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Case study: Legrand's sustainable product design

Practical solutions to engineering a sustainable data center and maximizing the value of existing technology

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Contents

Catalyst

The information and communication technology (ICT) industry enables sustainable development by making the global economy less energy-intensive. The wave of digitalization that swooped the world over the last two decades enabled an increase in economic productivity and energy efficiency. In fact, the American Council for an Energy-Efficient Economy (ACEEE) estimated that for every 1kW of energy consumed by the IT sector, 10kW are saved in other sectors.

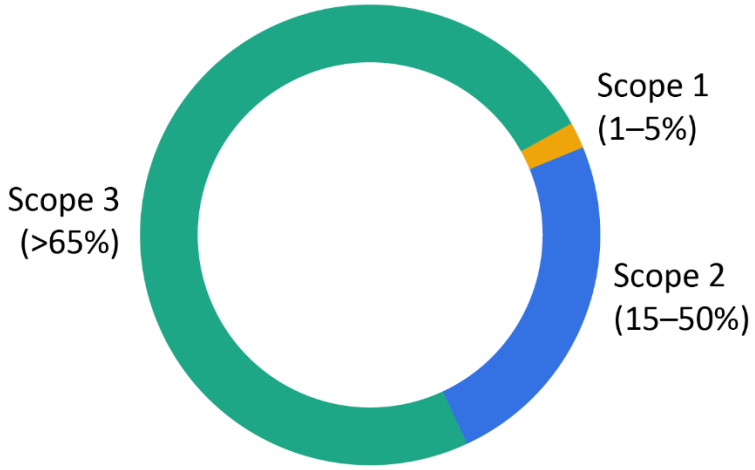
The backbone of the digital economy is the global network of data centers. During a wave of huge growth in compute demand between 2010 and 2020, the data center industry maintained stable energy consumption of approximately 200TWhs per year—a considerable achievement. With demand for AI applications through the roof, the data center industry doubled its power consumption in 2023, exceeding 400TWh based on Omdia data points.

The IT industry is also having to invest in an overwhelming amount of new IT infrastructure, optimized for the creation (training) and running (inference/generation) of AI models. To satisfy the unprecedented demand for AI, the data center industry cannot rely only on new power generation and will need to find power savings within existing facilities. This compelled us to focus this report on the environmental aspects of the industry’s effort to reduce its carbon footprint.

Introduction

Many data center operators have already deployed robust carbon emissions reporting processes—for example, Equinix, Digital Realty, and Cloudfront. Analyzing these companies' data has helped us establish a rule of thumb on the environmental impact of various factors related to data center operations. Carbon emissions reporting, or greenhouse gas accounting, consists of scopes 1 through 3. Scope 1 emissions stem from sources that are controlled or owned by an organization, such as onsite diesel generators, refrigerant leakage, fire suppression discharge, and maintenance vehicles, among others. Scope 2 emissions stem from the production of electricity and chilled water that data center operators purchase. Scope 3 emissions stem from the carbon emitted from the production of purchased equipment, goods, and services. This includes the transportation of equipment to the site and emissions arising from equipment retirement. It also includes emissions from employee commuting and business travel.

Figure 1: Data center carbon emissions by type



Source: Omdia

Data center operators have historically focused on the low-hanging fruit when trying to reduce their environmental impact. With scope 1 emissions being relatively low, much of the industry action has focused on electricity-purchasing strategies, targeting the reduction of scope 2 emissions. To improve the efficiency of data center operations, operators need a program focused on reducing electricity waste and saving water, and a substantial part of the recommendations in this paper focus on this.

