

Environmental care in high tech and electronics

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white paper



- ▶ A pro-active business strategy for environmental care based on green design positions high tech and electronics companies to address the dual challenges of today's intense competition and the global push for environmental regulation. Enterprise PLM is proving to be an ideal platform for seamlessly integrating compliance into product development processes across the enterprise and throughout the supply chain.

PLM Software

Answers for industry.

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▶ Executive summary

The increasing number and complexity of environmental regulations has reached the point where global high tech and electronics companies need to adopt comprehensive compliance strategies. With regulations varying from country to country and state to state, the potential to meet a directive's requirements in one geography but not another should be a major concern.

Indeed, environmental compliance is becoming one of the industry's driving factors. Governments are increasingly more active in defining and enforcing regulations that control pollution and reduce waste. Companies must manage their risk of non-compliance at a time when competition is fierce and a single misstep can cost tens of millions of dollars in lost revenue.

While some deadlines for Restriction of Hazardous Substances (RoHS) and Waste Electrical and Electronic Equipment (WEEE) compliance have already passed, others such as the Registration, Evaluation, and Authorization of Chemicals (REACH) are on the horizon. Yet high tech and electronics companies face significant barriers to carrying out an enterprise-wide environmental care strategy, including:

- Difficulty in managing the information required to validate compliance in a dynamic regulatory setting
- Lack of visibility into part material content when sourcing and designing products
- Evolving standards for exchanging and reporting material content information
- Miscommunication and uneven enforcement of compliance policy and procedures throughout an organization and its supply chain

Instead of lamenting government oversight, market leaders are turning environmental compliance into an asset by aggressively adopting strategies based on green design and integrating compliance into everyday business processes. They are supporting these strategies with enterprise product lifecycle management (PLM) solutions. These solutions make it possible to execute an environmental care strategy consistently throughout the product lifecycle while enforcing the strategy with automated data collection and reporting capabilities that:


- Ensure compliance with current and future environmental mandates
- Reduce compliance tracking and reporting costs through automation
- Improve information exchange through standardized protocols
- Increase manufacturing efficiencies
- Align corporate and product branding with environmental stewardship

Whether a company wants to reduce energy consumption in manufacturing or stem the high costs associated with today's mandatory recycling programs, the fundamental issues of environmental compliance originate from decisions made in product design. When regulatory requirements are considered as an integral step in product design, the impact is felt across the entire corporate organization – from purchasing to manufacturing, legal to marketing, and product retirement. The most effective way to implement a pro-active environmental care strategy is to begin with green design and put the management structure, business processes, and information technology (IT) in place to integrate environmental compliance into the company's daily activity.

Until recently, an ad hoc approach to compliance has been sufficient to meet basic regulatory requirements. However, current procedures rely on manual processes and disparate data sources. Lacking executive oversight, compliance efforts are poorly coordinated and lack traceability. As a result, compliance activities add considerable cost to every step of the product development process and often fail to pass increasingly stringent regulatory guidelines, especially if a company's products are torn down for inspection. Leading high tech and electronics companies are shifting their attention from tactical ad hoc activities to a more strategic approach to environmental compliance.

In their efforts to adopt a more strategic environmental care initiative, high tech and electronics companies struggle with:

- Inability to effectively manage and validate compliance across all stages of the product lifecycle. Without access to current, aggregated information, executives have no visibility into the status of their environmental compliance initiatives. It is difficult to enforce compliance validation at critical stages, particularly as pressure increases to speed new products to market.
- Insufficient visibility into current part, material, and substance information. Design engineers – who make the decisions that affect a product's composition, manufacturing process, and retirement – cannot readily verify the compliance rating of parts and components they select for a new product. Existing products cannot be readily evaluated for non-compliant parts. As a result, additional costs are incurred during the manufacturing stage.
- Lack of a coherent digital environment to communicate, support, and automate compliance data collection and reporting. Inconsistent standards and changing requirements make it difficult to track and report on compliance information across the supply chain. Costs and delays associated with managing declarations and documenting compliance for multiple regulatory bodies in multiple languages remain high.



