



Real-Time Data as a Foundation to Drive Sustainability Performance



Summary

In today's tough economic environment, asset-intensive businesses are intent on achieving greater efficiencies in their application of energy, water, resources and labor. In addition, their senior executives are strongly motivated to reduce the risk of catastrophic failures that can destroy corporate reputation and shareholder value. Converging internal and external pressures are compelling companies to publicly report their sustainability performance results with increasing levels of detail and precision, approaching what is expected in financial reporting.

Asset-intensive companies are finding that the pursuit of sustainable operations requires a bottom-up approach, supported by a real-time data infrastructure. This white paper is a collaborative effort between IHS and OSIsoft that addresses the following questions with respect to sustainability performance and real-time data:

- What is the definition of an Enterprise Sustainability Management (ESM) information strategy? We discuss the importance of ESM strategies for asset-intensive companies.
- Why is a “bottom-up” approach to ESM necessary? We look at how a foundation of real time operations data is critical to enabling the enterprise to drive sustainability improvements.
- How is sustainability reporting a new type of accounting challenge? We discuss the growing demand among various stakeholders for sustainability performance reporting that is as rigorous and auditable as financial reporting.
- What are the unique challenges seen in sustainability accounting? We explore some of the nuances experienced while measuring the success of an ESM program, and the role that a real-time data infrastructure plays in meeting that goal.
- Where has the real-time infrastructure been proven effective as a foundation to drive sustainability performance? We share key case studies in which the infrastructure for streaming data and events was essential to addressing the ESM needs of two large, complex industrial customers.

Why Does Enterprise Sustainability Management (ESM) Matter to Asset-Intensive Businesses?

In today's tough economic environment, asset-intensive businesses are intent on achieving greater efficiencies in the application of energy, water, resources, and labor. Companies in the oil and gas, chemicals, power generation and supply, mining, metals, and manufacturing sectors began setting goals around better sustainability performance more than a decade ago. Now their challenge is to reach beyond goal-setting and marginal gains by embedding sustainability in their operations. Industry leaders are transforming sustainability information – through creativity and engineering analysis – into a

driver for continuous improvement and a culture of operational excellence.

Operational risk reduction is another key aspect of sustainable business operations. Senior executives are strongly motivated to reduce the risk of catastrophic failures that can destroy corporate reputation and shareholder value. Consider, for example, that BP will take more than \$40 billion in charges against its balance sheet as a result of the 2010 Deepwater Horizon disaster¹, in addition to incalculable losses in terms of corporate reputation and broad implications for the offshore oil and gas industry.

Chief executives are acutely aware of the need for more sustainable operations. A recent executive

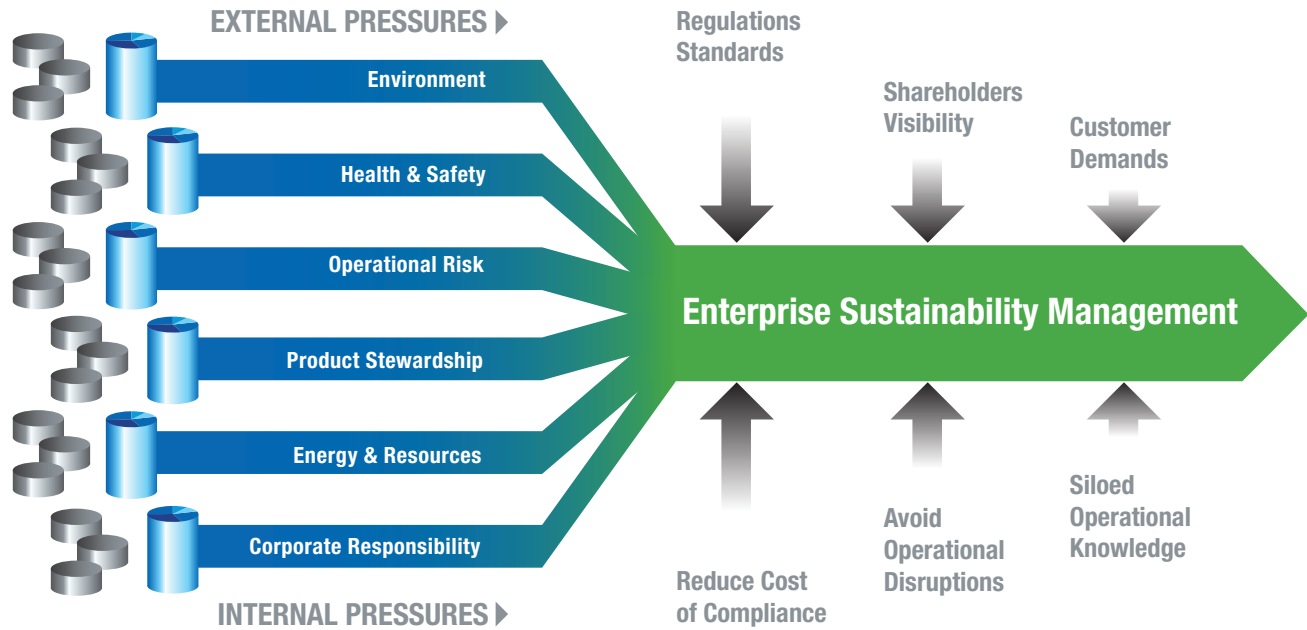


Figure 1: Key pressures driving companies to start the journey to establish a consolidated framework around ESM

survey released by Accenture and the UN Global Compact reports that 96 percent of CEOs believe that sustainability issues should be fully integrated into a company’s strategy and operations. However the survey also indicates that less than half of those CEOs have a plan to implement a sustainability program within their organizations².