When tackling scope 3 emissions, a lone wolf strategy does not work due to the broad scope of activities and complexity of supply chains. Choosing the suppliers whose values and internal actions

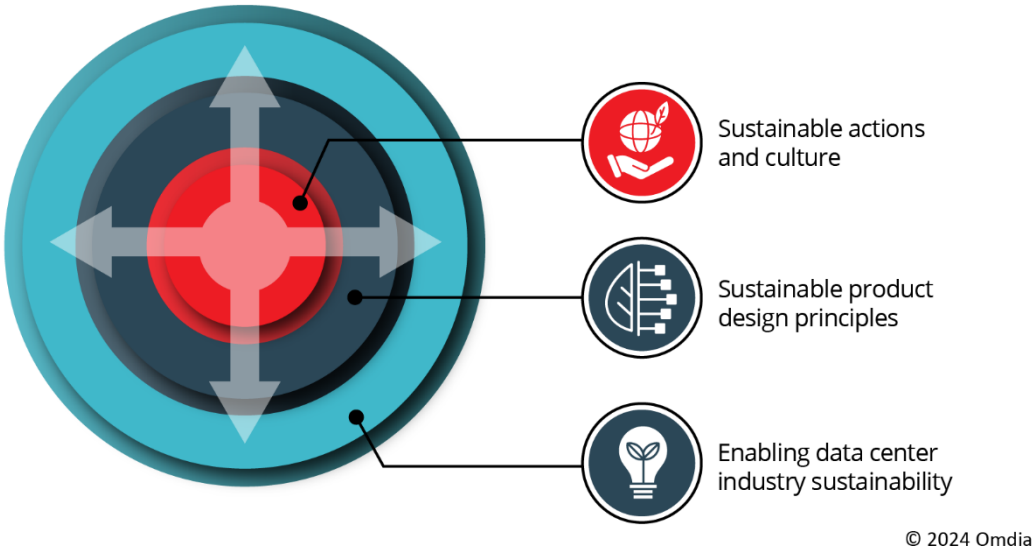
align with sustainable practices and actively collaborating with them to overcome challenges is the approach most likely to yield positive results. This is where case studies like this one come in.

The goal of this case study is to provide practical advice to data center operators on actions they can take to enhance sustainability, as well as factors to consider when selecting suppliers. By examining how Legrand's product innovation can be exploited to improve data center sustainability, we aim to highlight potential untapped opportunities to improve data center sustainability. By providing a 360-degree view of sustainability at Legrand, we aim to highlight important areas of consideration when selecting partners, investigating both company-level and product-level strategies.

To aid our examination, we have split this study into three parts because Legrand has three spheres of impact driving improvement in environmental sustainability.

- The first is the internal sphere of impact. We examine Legrand's company-level sustainability goals and the steps it is taking to realize them.
- The second is the product-level sphere of impact. We will study Legrand's product-level engineering decisions, which have a positive impact on environmental sustainability.
- The third and broadest sphere of impact is the ecosystem level. In this study, "ecosystem" refers to the broader data center industry. Data center operators are utilizing Legrand's infrastructure solutions and services to enact change and better control their data center environment.

Figure 2: Legrand's spheres of impact to enact environmental sustainability in the data center industry



Source: Legrand

This framework can be used by and applied to other companies in the data center industry and beyond.

Part 1: Legrand's corporate culture of sustainability

Legrand is an €8.4bn (2023 revenue) global specialist in electrical and digital infrastructure, with a portfolio spanning residential, commercial, industrial, and data center markets. While this case study focuses on data centers, it is important to consider a company's carbon impact across its entire value chain because its carbon emissions have a direct impact on the scope 3 emissions of companies that purchase its products. As such, we will study Legrand's sustainability efforts holistically.

