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Optimizing **EFFICIENCY**

Standards in sustainable
electrotechnical manufacturing

Introduction

Manufacturers work hard to continually monitor and manage their sustainability responsibilities.

Energy use is a critical design consideration, so appliances and equipment can remain efficient throughout the product lifecycle. This report outlines specific standards that producers of electrical appliances can use to inform their processes and operations when it comes to energy optimization.

It also looks at how standards are shaping the development of smart grid technologies and applications.

The factory of the future combines cutting edge technology to optimize processes, monitor and maintain production systems and improve efficiency. We look at standards development in this capacity – highlighting digital twin manufacturing and visualization ●



Standards in energy efficiency and improved manufacturing sustainability

As global energy demand continues to grow, manufacturers must work hard to maintain their sustainability responsibilities, while keeping up with technological advances and meeting the needs of consumers.

Energy conservation must be prioritized in product development and production to ensure the sustainable future of the industry. Having energy use front of mind in the planning process is critical, so appliances remain efficient throughout the product lifecycle, allowing users to reduce energy consumption.

There are several useful standards that manufacturers of electrical equipment can use to inform their operations. [BS ISO 8887-1](#) provides general requirements around environmentally sensitive design, incorporating manufacturing, assembly, disassembly, and end-of-life processing (MADE).

[BS 8887-2](#) outlines important MADE design definitions, covering terms introduced by the Waste Electrical and Electronic Equipment (WEEE) Directive, and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations, as well as other legislation.

[BS 50564](#) specifies methods by which to measure, test and report electrical power consumption for a range of household and office equipment. Used in conjunction with more specific product standards, it enables manufacturers to determine the energy efficiency of their goods.

The standard also considers energy use by different operating state - for example when the product is in 'off', 'standby', or 'active' mode. This is an important aspect of empowering consumers to decrease their energy consumption.

It's vital to consider production and usage aspects from the initial development stage – and any changes to design should not compromise a product's energy efficiency. Consistently delivering energy efficient goods also bolsters the reputation of the manufacturer among customers, suppliers and the general public.

Manufacturers can also use [ISO 14001](#) to create a tailored environmental management system, which will inform all aspects of their facilities and operations. It actively demonstrates a commitment to environmental protection, through the production of high-quality, sustainable products.

In the modern context, this responsibility also includes the development of [smart appliances](#), internet-connected products that are able to respond automatically to external signals and modulate their energy consumption as a result.

Finally, BSI offers [Full Kitemark Certification](#), recognized globally as a mark of quality, safety and trust. BSI can test products to a variety of international energy-related standards or specifications, helping manufacturers gain access to many different markets around the world ●



ISO 50001 and the benefits for manufacturers: Avara Foods

“ We first used the ISO 50001 certification as a route to ESOS (Energy Savings Opportunity Scheme) Regulations compliance in 2014. Our management team viewed it as an opportunity to fully embed a standardized energy management system to drive efficiency in our manufacturing process. ”

“ We’re now in the fifth year of successfully using the standard and have seen incremental gains across the business year on year – in operational efficiency, cost savings and reputational benefits. What’s more, because the standard focuses on a continual improvement process, we’re seeing a consistent reduction in energy consumption each year. ”

“ Implementation of ISO 50001 has helped us deliver on a number of internal KPIs. For example, through good in-house management, we’ve been able to save more than 1000 megawatt hours of grid electricity consumption. And, despite being a larger organization, we’ve driven energy efficiency throughout the entire business – in fact, it’s brought teams closer together, while helping our employees to become aware of the importance of saving energy at every step. ”

“ Crucially, ISO 50001 has helped us make a significant contribution to environmental and climate protection, while reducing carbon emissions. The standard has enabled us to look at energy from a number of non-linear perspectives, exploring renewable energy, demand-side response and the circular economy. Using the standard, we’ve also been able to demonstrate our commitment to corporate responsibility to customers and stakeholders, improving our reputational image and increasing trust. ”

“ Utilizing a standard like ISO 50001 can truly have a powerful impact for individual companies and on the manufacturing industry. But more than this, it allows any business owner to contribute towards a sustainable energy future, introducing a culture of energy efficiency and reaping the benefits for years to come. ”

Baishakhi Sengupta, Energy Compliance & Sustainability Manager, [Avara Foods](#)





Standards and the smart grid

Smart grid technology, and related product and service applications, promise significant opportunity for companies across the electronics industry.