Establishing an Enterprise Sustainability Management (ESM) framework is a path forward for CEO’s looking to integrate sustainability into their operations by enabling the delivery of timely, reliable, and relevant information to support business critical decisions. ESM is a comprehensive, unified information management strategy that drives value into all aspects of a business – including product design and materials planning, manufacturing and operations, resource consumption and daily work processes. In asset-intensive industries, the ability to collect, manage, analyze, and present streaming asset data and its related processes is a key to making strategic decisions that drive

enterprise sustainability. Figure 1 highlights internal and external pressures driving companies to start the journey to establish a consolidated framework around ESM.

In asset-intensive industries, the ability to collect, manage, analyze, and present streaming asset data and its related processes is a key to making strategic decisions that drive enterprise sustainability

As a by-product of these external pressures, formalized sustainability reporting is gaining momentum and organizations such as the Carbon Disclosure Project (CDP) and Global Reporting Initiative (GRI) continue to see large growth in the number of companies reporting to them. As of the end of calendar year 2011, 95 percent of the 250 largest companies in the world now do

sustainability reporting, a 14 percent increase compared to the prior 3-year period³ (See Figure 2). The quality, auditability and consistency of reporting are increasingly critical as shareholders consider sustainability performance to be material to their investment decisions.

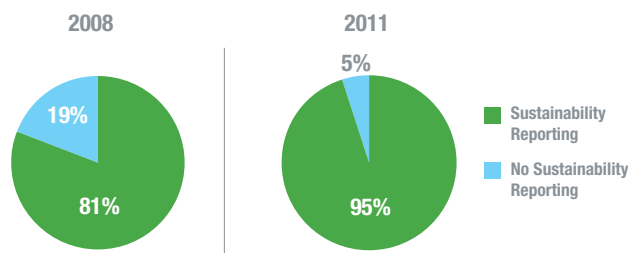


Figure 2: Growth of Integrated Reporting - Source: GRI

The combination of the business drive for more-sustainable operations and the need to accurately report sustainability performance is making ESM a key strategic priority for CEOs of asset-intensive companies. According to Gartner’s CEO survey conducted at the end of 2011, sustainability-related information will be viewed as a key “source of disruption” within manufacturing and natural resources companies during the next 5 years, more than any other source of information, and second only to Customer Relationship Management as a critical technology investment⁴.

It is clear that an effective ESM program must include a strong information technology component. The CIO has a key role in enabling ESM by building a solid supporting architecture that combines enterprise information technology (IT) with site-level operational technology (OT). In addition to a strong information technology component, an effective ESM program must also ensure that domain-relevant data and calculations are taken into consideration. Without an understanding of the business context and sustainability performance metrics, any

information system that is implemented will fall short of the mark. As a simple example, an ESM program for a retail store chain is vastly different from that of a chemical manufacturing firm. Although their sustainability reports may end up looking similar to one another, the complexity of their industry-sector requirements differ considerably, as will their supporting information systems.

Why is a ‘Bottom-Up’ Approach to ESM Necessary?

Like financial performance, quality improvement, and other corporate objectives, sustainability is a journey, not a destination. This journey is different for every company, and even close peers in a given industry are at different levels of maturity at any point in time. Consider, for example, that Repsol SA, an integrated oil and gas company, is a supersector leader today on the Dow Jones Sustainability Index (DJSI), while peer companies do not even appear on the index⁵.

Figure 3 is a maturity model for how companies typically move from a tactical to strategic approach to enabling sustainability. Note that companies do approach the maturation of information management systems from different directions. Some have started with a top-down view by implementing a Business Intelligence (BI) or corporate layer to capture sustainability key performance indicators, without a link to the underlying data, the “IT” portion of the solution. Others have focused on the operations-level solutions without providing visibility to the greater corporate organization, the supporting “OT” solutions. Industry leaders realize that both are important: to drive improvement in sustainability performance, the enterprise information management framework must be linked to the operational level.