- Reviewing Legrand's company-wide strategy, policies, and actions, we observed clear medium- and long-term goals and actions to reduce its environmental impact. We also found that progress toward these goals is reported clearly in its annual report. **By 2030, Legrand wants to reduce scope 1 and 2 emissions from its own activities by 42%.** To achieve these goals, Legrand has already implemented 150 initiatives to reduce its energy use. Legrand's Data Power and Control division, which is responsible for much of the company's data center solutions and services, reduced its energy use by 1.4GWh in 2023, beating its target of 1GWh in energy savings. At a corporate level, Legrand saved 14GWh of electricity between 2022 and 2023, equivalent to a 10% reduction. When compared to 2021, that is equivalent to a 39% reduction. From an electricity sourcing perspective, Legrand reported that 84% of electricity consumed across its manufacturing and distribution sites stems from renewable sources. A portion of this comes from onsite generation, as 25% of Legrand sites are equipped with a renewable microgrid**.**
- **By 2030, Legrand aims to reduce scope 3 carbon emissions by 25%.** To realize this, it set up a dedicated program to help 250 Legrand suppliers on their journey of reducing carbon emissions. So far, it has received commitments from 195 suppliers that they will reduce their emissions by 215.5 ktons of CO_2 by 2030.
- **By 2030, Legrand plans to achieve 80% of its sales with eco-responsible solutions.** In 2023, Legrand estimates that it generated around 76% of its sales from products deemed eco-responsible because of how they are designed or used, particularly in terms of energy efficiency. Still, to get to the 80% mark and beyond, Legrand is focusing R&D on further improving the efficiency of its products and is adopting circular economy principles. The latter is a significant challenge faced by most technology vendors. In the pursuit of circularity, Legrand aims to utilize 15% recycled plastic and 40% recycled materials in its products. It plans to completely eliminate single-use plastic from its flow pack wrappers and expanded polystyrene. Legrand reported that, so far, it has increased the use of recycled content and/or certified renewable material in its products overall from 73% in 2022 to 85% today. Another example of eco-responsibility demonstrated by Legrand's Data, Power, and Control division is that it reduced the weight of its packaging by over 700 tons between 2022 and 2023.

- **By 2050, it plans to be carbon neutral, matching the commitments of the US, UK, and EU governments, among others.** This will be achieved by a 90% reduction in carbon emissions across Legrand, with the last 10%, unavoidable emissions, offset through investment, including in local regeneration projects. For example, in 2024, Legrand plans to invest in protecting the flora and fauna in Kenya and extending the New Delhi metro in India. These targets were recently validated by the Science Based Targets Initiative.

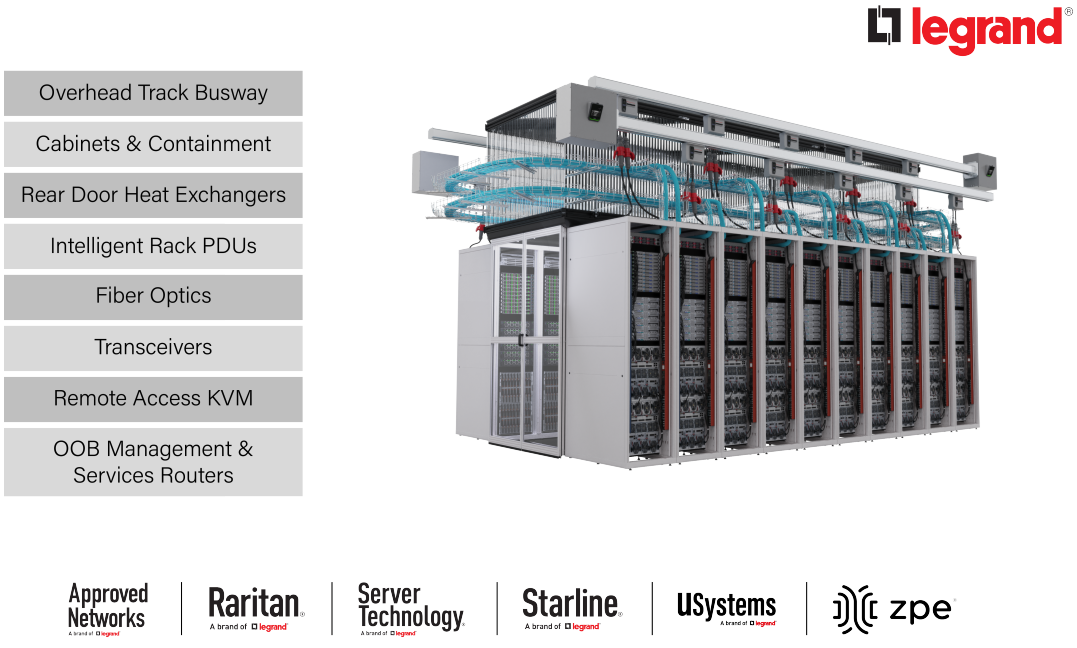
These goals and actions drive down Legrand's own scope 1, 2, and 3 carbon emissions, which, in turn, reduces its clients' scope 3 emissions. In the next part of this study, we delve deeper into data center (DC) product design and provide practical advice to DC operators.

