Web-Based Toolkit for Multi-Location Energy Programs

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Executive Summary

Commissioning (Cx) and Retro-Commissioning (RCx) are proven strategies to cost effectively reduce both energy costs and CO_2 emissions while helping companies achieve Energy Star ratings. The perennial challenge is how to accelerate the adoption of these programs by company decision makers and an even greater challenge, how to educate these decision makers to implement effective programs across a portfolio of geographically dispersed buildings.

Companies need to understand how they would verify the implementation of RCx program recommendations, how to maintain the savings achieved in both RCx & Cx programs and how to manage such a large program. While they can understand the benefits of achieving these savings across their portfolios, obstacles to overcome are:

- Inadequate communications
- Difficult data collection
- Lack of accountability at the sites
- Challenges tracking the implementation of Energy Savings Measures (ESMs)
- Verification of the savings

Unless we can show owners how these challenges will be addressed, management skepticism will continue to be one of the major obstacles to overcome in gaining approval of these of projects..

One successful approach that addresses each of the obstacles above is to leverage the power of the Internet and web-based services through an Application Service Provider (ASP) model that supports a life-cycle approach to program implementation and management reporting. Leveraging the Internet and a web-based platform provides:

- A communications platform for all stakeholders
- Integration of multiple data sources
- Management status reports in near real-time
- A continuous improvement process

The introduction of a life-cycle approach supported by a web-based platform to create and execute a multi-site program for customers is the basis of the solution.

Multi-site Program Considerations

Energy costs have risen in many places by 25% or more in just the last few years with no obvious relief in sight. As a consequence, energy costs are taking an ever bigger bite out of corporate profitability. In addition, Global warming (a by-product of energy use) is a world-wide political issue and likely to be a major political theme in the 2008 elections (Horsley).

Beyond strictly viewing energy conservation as a cost reduction strategy (or support sustainability objectives), a building's "energy fitness" is gaining recognition as a key parameter in the overall value of a property. In Feb 2007 CoStar, the number one provider of information services to the commercial real estate industry, will begin adding the Energy Star rating of properties in its massive online database--which currently contains more than two million researched and verified commercial properties of all classes and types.

While commercial building owners, REITS and Property Managers are signing up for Energy Star ratings, few have launched company-wide RCx programs, in part due to the challenges of implementing complex multi-site programs.

Successful implementation of any energy program needs management support. While a single-site program can be successful with a strong site champion, a multi-site program needs ongoing management support, communications and meaningful affirmations for good or poor performance of their facility. Some additional challenges include:

- Visibility and leadership of key top management
- Creation and maintenance of program awareness at the sites
- Communication with stakeholders that vary site-by-site
- Minimization of travel costs and maximization of onsite effectiveness
- Data collection challenges
- Conversion of recommendations into actions
- Program measurement effectiveness and savings
- Prevention of back-sliding of savings (post project)

Accessing web-based services through an Application Service Provider (ASP) model has several advantages for a multi-site energy program. The application software resides on the vendor's system and is accessed by users through a web browser. Common features associated with ASPs include:

- ASP fully owns and operates the software application(s)
- ASP owns, operates and maintains the servers that support the software
- ASP makes information available to customers via the Internet browser or a "thin client"
- ASP bills on a "per-use" basis or on a monthly/annual fee

The advantages to this approach include:

- Software integration issues are eliminated from the client site
- Software costs for the application are shared over a number of clients
- Vendors can build more application experience than the in-house staff

- Key software systems are kept up to date, available, and managed for performance by experts
- A provider's service level agreement guarantees pre-determined service levels
- Reduction in the uncertainty associated with internal IT costs in favor of a predictable monthly fee
- Elimination of IT staff involvement with potentially conflicting program priorities and firewall issues that can delay data acquisition
- Redeployment of IT staff and tools to focus on strategic technology projects that impact the enterprise's bottom line