Consider, for example, a company pursuing corporate energy management goals:

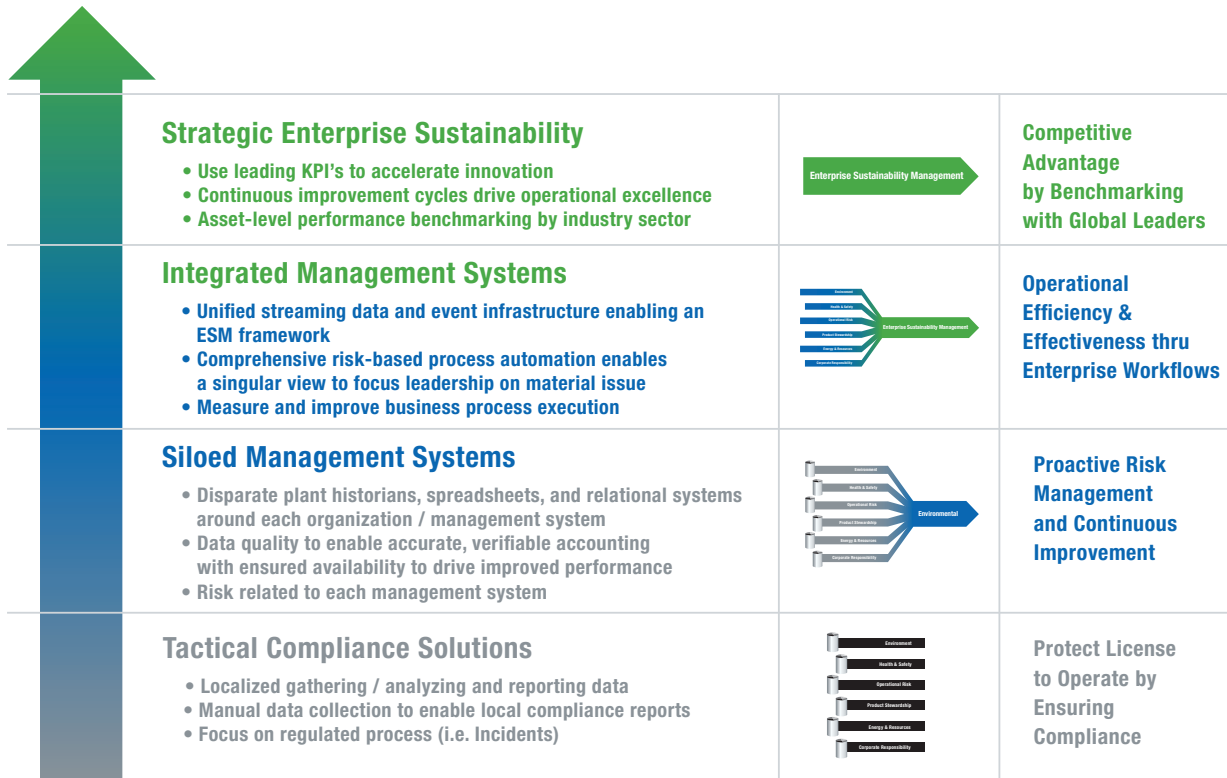


Figure 3: The Journey to Enterprise Sustainability Management

- Implementing an enterprise solution to report energy efficiency improvements company-wide is necessary to support sustainability reporting
- Implementing site-level systems to meter asset-level energy performance is necessary to track actual project performance
- Tying these two systems together, the enterprise system and the site OT system, enables a near real-time view of sustainability performance across the corporation

Asset-intensive companies, particularly those operating in heavily-regulated jurisdictions, have long been leveraging real-time data for continuous compliance certification. For example, air permits increasingly demand daily, hourly, and even sub-minute compliance demonstration. This compliance-driven activity is a predecessor to

sustainability solutions, where site-level information is rolled up to support an enterprise-level view. The near real-time approach makes course corrections possible throughout the year. The end of the year is too late to ask “Why didn’t we meet the corporate objectives we set?”, or “Why is our incident rate climbing?” As with profitability, improvement in the annual performance numbers will only come

As with profitability, improvement in the annual performance numbers will only come with consistent monitoring and review against key performance indicators so that adjustments can be made – directly at the operational level thereby empowering operational staff.