The number of successful smart grid projects is steadily growing, with each varying in scope and size. Although there's no universal smart grid definition yet, the EU Commission offers the following:

“ An electricity network that can cost efficiently integrate the behaviour and actions of all users connected to it... to ensure economically efficient, sustainable power... with low losses and high levels of quality and security of supply and safety. ”

It explains that a smart grid combines innovative products and services with intelligent monitoring, control, communication, and self-healing technologies. A smart grid allows varied power generators to connect successfully, while enabling consumers to aid system optimisation, partly by controlling their own supply.

Governments and utilities companies are working to strengthen infrastructure, build the right digital connective layers, as well as configure the required commercial transformations to accelerate smart grid growth.

Standards also have an important role to play in smart grid projects across the world. For manufacturers of products with smart grid applications, there's a growing number of standards designed to help optimize design, as well as navigate and understand the rather fragmented market.

For example, [BS IEC SRD 62913-1](#) provides generic smart grid requirements derived from a use-case methodology, while [BS IEC SRD 62913-2-2](#) develops this to consider common smart grid system uses, and inform further standardization activities for market related domains. [BS IEC SRD 62913-2-4](#) focuses on generic requirements for the electric transportation domain.

Manufacturers can consult specific standards which consider the need for new standardization work, based on use-case analysis, for grid management ([BS IEC SRD 62913-2-1](#)) and for resources connected to the grid ([BS IEC SRD 62913-2-3](#)).

Further important guidance can be found in [PD IEC/TR 63097](#) which provides a smart grid standardization roadmap. Manufacturers can use the document to select the most appropriate set of standards for their operations, whether they are already published or in development.

A living and continually updated resource, the document also aims to create a common set of guiding principles around the specification, design, and implementation of smart energy systems.

Similarly, manufacturers can consult technical report [PD CLC/TR 50608](#) for an overview of over 30 European smart grid projects in operational or construction phases. It outlines structure, contents and regulatory arrangements for each project, and is intended to inform smart grid standards development by sharing key learning points from early projects.

An important aspect of the smart grid concept is electrical energy storage (EES), which helps secure supply by capturing surplus power when it's available. This electricity can then be released to maintain supply when demand increases. Manufacturers can use [IEC TS 62933-5-1](#) to optimize ESS system safety in terms of hazard identification, and risk assessment and mitigation. Many ESS systems also include predictive monitoring capabilities - another important area for standards development.

Beyond storage capabilities, every smart grid project requires wider communication, measurement and control systems. [IEC TS 62939-2](#) provides an architecture to define information exchange interfaces between demand-side smart systems and the power grid. This architecture is designed to cope with the currently fragmented market and lack of harmonized standard solutions.

Similarly, [PD IEC TS 62872-1](#) defines the interface, in terms of information flow and other required standards, between industrial facilities and the smart grid. Meanwhile, [BS IEC 62746-10-1](#) specifies a minimal data model and services for demand response (DR), pricing, and distributed energy resource (DER) communications. It outlines how to implement a two-way signalling system for information exchange between electricity service providers, aggregators, and end users.

Finally, many manufacturers are now producing smart grid-ready products and components, for home and building electronic systems (HBES), as well as building automation and control systems (BACS). [BS EN 50491-12-1](#) specifies general requirements and architecture for an application layer interface between the customer energy manager (CEM) and smart devices (SD) operating within a non-industrial smart grid premises-side system •





The future factory and energy efficiency

In many ways the factory of the future is already upon us – industrial processes have transformed over the last 15 years, largely driven by the digital communications revolution.