Because decisions related to product design, manufacture, and retirement are so interconnected, companies need to establish enterprise-wide policies and procedures to guide environmental compliance at every stage of the product lifecycle. All stakeholders need to be able to access this information wherever and whenever they need it in order to make decisions in the context of relevant regulatory requirements.

To address these challenges, high tech and electronics companies are leveraging their enterprise PLM solutions to achieve their environmental care strategies and embedding compliance into routine business processes at all stages of the product lifecycle. These solutions combine software tools with workflow management in a coherent digital environment that makes it possible to design green from the start and to automate activities relating to data capture, tracking, and reporting across the supply chain. By managing all product and process data within a PLM solution, companies can respond quickly to regulatory shifts in their target markets while maximizing the strategic, competitive benefits of environmental stewardship.

This paper discusses key processes that set a foundation for an environmental care strategy, including:

Establishing environmental compliance as a business strategy

- Identifying compliance initiatives that can have the greatest impact
- Facilitating executive oversight
- Automating compliance activities, data collection, and reporting across the product lifecycle and the supply chain

Implementing green design

- Accessing real-time compliance status on all parts, components, and materials
- Integrating compliance requirements into the bill of material (BOM)
- Assessing manufacturing and retirement issues in conceptual design

Manufacturing for compliance

- Optimizing production for lead and lead-free lines
- Managing last-minute changes and part substitutions for continued compliance
- Establishing traceability to the operator level

Which compliance initiative offers the most pro-active enterprise strategy?

In order to manage the costs and risks associated with proliferating international, state, and local regulations, high tech and electronics companies need to establish environmental compliance as a key business strategy. This requires companies to initially evaluate how they conduct their business today, as well as understand what initiatives have the greatest potential impact on end-to-end compliance and traceability.

Market leaders have discovered that green design lies at the heart of an effective environmental compliance strategy. To execute such a strategy, companies need to capture regulatory requirements in a way that makes it possible to integrate them into decision making and to validate compliance at critical stages without creating additional burdens or delays. At the same time, employees must change their processes to request supporting compliance documents. For example, purchasing needs to qualify suppliers and quickly obtain certification for materials, parts, and components. Design engineers should be able to access this information electronically at the start of the product development process.

To establish environmental care as a pro-active business strategy, high tech and electronics companies must address several barriers to integrating compliance into everyday practices, including:

- Insufficient accountability or responsibility for environmental care on the corporate organization chart. With a few exceptions, companies have not assigned responsibility for environmental compliance to any one individual or even at a departmental level. Information is not aggregated at a corporate level for executive oversight. As a result, enforcement of compliance mandates is uneven at best.
- Lack of automation in both compliance data collection and information access. It is becoming prohibitively expensive to track and manage product compliance with environmental directives using approaches that rely on ad hoc activities. Current processes add time and cost at all stages of the product lifecycle. And yet failure to ensure that products – and all the components and materials they contain – are fully compliant with environmental directives can lead to serious delays or even denied access to markets.
- Need to adapt to evolving standards for data collection and information exchange. Reporting standards have developed slowly and remain in flux. As a result, it is difficult and time-consuming to prepare for an audit, demonstrate pre-compliance, or respond to a government's punitive actions. Without a persistent audit trail, it is not possible to effectively argue due diligence.

Global retailers increase pressure on consumer electronics suppliers

Major retailers are taking steps to protect their brands and minimize their exposure to potential liability by adopting more environmentally responsible business practices. For example, Wal-Mart has announced plans to evaluate suppliers based on the environmental sustainability of their products. The company is taking steps to promote environmental stewardship in a variety of initiatives, including its "electronics products scorecard." Beginning in 2008, suppliers will be asked to complete the scorecard, reflecting the environmental sustainability of their products.¹

¹ *Green Electronics Coming to a Wal-Mart Near You*, Forrester Research, June 18, 2007.