While this study focuses on environmental sustainability, the UN's sustainable development goals, which many consider a de facto standard, include both social and governance actions like promoting diversity and inclusion and ethical business practices. As two examples of a broader set of policies, Legrand considers diversity as a criteria when selecting suppliers. Their 2024 goal is to develop 200 additional businesses with suppliers supporting diversity and inclusion by being publicly recognized as being minority-owned or women-owned. By 2030, Legrand is focused on the placement of at least 1/3 women in key positions.

Part 2: Sustainability as a key factor in product design and operations

Legrand's product portfolio spans data center power distribution, cabinets, cooling, and management solutions and services (Figure 3).

Figure 3: Legrand's data center product portfolio



Source: Legrand

We examine key actions product development teams took to make these solutions and services more sustainable, from selecting more sustainable building materials to carefully controlling the production and logistics processes and engineering to maximize the useful life of equipment. Most importantly, we review the design principles that led to reducing the embodied carbon in Legrand's products.

In 2014, Legrand introduced a company-wide eco-design approach within its R&D teams, and in 2023, it extended the practice to new areas. This includes incorporating sustainability as a key project parameter during new product design, developing products with lower environmental impact through better assessment of a product's life cycle, and so on.

In conversations with engineering teams at Legrand, we also learned that product features and solution customization options are often developed in response to end-user requirements. In the context of sustainability solutions, right-sizing is an important efficiency building block.

Legrand's efficient design principles: From lower power consumption to modularity

Reliability, flexibility, and efficiency of track busways for power distribution

Busways are innately more efficient for power distribution as they reduce the voltage loss that occurs when distributing power with cables. A busbar has much better resistance than cables, especially in short-circuit testing. Within the busbar's casing, there is a minimum distance between each conductor, reducing resistance induction. Busbars also have lower density levels due to a thin flat tire, which aids in the optimal distribution of current density and reduces resistance. Due to this, the voltage loss from the busbar is much lower than it would be for cables. Eliminating energy waste improves efficiency and, therefore, sustainability.

Beyond reducing voltage loss, busway systems drive lower harmonic distortion, resulting in further efficiencies. The oversized neutral conductor accounts for harmonic distortion, optimizing airflow and improving energy efficiency. Busways can also be integrated into the data center infrastructure management (DCIM) or building management system (BMS) for optimized power and cooling design and operations.

Legrand's market-leading track busway specialist, Starline, has added flexibility to its design as it provides continuous access slots along the busway, giving data center operators the ability to easily expand and/or reconfigure their IT room. Starline also designed the busways with visibility in mind to allow for load balancing and metering. High-power busways dissipate less heat, eliminating the impact on room temperature from power distribution equipment. Importantly, Starline's busways are virtually maintenance-free, reducing the need for maintenance-related travel and disruption to operations.

Feature-rich and efficient rack-level power distribution

Legrand's rack power distribution specialists, Raritan and Server Technology, have taken multiple engineering and design decisions to make their rack power distribution units (PDUs) capable of giving data center operators the ability to identify new efficiencies and become more sustainable.

- High Density Outlet Technology (HDOT), a patented design, removes unnecessary moldings around the outlet, increasing the space to fit more outlets in the same footprint, and in some cases, reducing the need for an additional rack PDU.
- HDOT Cx outlet, a hybrid C13 and C19 outlet, allows C14 or C20 power cables to plug into the outlet without adapters, increasing density and flexibility and reducing the need to buy a new set of PDUs when equipment changes. If new IT equipment has a different power cable

standard, it can still use the same rack PDU, extending the solution's lifespan. In dense configurations, two of Legrand's rack PDUs equipped with HDOT Cx outlets can replace three or four rack PDUs with a traditional design.