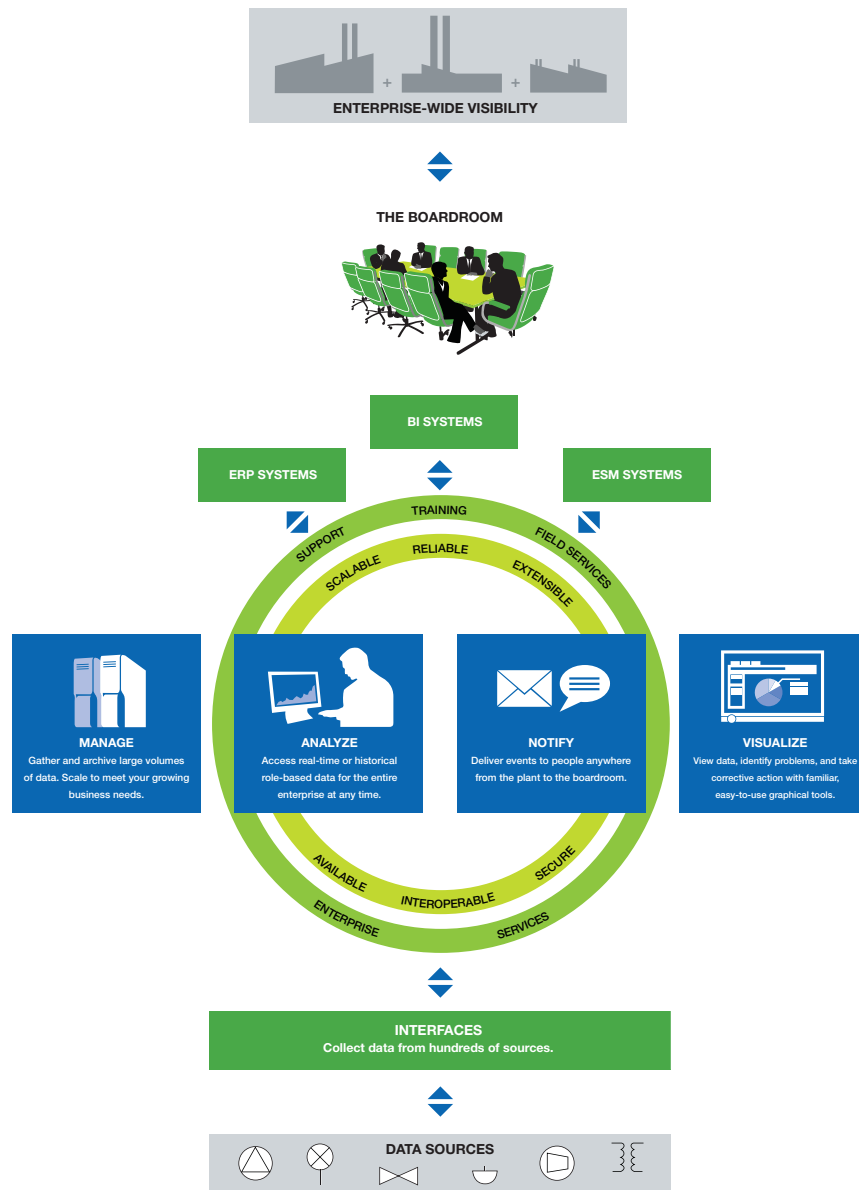


Figure 4: Enterprise-level reporting, supported by an unbroken chain of real-time operating data.

with consistent monitoring and review against key performance indicators so that adjustments can be made directly at the operational level – thereby empowering staff.

Figure 4 illustrates the end-point where enterprise-level solutions are supported by an unbroken chain of real-time operating data from the operating systems. Retaining the chain of custody of the

data - from assets to the enterprise - enables strong auditability and a single version of the truth. This helps eliminate the situation where different, conflicting values are reported or reported values do not have sufficient backup. This kind of structured approach is important for facilitating compliance obligations and reducing risks as well as driving sustainability objectives.

How is Sustainability Reporting a New Type of Accounting Challenge?

The ESM framework creates a system of record so that stakeholders, both internal and external to the organization, have a clear and direct view into all aspects of operations from the bottom-up. To a large extent we are really establishing an accounting system for sustainability data, and as with any accounting system, details matter.

Every CEO understands the idea of implementing an ERP solution to model the order-to-cash process, and that this is essential to provide clear financial visibility. Although the same is true when addressing sustainability performance, implementing the

enterprise solution in alignment with the operational solutions can present an even bigger challenge. Production schedules, maintenance, unplanned down times, even ambient temperatures can affect sustainability measures. These can vary even further from facility to facility.

The next sub-sections address three key considerations when implementing an ESM solution to support sustainability reporting.

Sustainability Accounting Topic #1: Parallels between Financial and Sustainability Accounting

Table 1 highlights some of the parallels between financial and sustainability accounting.

	Financial Accounting	Sustainability Accounting
Aggregated corporate results are reported to shareholders	Profit	Environmental, Social, Governance (ESG) KPIs
Time matters, and high fidelity, historized data needed	Yes	Yes
Multiple calculation protocols are applied	GAAP, JV, leaseholder	GRI, CDP, etc
Calculation approaches change over time	Yes	Yes
Reporting is done throughout the hierarchy	Yes	Yes
Bottom-up approach required for auditability	Yes, record of financial transaction	Yes, asset-level data
Critical to achieve one version of the truth	Yes	Yes
Data Management Framework	Transactional Data Only	Integrated Time-Series and Transactional

Table 1: Parallels between Financial and Sustainability accounting

Some of the world's largest accounting firms, including Deloitte and PriceWaterhouseCoopers, have developed audit and verification practices around sustainability accounting that parallel financial accounting. Despite the parallels, in order to achieve a comprehensive ESG assessment for an organization, the sustainability accounting approach must leverage both time-series and transactional data.