Leverage enterprise PLM for a pro-active environmental care strategy

According to research by Aberdeen Group, 40 percent of manufacturers lack any type of formal metrics for measuring and ensuring product compliance. For those companies that do measure relevant key performance indicators, few measure compliance consistently at a divisional level, let alone at the enterprise level. In contrast, best-in-class companies measure product compliance on a monthly or real-time basis. Over 90 percent of these top performers have established formal metrics to drive product compliance.²

Market leaders that embrace environmental care as a pro-active business strategy are organizing and educating their employees and suppliers across their extended enterprises to practice environmental stewardship as part of their day-to-day responsibilities. To support these efforts, companies are implementing a digital PLM environment to automate compliance activities and integrate green processes into product design, sourcing, manufacture and retirement.

An enterprise PLM solution makes it feasible to maintain information on regulatory requirements and banned substances, along with all product and process information in a centrally managed repository. When regulations change, this information can be readily updated and shared with all stakeholders. Companies can evaluate the impact of regulations on the business they conduct in global, regional and local markets. Data collection and reporting are dramatically simplified through automated tools. With digital PLM in place, traceability can be demonstrated down to the production line and operator level.

Focus on compliance yields big returns³

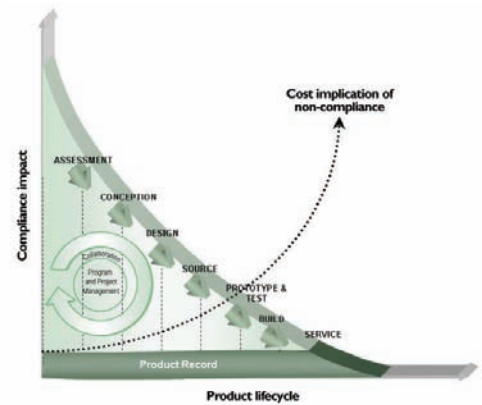


Figure 1:
The Design for Compliance Benchmark Report.

² *Environmental Compliance in Electronics: Creating a Successful Strategy*, March 2006.

³ *Design for Compliance Benchmark*, Aberdeen Group, November 2004.

Are your design decisions reducing environmental compliance efforts and risk?

Eighty percent of a product's environmental impact is decided at the conceptual design stage. To practice green design, designers need to know what regulations govern the markets where their products will be sold. They also need to verify that all parts and components selected for the design meet these regulations. Today, designers frequently lack enough information to make these determinations. Data often is missing, or might be stored in a variety of disparate systems. This adds considerable time to the product development process and creates additional work for the company's procurement staff.

As regulations evolve, existing products also should be evaluated for compliance. In many cases, new parts that meet compliance regulations need to be substituted for existing ones. This requires companies to re-evaluate product performance in the context of these changes to ensure that customer expectations continue to be met.

High tech and electronics companies that want to design for compliance from the start face a number of constraints, including:

- Lack of real-time access to the compliance status of parts, components, and materials. Without this information, design engineers cannot be sure they are incorporating compliant parts in their designs. In some instances, issues involving non-compliant parts do not become evident until production begins; in others, these issues are not captured until the product is released to market. This creates significant cost to the company through product re-designs, last-minute part replacements, and product recalls.
- A time-consuming sourcing process. Current practices introduce delays into the product development process while requests are sent to purchasing. There is no seamless way to identify new sources and verify supplier compliance with applicable mandates. Typically, this results in a large number of engineering change requests (ECRs) late in the design stage, delaying product release to manufacturing.
- Poor visibility into manufacturing processes and late-stage changes. Manufacturing efficiency can be increased dramatically when production constraints are considered in the early stages of product design. For example, without input from manufacturing, it is difficult to design a product to optimize lead-free manufacturing processes. Process changes and part substitutions made on the factory floor are not captured in a way that builds a knowledge base for future designs.
- Difficulty of incorporating end-of-life considerations into product designs. In addition to regulatory considerations, design engineers should consider feedback from maintenance or support organizations so that they can address end-of-life issues, such as disassembly and disposal in the initial design.