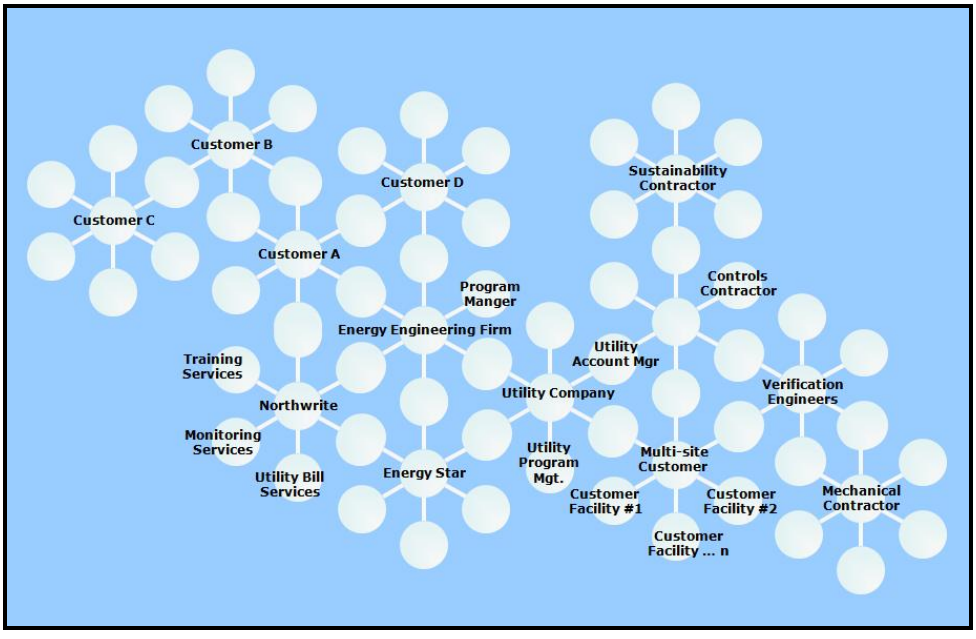
Some inherent disadvantages include:

- The client must generally accept the application as provided since ASPs can only afford a customized solution for the largest clients
- Changes in the ASP market may result in changes in the type or level of service available to clients
- Integration with the client's non-ASP systems may be problematic

These disadvantages can be addressed by the selection of an ASP vendor that provides a full suite of applications with the depth to support a full service energy program.

Communications Platform for all Stakeholders

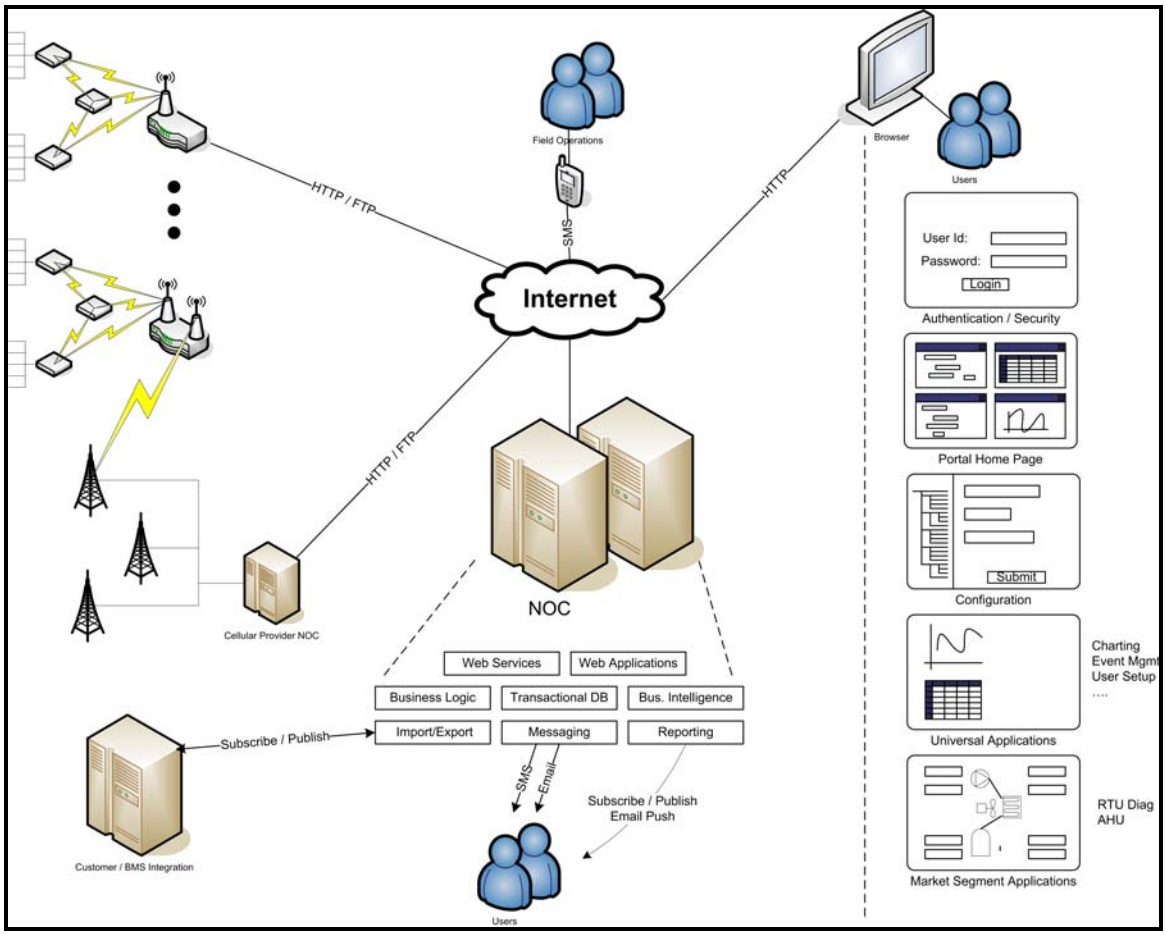
The ASP model allows all stakeholders to access applications through a web browser and become part of an energy business network. A business network created for your multi-site program can be as powerful as the social networks that are proliferating on the Internet. All stakeholders can have access to view their own data or the data for a group (with permissions) that is created for the program. The stakeholders are the RCx / Cx providers, your multi-site customers, utilities, service contractors and any other internal/external users as required. The graphic below demonstrates this network dynamic.