Sustainability Accounting Topic #2: Key ESM Requirements and Capabilities

If you consider the millions of data points that must be mined with the corresponding potential data quality issues, the challenge can be daunting. Asset-intensive businesses need to manage vast amounts of data, for example 10,000s of sustainability-relevant operating equipment, 100,000s of data sources, and 10,000,000s of data points. However if the right approach is used, the opportunity to leverage the value that operational data represents is substantial. If the right logic and processes are applied in a systematic way, this data then becomes the foundation upon which you may effectively build operational efficiencies, reduce compliance risks, and ultimately achieve sustainability objectives.

At a data level, some of the key accounting challenges are:

- Data acquisition – How do you systematically pull in data from countless meters, siloed data and disparate systems in a seamless integrated way?
- Data quality – How do you ensure consistency in data so that missing data and erroneous data are handled in a way that doesn't muddle the overall results?
- Management of Change – How do you accurately reflect changes in equipment, facilities and operating parameters in sustainability accounting?

- Data Aggregation – How can you aggregate and then share data to drive better decisions?

Some of the most important capabilities to look for when implementing a sustainability accounting solution are as follows:

- The ability to have a unified infrastructure to collect time-series data from disparate data sources -- independent of source, protocol or vendor -- without having to use customized integration or multiple aggregation platforms. This will reduce implementation time and cost of maintenance.
- The ability to complement operational technologies that play an established role, rather than introducing new technologies that may cause disruption. Those operational technologies are not transactional management systems that can directly address sustainability or compliance needs, so they must be paired with a sustainability solution that manages operational data enterprise-wide and meets corporate reporting requirements.
- The ability to leverage an asset-mapping interface that enables you to map tags and apply validation rules through a front-end tool. By relating raw data streams with their associated assets, relevant data streams can be joined with static asset metadata to readily provide a full 360° view about the health and performance of an asset in real-time. This capability will facilitate the aggregation of data from multiple sources, both time-series and transactional.
- The ability to make decisions based on near-real-time situational awareness rather than based on models and predictions. Operational activities are very dynamic by their very nature and require supporting technology which leverages actual, measurement-based

information rather than purely retrospective analysis and process modeling.

- The ability to manage data substitution and validation. This may vary from simple monitoring for missing data to complex data validation and substitution rules managed from a rules library. This capability will contribute to ensuring data quality as part of a rigorous quality assurance process.
- The ability to leverage a calculations library that uses standard statistical functions and user defined expressions to calculate required values for reporting in a consistent, reliable framework that eliminates manual processing errors.
- The ability to implement data approvals and exceptions control. The capability to utilize a structured data validation, review, and approval work process will control data exceptions and assure quality.

- The ability to generate a complete audit trail. The capability to quickly access a complete electronic history from data source to reported values showing all values, changes, and annotations for accountability and verification is critical for compliance obligations and supporting all types of reporting.

Many of these potential issues can be overcome with the implementation of the right solutions or technologies. The types of equipment or industrial assets may vary by industry and company but there are commonalities in the way the data needs to be captured and processed.

Sustainability Accounting Topic #3: Dealing with Change Management

Once the issues of data integrity and aggregation are out of the way, there is still the challenge of change management. A real-time enabled ESM solution should also provide a single place to manage rapidly changing data and compliance obligations,