Total cost of non-compliance with local directives is significant

In the Fall of 2001, the Netherlands government seized 1.3 million Sony Playstation game consoles because of cadmium levels that exceeded the limit allowed under Dutch regulations. Sony Computer Entertainment Europe suspended some product shipments in Europe while it conducted a thorough inspection of all of its products throughout its entire supply chain. While the press has focused on the estimated \$93 million in lost sales that resulted from this event, its total cost is actually higher when product inspections, recalls and re-designs are considered.⁴

⁴ Sony's Cadmium Heartburn: The Cost of Non-Compliance, February 18, 2002, <http://www.rohswell.com/News/rohs003.php>

Integrate compliance checking into product development gates and workflows

To design green from the start and to ensure that all existing products remain compliant with evolving regulations, high tech and electronics companies are leveraging PLM to integrate regulatory considerations into the product development process. For example, material and substance data can be stored as requirements in the BOM. As a result, designers are aware of the issues relevant to a particular product in the markets where it will be sold. They can immediately verify the compliance of any material, component or part they want to use or quickly source an alternate. Stage gates for compliance validation can be built into design workflows to ensure continued vigilance.

In addition, PLM provides a global digital environment for collaboration and information exchange. Compliance information and best practices can be shared easily among all stakeholders across the supply chain. This also makes it possible to establish and enforce data collection and reporting standards. By capturing and managing all product, process and regulatory data in a centrally managed repository, PLM makes it possible for companies to continually validate new and existing products against any number of compliance standards over time. Non-compliant configurations can be flagged instantly, eliminating the potential for releasing non-compliant designs. This minimizes costs and delays related to ECRs and helps ensure a successful, cost-effective product launch.

Green design reduces customers' energy use from 10-50 percent

Since the introduction of the world's first green PC in 1994, Fujitsu Siemens Computers (FSC) has had an aggressive green strategy with strict criteria for minimal environmental impact across all of its computer products. Currently, 52 percent of all of FSC's PC products are green. The company's PC and server customers save between 10 and 50 percent per year in energy use compared to competing models. In its own production operations, FSC has reduced its energy consumption by 60 percent.⁵

To validate its green initiatives, FSC commissioned a report in 2007 with independent analyst firm IDC, which substantiated its stellar record for environmentally sound business practices.⁶

⁵ http://www.fujitsu-siemens.com/aboutus/sor/energy_saving/prof_desk_prod.html

⁶ http://presszoom.com/print_story_140768.html

Can you optimize production and provide end-to-end traceability?

Once a design is released to manufacturing, high tech and electronics companies must ensure that compliance is maintained throughout the production and assembly process. Typically, quality analysts verify the use of compliant manufacturing parts by comparing the parts list to what parts reside in inventory at any given time. Planners must ensure that production lines are optimized while adhering to regulatory requirements of each manufactured or assembled product.

In order to integrate compliance into the manufacturing process, high tech and electronics manufacturers must address these key issues.

- Accurate part material and substance data are hard to find. Oftentimes, analysts rely on information maintained in Excel spreadsheets or an ERP system. However, these systems typically lack detailed information on part composition or compliance status. Since suppliers upgrade or obsolete their components more and more frequently to remain compliant with evolving regulations, it is difficult to ensure that compliance status is up-to-date for every inventoried part.
- Additional verification steps are required to ensure that the right parts are on the right production or assembly lines. Companies that are transitioning to lead-free production or have medium to high turnover rely on manual processes and human intervention to verify compliance. Dual inventories maintained for lead-based and lead-free production increase the risk that the wrong parts will end up on the wrong lines unless part numbers can be verified at the point of material release.
- Change management processes are inefficient and error prone. Currently there is no easy way to document and validate that last-minute process changes or part substitutions remain in compliance. Without real-time access to compliance data during production and assembly, it is difficult to ensure that all contributors are working with accurate information.
- Tracing the history of components, parts, or processes for compliance declaration or audit purposes is difficult.

Ensure compliance at launch with a closed-loop solution

High tech and electronics companies can ensure compliance through manufacturing and assembly by integrating manufacturing execution (MES) and compliance solutions into their overall PLM environment. Manufacturing execution systems provide comprehensive information on all parts and components by automating data input as they arrive in receiving. Enterprise PLM solutions that provide a digital manufacturing environment integrate part sourcing, content, and compliance certification information from the MES and make it accessible for decision support during the production planning process and on the factory floor.