Integration of Multiple Data Sources

User adaptation of an energy website is greatly enhanced when the website accepts multiple data sources and integrates them into the applications used in the program. Users are more likely to utilize these tools when all applications and data are available in one place with one login. The website should accept multiple methods for data entry and avoid complexity.

In a web-based system, data from multiple sources can be uploaded to the vendor's Network Operations Center (NOC) and made available to users in near real-time. Data sources include: user data entry into task tracking and information-sharing applications, file uploads, wireless or utility feeds of interval meter data, utility bills and various program documents. These data are uploaded to the NOC servers and accessed by users through their program website as shown in the graphic below.



Two of the main data sources for an energy program are Utility Bill Data and whole building Interval Meter Data.

Utility Bill Data – While manual data entry is often required, it is highly prone to errors when interpreting a variety of utility bills. Automated data feeds from utilities are practical for a multi-site program within one utility territory; but very difficult to implement when dealing with the many utilities that might serve a multi-site client.

Many companies provide third party utility bill data entry services, which has the advantage of more accurate data entry with quality control processes in place to ensure data integrity. Some of these companies provide this service to support their utility payment services, while other companies provide this as part of an integrated energy program.

Vendors that are Automated Energy Star Benchmarking Partners provide automatic uploads of Energy Star data in XML format to the EPA. These data are then populated in both the Energy Star website and in tables and graphs integrated into the energy program website.

Interval Meter Data – Whole-building interval meter data are critical to any multi-site energy program. Using the existing company intranet to upload these data appears to have the lowest cost. However, this approach can delay the launch of the entire energy program as it requires IT involvement for a myriad of logistics and security issues. Once a program is launched, painful experience has shown that network changes (e.g. firewall upgrades, IP reallocations, etc.) can suddenly stop the flow of data--resulting in weeks or months of missing information. The lost energy savings caused by these delays can never be recovered. Dial-up data collection has some of the same issues and often there is no access where the energy meters are located.

We have found that wireless monitoring and data upload in near real-time can successfully address most of these issues. Wireless telemetry monitors can be installed right at the meters and require little additional wiring and no local network connection. The site technician can usually install the hardware and data can be flowing into the NOC in a matter of minutes.

In addition to energy data, other sources of information (documents, task details, schedules, etc.) come from direct user input, RCx/Cx provider audit reports and program management activity. To truly understand what is going on with a program, all of these data should be available (and integrated into the same workspace).