Like the smart grid, there are varying definitions and perceptions of the future factory – arising from a more general 'Industry 4.0' concept. They all describe developing scenarios in which cutting edge technology optimizes processes, monitors and maintains production systems and improves efficiency.

Advances in data processing are central. Sensors of varying complexity and scope are now used to dynamically monitor and measure machinery, plant, facilities, processes and equipment. Digitally linked to other assets – as well as management systems and data repositories – they gather and communicate information for constant analysis.

These sensors can have wired or wireless connections which feed operational variables such as temperature, power usage, vibration, pressure and other markers into cloud-based management platforms. Manufacturers use this to inform dynamic decision-making around production efficiency.

For example, if a particular component within a specific machine or process element has failed and is starting to impede production performance or waste power, real-time analytics can trigger alarms to flag this immediately for investigation.

This intelligence allows manufacturers to better control energy use, as well as fine-tune maintenance planning. A further benefit is the ability to focus maintenance budgets appropriately, avoid over and under-servicing, and predict equipment failures before they occur. Data-driven insight also offers increased clarity around plant and machinery lifespan, mitigating production downtime risks.

A further important advance is the rise of the digital twin – a 'living' digital replica of a connected asset – promises further energy efficiencies, as well as design advantages.

Manufacturers can use a digital twin to refine design efficiencies relating to a product's energy consumption, through dynamic simulation and modelling, to predict and measure power wastage. Performance data from products already in use by consumers can also be fed back into the twin to help future design iterations.

Standards creation is active in this area. Currently in development, the BS ISO 23247 series is designed to provide an overarching framework for digital twin manufacturing, while PD ISO/TR 24464 will focus on the relevant visualization elements.

Further efficiencies – as well as improved supply and demand balance – can be unlocked by manufacturers with micro-grid or renewable generation capability selling back their excess energy. It has been proposed that blockchain could provide an independent, swift and practical means of achieving this.

Manufacturers can use internationally recognized standards to help integrate these technical advances. Chief among them is [ISO 50001](#), which provides a framework by which companies can implement an energy management system to help reduce cost, comply with legislation and improve sustainability. It also helps organizations identify future supply risks for mitigation.

Any effort to improve energy efficiency in a manufacturing context must work in concert with wider sustainability strategies. [ISO 14001](#) empowers companies to create an environmental management system.

As well as improving sustainability it promotes cost-savings, improved brand reputation, and employee engagement. Taking a standards-based approach in this way builds resilience against energy supply uncertainty, as well as the ability to adapt to change.

Integral to every sustainable operation is the circular economy concept which seeks to decouple economic growth from resource consumption, and ease pressure on the planet. It also promises fresh economic and employment opportunities. [BS 8001](#) offers a practical framework and guidance for organizations looking to implement circular principles.

Finally, for those manufacturers looking to invest in their own wind generation capabilities, [BS EN 61400-25-1](#) describes overall principles for monitoring and control for wind power plants. Once a company has an optimized and energy efficient manufacturing operation in place, and is truly balancing out any negative environmental impacts, it can use [PAS 2060](#) to demonstrate its carbon neutrality ●



Standards for the Energy Efficient Factory

BS EN 50491

Requirements for home and building electronics, control and automation systems.

BS ISO 20140 series

Evaluating energy efficiency of manufacturing systems that influence the environment.

ISO 50001

Energy management.

ISO 14001

Environmental management.

BS ISO 8887

Environmentally sensitive design.

PD IEC/TR 63097

Smart grid standardization roadmap.

BS IEC SRD 62913-2-4

Generic smart grid requirements.