Unlike ERP or disconnected shop floor systems, an integrated solution based on PLM makes it possible to capture data at all stages of the manufacturing and assembly process, thereby providing full product and process traceability. To close the loop, engineers can compare the as-built with the as-designed BOM to quickly identify, analyze, and report on any discrepancies and their impact on compliance status. If issues are identified, companies can automate the way they initiate and resolve change orders online. By highlighting non-compliant items and automating their resolution at all stages of the product development cycle, PLM solutions help companies ensure that the end product is compliant when it enters the market place.

PLM and MES solutions support compliance in manufacturing

Manufacturers gain visibility into MES data through an enterprise PLM environment, making it possible to monitor compliance throughout the manufacturing and assembly process. According to AMR Research, "The hurried transition to lead-free components is wreaking havoc with procurement, inventory, and production systems all across the electronics supply network. Visibility into inventory levels and consumption rates is critical for manufacturers that don't want to be stranded with non-compliant scrap or component shortfalls. During the transition to lead-free production, routing complexity skyrockets, demanding precision tracking of component lots, substitutions and parts consumed."⁷

⁷ "MES: A Must for RoHS and WEEE Compliance", *ARM Research Alert*, April 2005.

► Conclusion

In order to compete globally in a dynamic regulatory environment, high tech and electronics companies must embrace environmental stewardship as a business strategy based on green design. They must elevate compliance from a reporting function and consider how green initiatives can create a competitive advantage. The only way to manage the growing number and complexity of environmental regulations while controlling the costs and risks associated with compliance is to ensure that employees and suppliers have the information and the tools they need to instill compliance into everyday business practices.

According to research by the Aberdeen Group, best-in-class companies have adopted compliance processes and incorporated product compliance checks, audits, and reporting into product development procedures and systems. These market leaders have addressed compliance in the design phase, and then ensured continued compliance throughout the product lifecycle as regulations, standards, and products change. They have adopted, integrated, and aligned product development, data management, and project management activities and information systems to perform automated compliance checks against new and existing product designs.⁸ Leading high tech and electronics companies are addressing the barriers to an environmental care strategy by leveraging their enterprise PLM solutions to integrate compliance into their new product development processes. PLM makes it possible to design green from the start, and to integrate data access, tracking and reporting into every phase of the product lifecycle.

As these and other industry leaders have clearly demonstrated, adopting pro-active environmental compliance strategies is good business and a very effective way to differentiate themselves in the marketplace. By establishing a unified, digital PLM environment, high tech and electronics companies can implement compliance strategies that help them compete for new customers or secure existing ones. PLM also ensures that environmental care regulations are observed and enforced across a company's internal organization and supply chain. Environmental care strategies built on PLM make it possible to:

- Ensure compliance with current and future environmental mandates
- Reduce compliance tracking and reporting costs through automation
- Improve information exchange through standardized protocols
- Increase manufacturing efficiencies
- Strengthen brand alignment with environmental stewardship

To learn how high tech and electronics companies are achieving these goals through PLM, visit: www.siemens.com/plm/greenhightech

⁸ *Product Compliance: Protecting the Value of Innovation*, December 2005.

Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with 6.7 million licensed seats and more than 63,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit www.siemens.com/plm.

Siemens PLM Software

Headquarters

Granite Park One
5800 Granite Parkway
Suite 600
Plano, TX 75024
USA
972 987 3000
Fax 972 987 3398

Americas

Granite Park One
5800 Granite Parkway
Suite 600
Plano, TX 75024
USA
800 498 5351
Fax 972 987 3398

Europe

3 Knoll Road
Camberley
Surrey GU15 3SY
United Kingdom
44 (0) 1276 702000
Fax 44 (0) 1276 702130

Asia-Pacific

Suites 6804-8, 68/F
Central Plaza
18 Harbour Road
WanChai
Hong Kong
852 2230 3333
Fax 852 2230 3210

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