- Advanced power quality monitoring and metrics give real-time insight with ±0.5% metering accuracy into critical power quality, energy efficiency, and equipment health at the cabinet.
- Remote power management provides outlet control for a reboot of locked-up or idle servers and power-up sequencing. It also provides per outlet measurements of current, voltage, power (kW), apparent power, crest factor, power factor, and accumulated energy to help you determine how to shift power loads and get full control of your power usage for a more efficient IT environment. Power monitoring and management features can be utilized to locate consistently unutilized servers as a part of a server consolidation program, as discussed in the next section of this study.
- Bistable latching relays built into PRO4X, PX4, and PX3 rack PDUs consume less energy and minimize inrush current overloads. Therefore, the power used by each PDU is reduced with this technology. Standard electromechanical relays consume power while the outlet is on. Bi-stable latching relays do not consume power while the outlet is on.
- Total harmonic distortion monitoring and visualization of harmonic events like voltage dips and swells, crest factor, and so on, allow end-users to identify power quality issues that could shorten the IT equipment lifespan or electrical inefficiencies in the power chain. When coupled with Waveform Capture, it provides visualizations of the power being fed to the PDU or distributed to the PDU's outlets, enabling optimization of rack power efficiency.

IT cabinet design for lower cooling overhead

Legrand's IT cabinets are designed and engineered to eliminate cabinet airflow leakage, ensuring that the heat generated from IT equipment can be cooled as effectively as possible. Additionally, Legrand's Cabinets & Containment team designs accessories that reduce bypass airflow and eliminate recirculation. For example, rail-mounted blanking panels with integrated cable management inside the rack and adjustable mounting rails with seals redirect airflow from between racks.

IT cabinet design is highly configurable with adjustable accessories and components. This enables the elimination of unnecessary components on a project-by-project basis (i.e., eliminate extra side panels for client A).

Containment for better cooling efficiency

Containment is designed to maximize efficiency while creating a predictable operating environment that increases equipment reliability. With airflow integrity greater than 97.5%, Contain-IT FLEX increases energy performance and reduces cooling costs while operating high-density environments.

Containment kits are designed specifically for each aisle/row, minimizing the waste that occurs when adapting a typical bundled solution.

Cooling solutions for lower water use

Legrand's rear door heat exchanger (RDHx) specialists, USystems, designed its RDHx with a closed water loop system to significantly reduce water wastage.

Efficient optical networking

Legrand's acclAIM fiber solutions design replaced pre-terminated cassette-based solutions with direct mating breakout connections. This re-engineering delivers one-to-one cassette functionality, design, and administration without the cassette.

AcclAIM's extended distance fiber solution enables up to 160m for 1G and 107m for 10G applications. The typical industry barrier of 100m created the need to deploy additional signal-amplifying active equipment, which can have high-power consumption and, like any infrastructure, has operations and maintenance requirements. AcclAIM's extended distance fiber solutions can, in some cases, eliminate this need, driving a further reduction in scope 3 emissions as amplifying equipment does not need to be manufactured to begin with.

Reducing carbon emissions during manufacturing

Data center IT cabinet fabrication, bending, painting, and assembly are done in-house, which enables control and reduces emissions from the transportation of semi-finished goods from one location to another.

Legrand's RDHx specialists, USystems, removed all water wastage from the manufacturing process in 2017. Before 2017, USystems used water to cool welding, migrating all manufacturing to a non-water method. It estimates that, by doing this, they have saved 100,000 gallons of water per year. USystems also uses a biomass boiler and solar panels to assist with the renewable power supplied by the grid in powering its manufacturing plant.

Circular economy

The circular economy model of production and consumption involves reusing, repairing, and recycling materials and products as long as possible to extend their life cycle. This reduces waste and can sometimes lower carbon emissions by delaying the need to produce new materials and products. An effective circular economy includes three steps: using fewer raw materials in product design, using recycled materials, and reducing waste by designing products that are themselves recyclable. Repair or recycling programs are a part of this model. Studying Legrand's focus on circular economy, we saw examples of all these aspects across its product portfolio. Ensuring complete exhaustiveness with any company the size of Legrand is nearly impossible; therefore, the below should be used as an example.

