EnergyPulse

Carbon Risk and Negawatts – Using Energy Efficiency Programs to Reduce Your Carbon Exposure

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Global carbon regulation is arguably the largest risk and opportunity most corporations will face in the beginning of the 21st century. It has been estimated that turnover in the global carbon marketplace could exceed a trillion dollars in the next five to ten years. Voluntary and mandatory reporting protocols are emerging.

How can an organization know its true carbon footprint and exposure? What options are available to manage corporate carbon risk? What impact can energy efficiency programs have on reducing a corporation's carbon footprint?

This paper presents a roadmap for deploying a real-time infrastructure that will support corporate energy efficiency and carbon reduction programs. The case will be made that a system with source-level measurement, verification, and aggregated reporting capabilities is needed.

Energy Use and Greenhouse Gases

Carbon dioxide (CO2) is the principal greenhouse gas (GHG) associated with global warming and is a by-product of burning fossil fuels. CO2 or "carbon" emissions are in the process of being regulated around the world. Governments are creating market-based mechanisms called "cap and trade" programs which provide incentives for reducing pollution. An emissions cap provides a limit on the total amount of pollution that can be emitted from all regulated sources. The cap is set lower than historical emissions to bring about phased-in emission reductions.

A company's allowable carbon emissions is a function of its carbon allocations and carbon credits, or put algebraically:

Carbon Emissions = Carbon Allocations + Carbon Credits

Carbon allocations will be assigned by governmental authorities based on a previous baseline year and the country's overall carbon reduction goals.

Typically, there are only four ways for an organization to meet their emission allowances:
1. Purchase emissions credits
2. Purchase energy efficiency credits
3. Lower production using existing assets to cap emission levels, or
4. Reduce emissions at their source

A company can purchase carbon credits from the market in the form of Renewable Energy Credits (REC) or Energy Efficiency Credits (EEC). A REC allows a company to reduce its environmental impact by paying another organization for a portion of their investment in renewable energy or energy efficiency projects.

Another alternative to reducing carbon emissions is to simply lower production levels and consume less fossil fuel that generate carbon dioxide emissions. This is usually not a very satisfying alternative because the firm exists to make product at a profit. In free markets, all else being equal, we use marginal price relative to market price to determine when and how much to produce.

The most cost effective way of reducing emissions is likely to involve retrofitting existing processes to clean the flue gas, or by decreasing fossil fuel consumption by increasing the thermal efficiency of the process. It turns out that in almost all cases, energy efficiency improvements are the most cost effective solution for reducing carbon emissions. The reason, of course, is that energy efficiency improvements come with a two-fold benefit: decreased carbon emissions, and lower fuel cost of production.

Energy Efficiency as a Lever for Reducing Greenhouse Gas Emissions

Energy use within companies is usually a corporate key performance indicator and is defined as the energy intensity of that industry. For a power company, the energy intensity of it's generation fleet is better known as the system heat rate expressed in Btu per kWh generated. For an agribusiness, it may be Btu per bushel of corn processed, for a water utility it would be kWh per thousand gallons of water delivered. Energy cost can range from 10 to 80 percent of variable cost in some industries and reducing the energy intensity of any company is good business. To simultaneously reduce carbon emissions while implementing energy efficiency programs makes the business case that much stronger.

As an example of how much carbon exposure some companies are facing, a recent evaluation of RWE's generation assets was conducted to determine the impact of "business as usual." The analysis(1) concluded that, all else being equal, if RWE made no fuel switching modifications or energy efficiency improvements to their generation fleet 17 percent of the corporation's net equity value was potentially at risk.

Energy efficiency or "demand-side management" programs have the lowest capital, lowest risk, and usually the shortest lead time for making substantive reductions in an organization's carbon emissions.

Components of a Successful Enterprise Energy Efficiency Program

Intimate knowledge of energy consuming processes is required for organizations to implement successful energy efficiency programs. Energy engineers, analysts, and operators need quality operational data—and lots of it. Basic energy and carbon dioxide data and reporting will not be sufficient and a corporation's energy invoices alone, will not be adequate.

Energy Measurement

Nowhere is "measuring what matters" and "managing what we measure" more important than in energy efficiency programs. A detailed measurement and understanding of the energy processes with data of sufficient granularity and fidelity is essential. By "granularity" we mean the level of process detail available. A fine-grained description of a system is a detailed, low-level model of it. A coarse-grained description is a model where some of this fine detail has been smoothed over or averaged out. By "fidelity" we mean the precision, faithfulness, and frequency of the data. In other words, energy users need detailed, timely, and accurate data around their energy consuming processes so they can understand what they have prior to developing plans to improve them.

Energy and Carbon Baseline

An organization must know its energy baseline before implementing an energy efficiency program. The "richer" and more detailed the data set, the better. Energy consumption is a function of many factors (weather, production levels, equipment load profiles, maintenance history, etc.) therefore, a key component of an energy efficiency program is "normalization" of the energy consumption data. Normalization means all of the energy consumption must be provided in a consistent set of units (kilowatts, therms, joules, etc.) and corrected back to the same standards. For example, energy consuming devices that have significant statistical deviations in capacity and efficiency due to varying ambient conditions may need consumption data corrected back to a standard temperature,

pressure, and relative humidity. This process is very important to ensure you are comparing "apples" with "apples", instead on an "apple" of energy consumption in one location to an "orange" of energy consumption in another location.