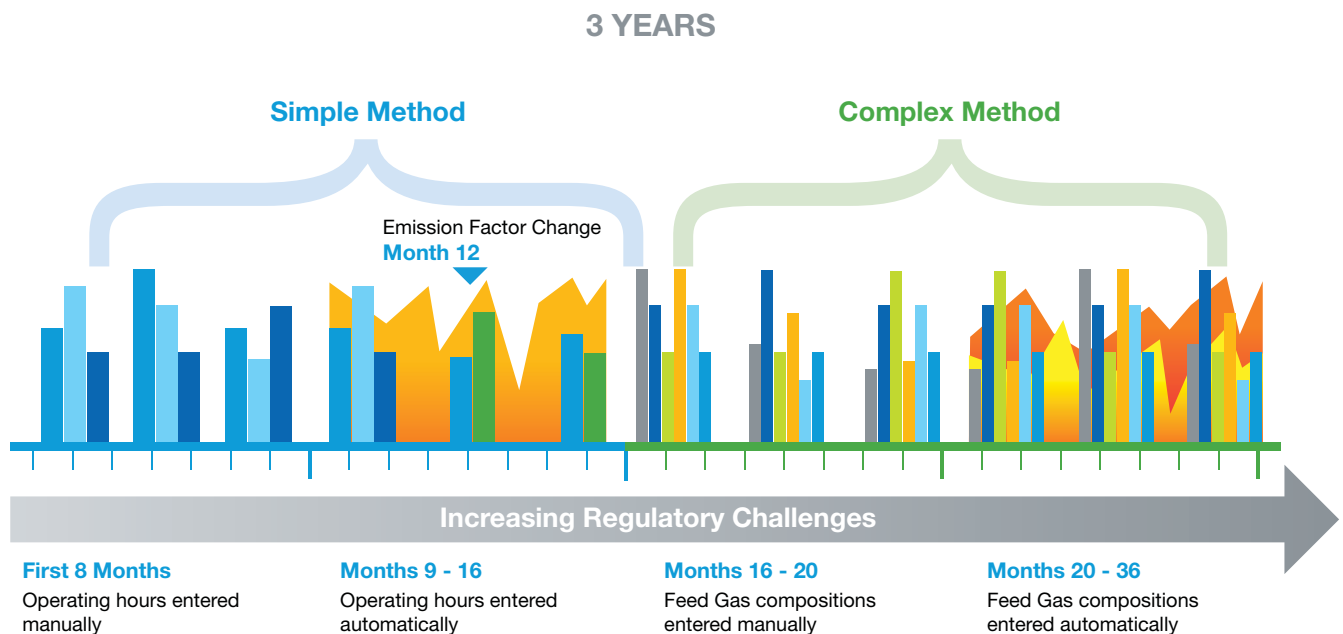


Figure 5: Complexities that can be present calculating periodic GHG emissions over a 3-year period

thus reducing system administration cost. Figure 5 illustrates an example of the complexities that can be present while calculating periodic GHG emissions for a single emission source, such as a process heater during a 3-year period.

Some of the challenges include:

- The calculation methodology changes multiple times during the 3-year period, driven by regulatory changes. It is critical that the old and new methodologies are retained so the output reflects the appropriate methodology in time.
- Data collection approaches evolve. Where data were entered manually in the beginning, over time, automatic data feeds replace manual ones.
- Values going into the calculations change on different time intervals. So combining input with different frequencies in a single equation creates unique challenges.

When you consider that these challenges apply for one emission source, consider the accounting challenge for properly applying the same calculations for thousands of sources. It is clearly desirable to have a solution that can manage this change automatically. This one scenario also highlights why spreadsheets quickly fail to provide an adequate accounting method especially as integrated reporting gains mainstream acceptance.

Where Has the Real-Time Infrastructure Been a Foundation to Drive Sustainability Performance?

Asset-intensive companies have already started on the journey of leveraging real-time data infrastructure. They are starting to realize results in terms of:

- Reducing the risks associated with their EHS compliance obligations and the burden that these place on their operations
- Benchmarking and forecasting in support of sustainability goals.

This is a rapidly maturing area, evidenced by the number of customers that are currently taking an integrated enterprise approach to sustainability reporting.

One example is a large producer of electricity in the APAC region, with 60 generation sites operating and more than 20 000 equity MW of capacity and serving more than 2 million customers. They were seeking a more unified approach to managing their environmental performance in order to gain a single version of the truth across all of their environmental data.

Figure 6 illustrates how data flows between the operational facility solution (the IHS Process Data Manager™, powered by the OSIsoft PI System) and the enterprise sustainability solution (IHS environmental, health, safety and sustainability). The implemented solution, which processes approximately 400,000 data points per month (5 million per year), has been in production for more than 3 years and has these capabilities:

- Wastewater discharge monitoring
- Solid waste, chemical inventory tracking
- Air emissions monitoring
- Calculates Scope 1, Scope 2 and Scope 3 GHG emissions
- Facilitating emissions forecasting

The following specific results have been achieved:

- Forecasting occurs on a monthly basis; it was previously done annually
- Time savings have been realized by eliminating manual data review
- Auditability has been improved by tracking data modifications
- Errors have been eliminated before reports are submitted, reducing the number of re-submittals

- More than 100 regulatory reports are generated each month, some of which are automatically delivered electronically to the reporting agency

There are many such cases in which organizations benefit from pushing operational decision making closer to the point where the data enters the system. A more real-time approach to managing data can greatly increase compliance process efficiency while also leading to data management and reporting cost savings.

The second example is a large chemical company in North America whose production facility sits on 1,300 acres with two utility power plants, two company-owned water and waste water treatment plants, 150 buildings, 11,000 employees, a fire department and a rail system.

The utilities systems are operated and monitored by a group of disparate building automation systems and distributed control systems. With such a vast energy and management system, the customer shares many of the same concerns as regional utility companies - conservation, optimization of resources, and consolidation of data from various legacy systems.

Any new technology solution added to this mix had to be compatible with existing well-defined information architecture requirements.