Reusability as a core design principle

Starline engineering teams highlight the reusability of track busway components. Sections and plug-in units can be reconfigured and even moved from one location to another. When data center re-design or adaptations need to be made, busway components do not need to be recycled or thrown out. They can be used to build a new power distribution system. Importantly, since track busway systems are not hard-wired into the ceiling or walls, they can be reorganized in a matter of hours.

Legrand prioritizes recycled and recyclable materials to build products

- Legrand's market-leading track busway specialist, Starline, also uses recyclable materials (aluminum and copper).
- Legrand's network and IT infrastructure services specialist, ZPE Systems, even has a buyback and recycling program for serial console servers, sensors, and services routers. This provides enterprises with a simple solution to participating in the circular economy.
- Legrand's rear door heat exchanger (RDHx) specialists, USystems, use recycled steel from cars to build its RDHx and row cooling solutions.
- Legrand's acclAIM fiber solutions are designed with a "ship less, waste less" principle in mind, using substantially fewer components compared to competitive alternatives. Legrand's solution weighs approximately 50% less than these, due to reduced material usage (less steel, plastic, etc.). In fact, the previously described direct mating design, instead of using a cassette, eliminated the typically used plastic box altogether.

Legrand's use of readily recyclable packaging materials and logistics optimization strategies

- For example, the buffering material used between the cabinet and the outer casing is all constructed from cardboard. Updated packaging also includes less cardboard. After installation, packaging can be deconstructed and flattened to be recycled.
- The packaging of Legrand's IT cabinets is 95% recyclable.
- Legrand's rack power distribution specialists, Raritan and Server Technology, have limited the use of foam inside the packaging of their rack PDUs, replacing foam with 100% recycled content molded pulp. It also offers bulk packaging design as a customer-specific strategy to further minimize packaging waste.
- Legrand even introduced a product dedicated to sustainable management of patch cables, Ortronics EZ Patch. It simplifies the dispensing of patch cords and the cardboard box it comes in is recyclable. So far, EZ Patch has saved over 5,224lbs of single-use plastic, enough twist ties for 250,753 loaves of bread, and reduced time on site by 51 days.
- In conversation with Legrand logistics team, we learned that it can optimize or customize product shipment processes to reduce carbon emissions. It has already distributed its manufacturing plants around the globe to ensure that more than 50% of products are produced in close proximity to the end user, reducing shipment distance and, therefore, carbon emissions.

Part 3: How data centers can become more sustainable utilizing Legrand's solutions and services

Many industry organizations focused on helping data centers become more sustainable have formed. Data Center Energy Efficiency Program (DEEP), iMasons Climate Accord, and many others have provided thought leadership, case studies, and frameworks to measure carbon emissions and embodied carbon action plans for data center operators. Where these efforts have done really well is in providing practical advice on energy sourcing, measuring the embodied carbon of data center equipment and building materials, and providing advice on efficient data center design, such as the use of containment to reduce the energy used for cooling.

Where these tend to fall short is in considering energy wasted by underutilized IT equipment and end-user impact on inefficiency such as data waste. Both are cultural problems for organizations. The first one, however, can be tackled with an action-oriented usage data program. Legrand has integrated advanced monitoring features in its products that can be used to enable such a program.

This can be very impactful. In a conversation with Dell about projects focused on improving IT equipment utilization, we discovered that a construction company they worked with, which operates its own data center, decreased its power consumption by 70% by addressing server underutilization. If every data center operator addressed this IT underutilization issue, the overall industry impact on the environment would greatly decrease. It would also decrease the industry's electricity bill.

Sustainable IT strategies: Tackling IT underutilization with Legrand rack PDUs and ZPE appliances and services

Data leads to better decisions, and the features of Raritan and Server Technology intelligent rack PDUs can be utilized to monitor server-level energy usage and remotely manage the power going to the IT equipment. Real-time data on power quality, energy consumption, energy efficiency, and equipment health should be utilized by IT teams to right-size their strategy, better plan server and storage capacity, and even power off idle servers. Data on the number of idle servers over a period, for example, can be used to deploy a consolidation program.

Unintentionally idle servers, often referred to as zombie servers, consume power and space but provide no real value to a data center operator or its clients. Monitoring and/or switching off such unintentionally idle servers can have an immediate positive impact on the efficiency of a data center.