Performance Benchmarking

Once the normalized baseline energy consumption is quantified, the next step in an enterprise energy efficiency program is to benchmark the performance of similar systems and locations. The goal is to plot enough energy versus capacity data for all major devices so that correlations begin to emerge:

- What is the average energy consumption for specific devices?
- Which assets and locations are in the top quartile of energy performance and what best practices can we learn from them?
- Which assets and locations are in the bottom quartile of energy performance? What can we learn from them and how can we apply the best practices identified at other locations to improve energy performance in these assets and locations?

Improvement Opportunities

Identifying opportunities for improving the overall energy efficiency of the organization and simultaneously reducing its carbon footprint is the fourth step in designing an enterprise energy efficiency program. Specialized energy engineering talent is required to do this well. Even a company with moderate fuel and carbon exposure can justify a full-time, in-house energy management position. If the company exposure is significant, a corporate "energy czar" with appropriately sized staff may be necessary.

Once the major energy efficiency opportunities have been identified, a business case should be made for each one (including the economics of the carbon liability) and each opportunity should then be ranked. Teams should be assigned to use the information gathered during the baseline assessment and benchmarking process to design efficiency improvement programs and set efficiency improvement targets.

Lather, Rinse, Repeat…

The final step is to monitor the progress of the energy efficiency initiatives, update your corporate energy and carbon baseline, and further mine your energy database for additional performance and carbon reduction opportunities. Improving energy efficiency is the process of attempting to defy the second law of thermodynamics. Improvement programs can rapidly give up their gains to recoverable and non-recoverable performance degradation as well as system neglect. To maintain efficiency improvement momentum you will need dedicated people to manage the program, further analyze your process data, and continually repeat the process over again.

The Nuts and Bolts of an Energy Management and Carbon Accounting System

The foundation of an enterprise energy efficiency and carbon accounting system is the real-time infrastructure platform it runs on. A rigorous data collection and tracking system will include:

Source-level measurement and quantification with sufficient granularity and data fidelity to identify energy efficiency opportunities and track benefits accrued.

- Aggregation by location, business unit, and activity.
- A complete audit trail and registration of carbon production and energy efficiency credits and the activities surrounding them.
- A robust reporting system that allows reports to be created based on the role of the user. Reports should allow aggregation of energy and carbon emissions by asset, location, region, business unit, and for the corporation as a whole.

The real-time performance management platform for monitoring energy efficiency program effectiveness and carbon emissions may already be deployed at your facilities and connected to your energy consuming assets. However, these plant-centric data historians need to be connected across the enterprise with a consistent and standard "asset model" to allow automated and real-time aggregation by location and business unit. It is only when this data becomes visible across the enterprise that managers and analysts can leverage this decision-making information to manage risk and maximize opportunities.

The emergence of the carbon trading and emission offset markets means CO2 emissions are now a corporate asset and liability. Auditable source-level reporting of all carbon emission and energy efficiency credits is required under emerging compliance protocols.

Guidelines set down by the European Union Emissions Trading Scheme (EU ETS) for greenhouse gas reporting are based on the following principles: relevance, completeness, consistency, accuracy, and transparency. Furthermore, California's Climate Action Registry incorporates these same principles from the work of the World Resource Institutes "Greenhouse Gas Protocol" for their reporting protocol. The term "transparent" is interpreted in all of these GHG reporting protocols as factual reporting based on a clear "audit trail" that allows for both internal review and external verification. The clear interpretation from these protocols is that an organization must demonstrate a clear path of auditable data from emission source and energy efficiency credit to the corporate financial statements.

Summary

Carbon dioxide is in the process of being transformed from being merely a byproduct of fossil fuel combustion into a fungible, tradable commodity. The tracking of where that molecule was created, how much of it was created, and how it moves on and off an organization's balance sheet is becoming very important. Organizations need a data collection and monitoring system that is robust and that will scale across the enterprise.

Energy efficiency programs are an effective way of addressing a corporation's carbon risk. Though a real-time tracking and reporting system is only one component of an energy efficiency/carbon management strategy, it is an important component. A real-time performance management platform with built-in measurement, verification, analysis, and visualization functionality is a key component an organization will need for meeting this emerging challenge. □

Note:

(1) Carbonizing Valuation--Assessing Corporate Value at Risk from Carbon, November, 2006; SAM Group, Zurich.

about the author

Steven Hanawalt has been active in the energy industry since the birth of the independent power industry in the early 1980's. He was the President and founder of Power Factors, an asset optimization software development company, which provided the emerging independent power market sector with real-time economic optimization software systems. Steve joined Calpine Corporation in 1999 and was promoted to Vice President, Plant Optimization. In that capacity, he developed a new asset optimization business unit to optimize the thermal and economic performance of its energy centers. The group integrated performance engineering, financial analysis and information technology disciplines to develop and deploy performance and economic optimization programs and systems across the world's largest fleet of combined cycle power facilities. In the process, his group received an InfoWorld 100 award for best information technology in the energy sector and managed a $625 million energy efficiency initiative for the corporation.

In 2006, Steve joined OSIsoft as Global Energy and Environmental Executive and is responsible for developing new business and working with customers to help them develop a roadmap for optimizing their portfolio of assets using real-time information.

Mr. Hanawalt received his Bachelor of Science degree in Mechanical Engineering from the University of California, Berkeley in 1982 with a specialization in energy conversion.

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