The business objectives included:

- Reducing utility costs through demand side management

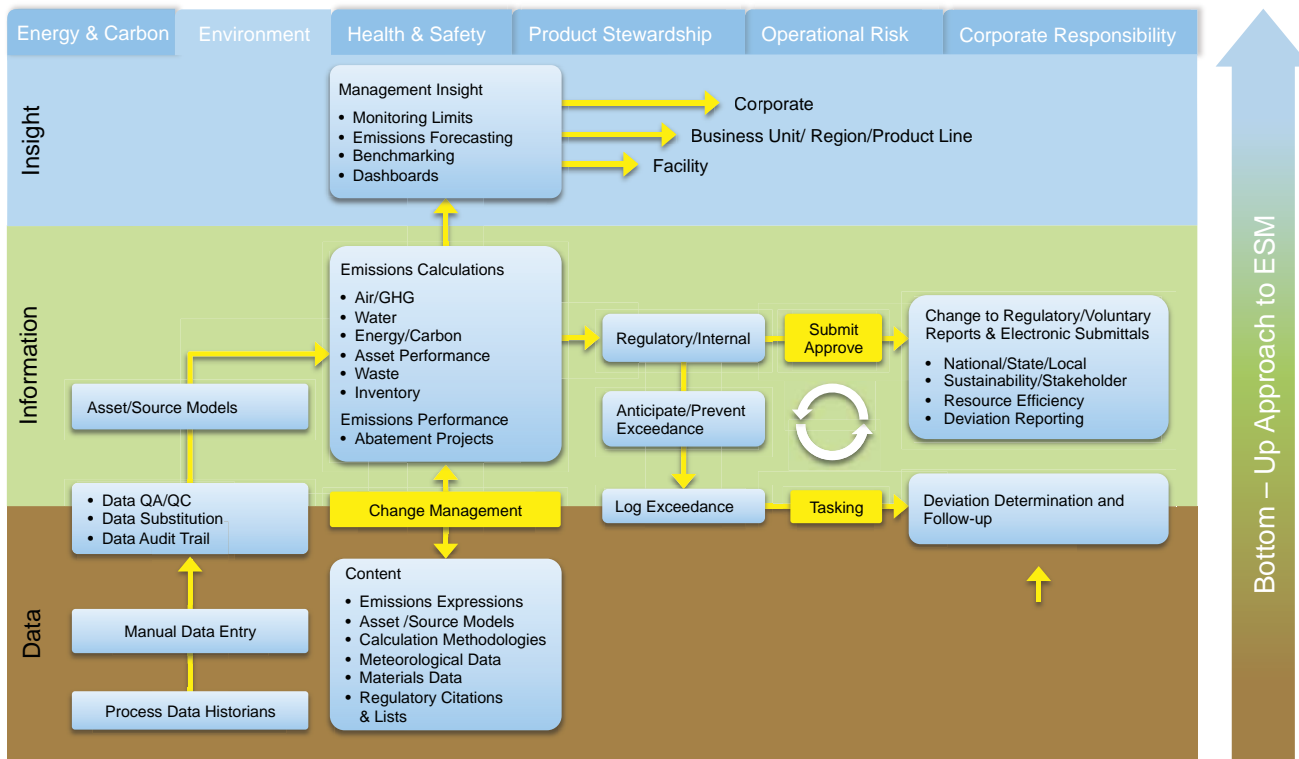


Figure 6: How data flows between site-level operations and the enterprise solution.

- Optimizing its generating assets
- Consolidating the utilities data from many different legacy systems into a common infrastructure
- Making energy data accessible to all employees through a web browser in real-time

Simply by making the data available, employees began investigating how they could individually reduce energy consumption through both processes and personal behavior. They became engaged in a continuous improvement process.

Many conservation opportunities emerged as the real-time state of usage conditions became visible. By observing real-time trends of electrical usage, the event teams were able to identify high-energy consumption systems and target them for improvement. For example, it is now possible to start and stop many fans, pumps, and motors, and quickly determine the overall impact that these complex systems have on the total energy usage within the building.

Since inception of the program, the utilities management and technical teams are constantly evaluating how building usage compares to site energy reduction goals and distribution of the services. Process engineers are gaining a better understanding of how and when processes use utility services - an eye opening experience for many. The real-time data is helping the engineers to optimize processes and minimize utility usage during product changes and down times.

Changes to processes and behavior alone have resulted in savings of over \$100M in 3 years, with little or no additional capital cost.

Conclusion

The most effective information solutions for Enterprise Sustainability Management recognize the need for relational data and database management in conjunction with time series technologies. Without easy access to operations data, it is difficult to measure performance and to make improvements. It is this key use of appropriate technology that enables decision makers to leverage operations data for better energy management, product quality, compliance reporting, and impactful sustainability results.