One example of the power of integrating data sources is shown below. Here, the tool integrates projected savings from the audit report, actual savings from utility bill analysis and project tracking showing ESM task completion percentage. To maximize the effectiveness of such reports, it needs to provide results at individual building levels as well as rollups for the portfolio.

	Projected Energy Cost Savings		Actual vs. Projected		Energy Action Items			Comm.
Site Name	Annual Savings	Savings %	Actual Savings Normalized kWh Per Day to Date	% of Projected	Comp.	Total	%	Days Since
-Energy Company1	$101,477	12.0%	12.6%	105%	7	7	100%	288
-Energy Company1	$129,600	14.0%	4.4%	31%	1	5	20%	380
-Energy Company13	$100,000	10.0%	12.1%	121%	6	7	85%	741
-Energy Company7	$85,000	6.0%	1.4%	23%	1	9	11%	42
-Energy Company1	$100,000	10.0%	8.6%	86%	2	3	66%	741
-Energy Company2	$50,000	12.0%	10.1%	84%	5	9	55%	274
-Energy Company175	$34,000	14.0%	1.3%	9%	1	6	16%	41
-Energy Company1	$200,000	16.0%	13.1%	81%	2	3	66%	407
-Energy Company1	$95,920	8.0%	18.3%	228%	6	6	100%	245
-Energy Company3	$100,000	10.0%	11.8%	118%	3	4	75%	287
-Energy Company3	$38,650	11.0%	8.2%	74%	2	4	50%	175
-Energy Company1	$175,887	21.0%	12.7%	60%	2	4	50%	244
-Energy Company175	$100,000	6.0%	7.5%	125%	2	3	66%	92
-Energy Company175	$100,000	10.0%	6.7%	67%	2	3	66%	114
roup Totals or Weighted Averages *commissioned sites and complete data only)*	$1,410,534	10.7%	9.5%	88%	42	73	58%	290

A significant advantage of this type of reporting is the creation of accountability at each location within the multi-site program. Using Energy Company7 as an example (from the report shown above), this site achieved only 23% of the projected savings. The result is not surprising given the fact the site has only completed 11% of the ESM tasks (Energy Action Items). Accountability is created through the assignment of ESM tasks to a specific individual user (internal or service provider) and through the visibility of these reports by management and peers. Another significant advantage of this approach is that it provides near real-time status of implementation at all locations since the tasks are updated as they are completed.

The Real Goal: Continuous Improvement Over Time

It is advised that any serious multi-site energy savings program take a life-cycle approach with a minimum three-year timeline. Why? Because it takes time to do it right; people must be mobilized, analysis needs to take place, and data feeds need to be established. Then, energy savings measures need to be defined, assessed, and implemented. Finally, the results need to be tracked to ensure that the expected impact is achieved and management needs a brief on the overall program success. Ideally, once you have established the infrastructure for managing and monitoring your programs, it is then used in an ongoing fashion to continuously improve your operations.

While continuous improvement sounds great, how do you implement it in a practical way? One problem that often arises is the instance where a building manager encounters extreme difficulty assessing the impact of modest changes to her building. Or, just as importantly, determining quickly when a “negative” change occurs, which increases the energy use in a facility (e.g. a setpoint override). To address this problem, the U.S. Department of Energy and NorthWrite have created the **Energy Expert**.