Sustainable cooling, power distribution, and backup strategies: Eliminating energy waste outside IT equipment

Cooling only the parts of the data center that need to be cooled

Airflow management is so important that the group of industry leaders behind the DEEP frameworks dedicated 20 of their 70 criteria to it. The 20 criteria utilize Energy Star and ASHRAE standards, including separating the supply and return of air using containment.

Controlling airflow is a critical step in improving data center efficiency. In its 2011 paper, *Best Practices Guide for Energy-Efficient Data Center Design*, the US Department of Energy discussed this in significant detail. In simple terms, data center operators should only cool the areas directly affecting the air flowing into the IT equipment and eliminate unnecessary cooling. This can be done at the cabinet or row level, using containment, or both. At a cabinet level, Legrand's airflow package and cable entry seal can achieve ≥80% reduction in airflow leakage. Its containment edges this close to 100%.

In conversations with data center operators, we often hear that the efficiency of a facility is determined at the design stage, with little opportunity to improve it over its lifetime. There are simple solutions to retrofit a data center for improved data gathering. One such solution is the implementation of sensors in and around IT cabinets. Similarly, accessories such as kits for sealing the space between cabinets can be used to improve data center airflow in a retrofit project. Even decisions on the cabinet power distribution can help optimize airflow. Server Technology PDUs use alternating phase outlets. Alternating the phased power on a per-outlet basis enables the use of shorter cords and improves airflow efficiency.

Opting for a heterogeneous cooling strategy

In the same paper, the US Department of Energy recommended that IT equipment with similar heat load densities and temperature requirements should be grouped together. In practice, this is difficult to achieve, as a large share of data centers have multiple tenants that make IT equipment placement decisions independently.

Cooling energy can be as high as 30% of a data center's total power consumption, and a centralized cooling system is not always the best choice. Data center operators should avoid planning the entire data center cooling system based on a small number of high-heat-density cabinets. A cabinet full of servers used for the development of AI models requires a different cooling strategy compared to a cabinet of servers running web services, which, in turn, generates more heat than a cabinet of storage arrays.

One effective strategy to address hotspots is through the use of RDHx. Legrand's USystems noted that some of its clients have been able to cut energy used for cooling by 70–90%, depending on the application. Their closed-loop system also reduces water wastage. USystems indicated it has achieved a power usage effectiveness (PUE) as low as 1.035 for one of its clients. For row-scale data center hot points, USystems indicated that its in-row cooling system is up to 60% more energy-saving compared to a computer room air conditioning (CRAC) and can deliver an industry-leading cooling capacity of 68kW. We optimize server configurations for the applications we want to run on them, so why not optimize our cooling strategy for the server configuration?

Enhancing efficiency by upgrading old power distribution and backup equipment

In a 2013 study, Meta noted that the inefficiency of UPS systems should not be ignored when trying to tackle energy consumption. Luckily for data center operators, UPS development over the last decade has been focused on improving its efficiency. For example, Legrand noted that its current UPS portfolio has an average efficiency of 98.5% (with a high efficiency of 97.2% at VFI Mode and 99% at UHE Mode).

Busways can make data centers more sustainable by reducing the voltage loss that occurs during power distribution with cables. A busbar has much better resistance than cables, and this shows especially in short-circuit testing. Within the busbar's casing, there is a minimum distance between each conductor, reducing resistance induction. Busbars also have lower density levels due to a thin flat tire, which aids in the optimal distribution of current density and reduces resistance. Due to this, the voltage loss from the busbar is much lower than it would be for cables. Eliminating energy waste improves efficiency and, therefore, sustainability.

Beyond reducing voltage loss, busway systems drive lower harmonic distortion, resulting in further efficiencies. The oversized neutral conductor accounts for harmonic distortion, optimizing airflow and improving energy efficiency. Busways can also be integrated into the DCIM or BMS for optimized power and cooling design and operations.