References

1. BP Slapped With Record Fine, Oil Giant to Pay \$4.5 Billion, Plead Guilty to Criminal Charges in 2010 Gulf Spill. Wall Street Journal, November 16, 2012.
2. U.N. Global Compact and Accenture (2010), "A New Era of Sustainability", page 22.
3. The State of Global Corporate Responsibility Reporting. Corporate Responsibility Reporting Comes of Age in 2011. KPMG, 2011.
4. Gartner Sustainability Scenario, 2012. October 21-25, 2012 Presentations, Orlando, FL.
5. Results Announced for 2012 Dow Jones Sustainability Indexes Review. SAM. September 13, 2012. http://www.sustainability-index.com/images/120913-djsi-review-2012-e-vdef_tcm1071-343064.pdf

About the Authors

IHS

David Cox, PE is a Senior Director of Sustainability Solutions with IHS. In this role, he helps develop the ecosystem of IHS system integration and technology partners necessary for successful global deployments of Environmental, Health, Safety and Sustainability (EHS&S) systems for Enterprise Sustainability Management (ESM). Cox has 20 years of experience consulting with customers around a diverse set of EHS compliance and management system topics, with an emphasis on IT solutions that enable continual performance improvement. Cox is a registered professional engineer in the State of California, and holds a Bachelor of Science degree, Civil Engineering, from the University of California at Berkeley and a Master's degree in Environmental Engineering from the University of Texas at Austin

David Bradley is a Client Services Director with IHS. In this role, he helps customers plan for and deploy their EHS and sustainability (EHSS) systems for Enterprise Sustainability Management (ESM). From helping construct a business case and project plan, to managing a team of implementers deploy a solution that meets a needed business outcome, Bradley's 15-plus years of experience in this industry has benefitted our customers during the implementation of their EHSS solutions. He has consulted major oil & gas companies on ESM strategy and delivered solutions across diverse operating and IT landscapes. Bradley is recognized as a Project Management Professional (PMP) from Project Management Institute (PMI), and holds a Bachelor of Science degree in Chemical Engineering from Texas A&M University.

OSIsoft

Heathcliff Howland is OSIsoft's Market Principal for Connected Supply Chain. In this role, he helps customers extend the reach of their PI Systems to deliver streaming machine and system performance data beyond their enterprise to key aftermarket service suppliers. Howland has been with OSIsoft since 2005. Previous roles at the company include Field Service Engineer and Business Development Manager of Transportation Markets. Prior to joining OSIsoft he was Director of Automation and Controls for a US based engineering services company delivering commercial engine solutions for optimizing fleet reliability, performance and compliance. He earned a B.A. in Environmental Studies from UC Santa Cruz in 1989, a B.S. in Mechanical Engineering from The California Maritime Academy in 1994 and holds a USCG 3rd Assistant Engineer's license for ships of unlimited horsepower steam and diesel.

Brian McMorow is in the Product Management team with OSIsoft. In this role, he manages a product feedback loop by educating customers about the capabilities of the PI System while gathering customer feedback that helps guide future product direction. McMorow has been with OSIsoft for over 5 years and has performed roles in Technical Support, NOC Operations Management, SAP Alliance management, and Product Marketing. McMorow holds a Bachelor of Science degree in Chemical Engineering from the University of Dayton as well as Master's degrees in Materials Science from University of Arizona and Chemical Engineering from Colorado School of Mines.

About the IHS Environmental Performance Solution™ and IHS Energy & Carbon Solution™

The IHS Environmental Performance Solution™ and IHS Energy & Carbon Solution™ combine enterprise software and world-class content, along with deep domain and industry expertise to help organizations efficiently collect and aggregate environmental and emissions data as well as manage energy efficiency requirements down to the asset level. These IHS solutions help your organization meet its business goals as it proactively manages environmental data from the asset-level upwards for greater accuracy and accountability to ensure compliance with regulations and voluntary initiatives. IHS enables you to meet both your EHS compliance and sustainability objectives by delivering extraordinarily high-quality information and analytic capabilities —and a single version of the truth — through an enterprise system of record. That system offers an out-of-the box capability that works in harmony with process data historians to continually monitor asset performance and detect deviations in process efficiency at the individual asset level so you have unprecedented access to verifiable, actionable information.



About IHS

IHS is the leading source of information and analytics in critical areas that shape today's business landscape – including environmental, health, safety and sustainability (EHS&S), operational risk management, product stewardship and resource management. IHS solutions for EHS&S combine world-class software, content and expertise to reduce operational risks, lower costs and drive growth. Pressure from customers, regulators and local communities is driving companies to make sustainability an integral part of their operations while managing sustainability performance as rigorously and transparently as they do financial accounting. IHS helps companies meet those Enterprise Sustainability Management (ESM) goals, turning risks into opportunities in order to earn superior returns.

www.ihs.com



About OSIsoft

OSIsoft delivers the PI System, the industry standard in enterprise infrastructure, for management of real-time data and events. With installations in 110 countries spanning the globe, the OSIsoft PI System is used in manufacturing, energy, utilities, life sciences, data centers, facilities and the process industries. This global installed base relies upon the OSIsoft PI System to safeguard data and deliver enterprise-wide visibility into operational, manufacturing and business data. The PI System enables users to manage assets, mitigate risks, comply with regulations, improve processes, drive innovation, make business decisions in real-time and to identify competitive business and market opportunities. Founded in 1980, OSIsoft, LLC is headquartered in San Leandro, California, with operations worldwide and is privately held.

www.osisoft.com



EHS & Sustainability

For information visit
www.ihs.com/ehs-sustainability
or email to ehs-sustainability@ihs.com