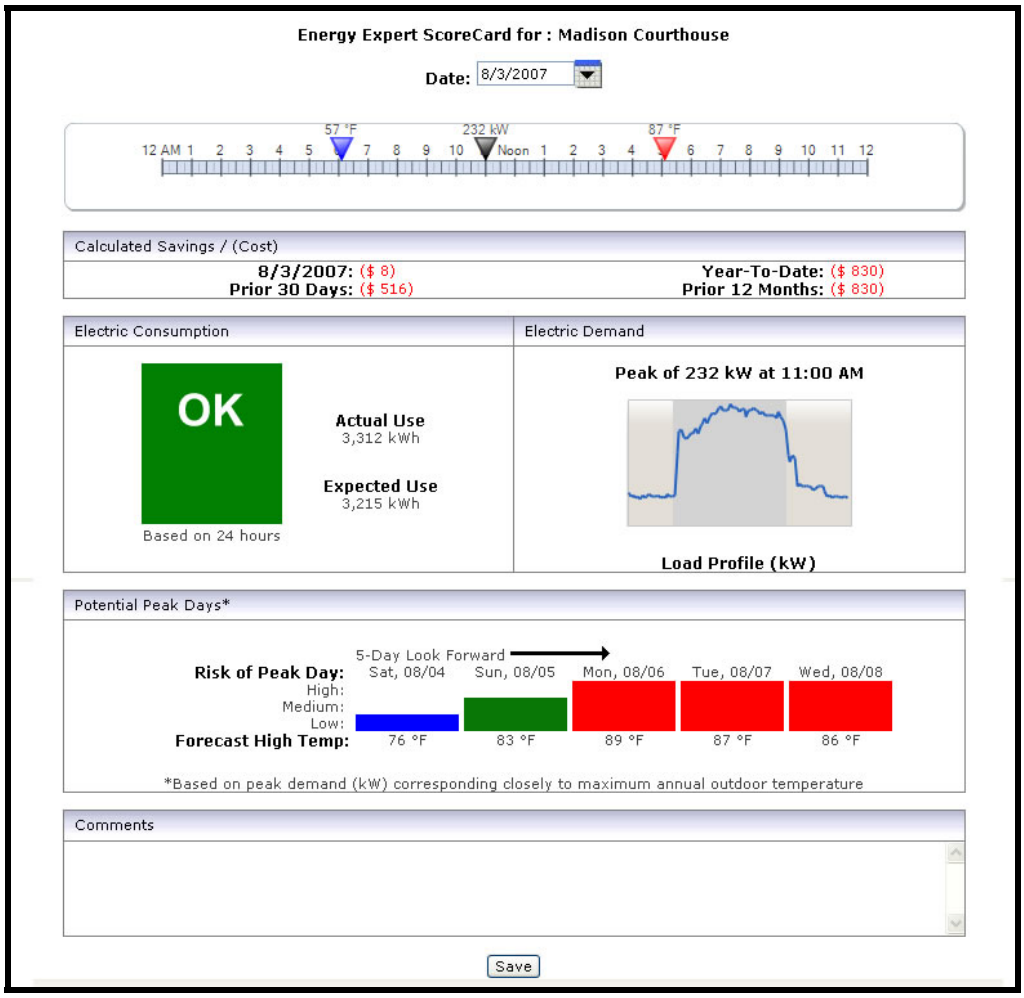
This sophisticated, yet easy-to-use software application allows you to create a model of how your building “should” consume energy and compare daily performance against that baseline. The Energy Expert will tell you whether your facility over-consumed, under-consumed, or used about the “right” amount of energy based on its baseline model.

Models are created by defining a relevant set of independent input parameters for the Energy Expert to use. Typical inputs include: outdoor temperature, outdoor humidity, time of day, day of week, occupancy, and major submetered loads. The dependent parameter is typically whole building electric consumption (15-minute or hourly) or another large building load. The Energy Expert can also be used on other energy streams such as gas, hot-water, steam, and chilled-water.

The application has an easy-to-understand interface based on a color grading scheme. Blue indicates low energy use. Green indicates energy usage was within the predicted range. Red indicates energy usage was higher than predicted. Every day, the Energy Expert will tell you how much more or less energy (and resulting cost) your building consumed versus your baseline model.

Energy Expert can also be configured to trigger notifications. For example, the notification shown on the following page (Energy ScoreCard), provides a multi-faceted overview of yesterday’s energy use and cost, as well as a prediction of potential peak days based on a five-day weather forecast.

The power of the Energy Expert is the fact that it provides daily assessments of energy changes in your facilities. If you re-sequenced your chillers last week, you should see the energy changes from that action in the current week’s Energy Expert results. Or, perhaps someone overrode your temperature setback when they came in on Sunday. You’ll know about it when you get to work on Monday—instead of a month or two later when you start seeing higher utility bills.



Conclusion

Some of the primary reasons senior management is historically hesitant to approve energy savings programs is the lack of accountability, visibility, and quantifiable results. The technology described in this paper can go a long way toward addressing these issues and ensuring that these programs get funded and more importantly, produce the desired results.

Contacts

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