BS 60364

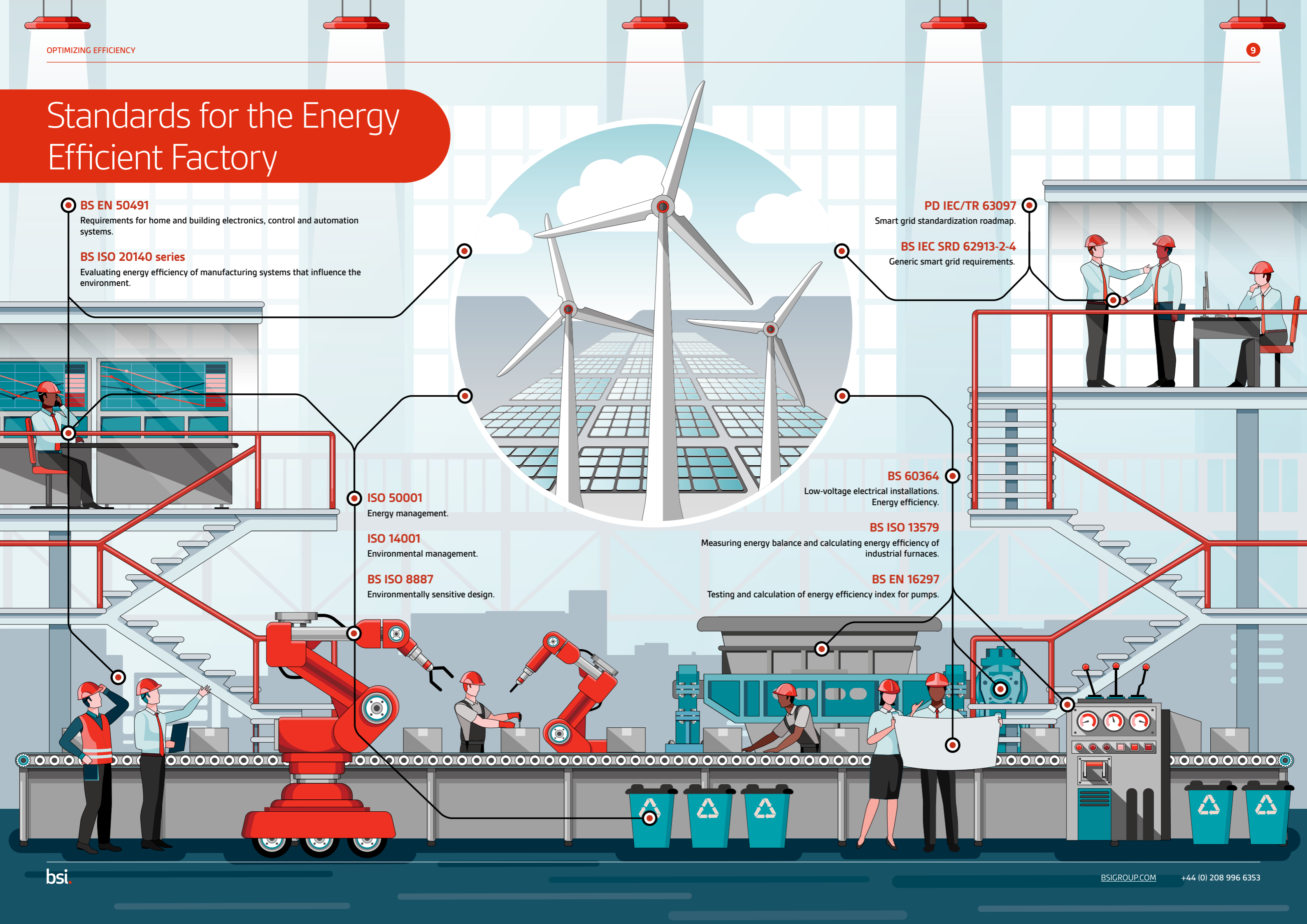
Low-voltage electrical installations.
Energy efficiency.

BS ISO 13579

Measuring energy balance and calculating energy efficiency of industrial furnaces.

BS EN 16297

Testing and calculation of energy efficiency index for pumps.





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