and carbon equivalent emissions.

Getting started

IBM has a large portfolio of offerings related to energy efficiency, and a world-wide team of subject matter experts to help you get the most from your data center, your IT investment, and your energy budget. To open a dialog about how our team can help with your specific challenges, send a note to <datacntr@us.ibm.com>. The Data Center Services staff can answer your questions and devise a plan to help you achieve your energy efficiency goals.

The following websites offer some interesting details about IBM's green data center offerings, including examples of how we put green concepts into practice at our own facilities and how we have helped clients to do the same. You will also find links to resources such as our "Data Center Energy Efficiency Assessment" and one-click access to IBM customer service personnel at these sites.

http://www-03.ibm.com/systems/services/labservices/solutions/labservices_datacenter.html

http://www.ibm.com/ibm/green/index.shtml

http://www-935.ibm.com/services/us/index.wss/offering/its/a1027893

Other resources for more information

The Database of State Incentives for Renewable Energy (DSIRE)
http://www.dsireusa.org

A resource cost test methodology
http://www.energywisepa.org/category/fact-sheet-categories/fundamentals-energy/total-resource-cost-test/total-resource-cost-test

International Performance Measurement and Verification Protocol
http://www.evo-world.org/index.php?option=com_content&view=article&id=272&Itemid=504&lang=en

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