Power usage and efficiency monitoring and real-time decision making

We discussed IT-level energy consumption monitoring, and the same applies to electrical systems. One effective approach is utilizing real-time power monitoring in the busway and tap-off boxes. Starline enables both busway-level and branch circuit monitoring. The data can be used to ensure that the electrical system is properly balanced across phases, so that increased savings and energy efficiency can be realized.

For an even more comprehensive critical power monitoring, Starline has developed a dedicated tool that provides granular data at the power feed, branch-circuit level, or standalone enclosure. Advanced energy metering capabilities enable data center operators to make informed decisions and take data-driven actions to ensure peak performance of their electrical infrastructure.

At the rack or cabinet level, real-time analytics and actionable data can help make decisions that ensure the electrical infrastructure's peak performance. One feature of Raritan and Server Technology rack PDUs that can be very helpful for this is monitoring total harmonic distortions, which provides visibility into harmonic events like voltage dips and swells, crest factor, and so on. When coupled with their Waveform Capture solutions, it gives operators intuitive visualizations of

the power being fed to the PDU or distributed to the PDU's outlets. This helps to action an optimal power distribution strategy, improving energy efficiency.

Sustainable operations strategies: Eliminating unnecessary maintenance and operations emissions

The simplest way to reduce the emissions generated from operations is to incorporate low- or no-maintenance infrastructure in the data center design. Busways are one of the best examples of a data center solution that has a low fault rate and is practically maintenance-free. A unique feature of Starline busway joints is that they are bolted. This means they do not require torquing or regular maintenance intervals.

Remote access to physical and IT infrastructure for monitoring, management, and maintenance can have a positive impact on a data center operator's sustainability goals, particularly when a data center operator has a highly distributed set of remote/edge locations. Being able to complete maintenance tasks remotely reduced scope 1 emissions by eliminating unnecessary maintenance vehicle emissions. Real-time data on the performance of physical and IT infrastructure can also reduce the need for certain staff to access a site, reducing the emissions caused by employees commuting, and driving down scope 3 emissions, like those caused by plane journeys. Raritan's IP remote access allows end users to use equipment remotely, reducing the need to travel to remote/edge sites.

Sustainable purchasing practices: Long useful life as an emissions avoidance strategy

The Swedish Industrial Design Foundation (SVID), an independent, governmentally funded research and development organization, developed a guide that aims to outline the characteristics of sustainable product design. Designing for durability, modularity, reliability, compatibility, and deconstruction are the five principles outlined in SVID's sustainability guide. These simple principles are easily applied to the data center industry. The longer the useful life of the installed infrastructure, the longer the production of a replacement can be delayed, and the lesser the environmental impact. Busways are the perfect example: they are reusable, reroutable, and expandable and are virtually maintenance free when installed well. Track busways like those made by Starline, the leading data center busway vendor, also enable the IT hall to grow over time, as tap-off boxes to server and storage racks can be easily installed as the need occurs. They tick all five boxes SVID outlined.

In fact, these product design principles are visible across the Legrand global product portfolio:

- Zucchini transformers have a lower level of partial discharge, leading to a higher resistance to work stresses and, consequently, to a higher life expectancy of the transformer.

- The acclAIM fiber solutions have a mix-match modular design, which enables future proofing and assures longevity. One trunk and panel can offer nearly any link configuration by swapping patch cables.
- An uninterruptible power supply (UPS) typically has a long useful life, and Legrand’s is designed to be easily repaired and maintained. Individual UPS components can be worked on individually and are refurbishable by design.
- IT cabinets are designed with long-lasting components and can be upgraded using accessories, which allows scalability and futureproofing.

Analyst recommendations

Data centers enable the global pursuit of sustainability by making the global economy less energy-intensive. Data center operators have already taken significant steps to become more sustainable. Software virtualization improved IT equipment utilization. The industry's focus on lowering PUE has had a material impact on increasing efficiencies. Data center operators were also quick to address their scope 2 by deploying low- and no-carbon electricity purchasing strategies. Still, more needs to be done, particularly as we take the economy from digital to AI-assisted. To optimize energy efficiency and future-proof the data center industry, we recommend:

- Start a new wave of IT utilization improvement. Simple, actionable data points, such as the number of idle servers, can be utilized to form an optimal consolidation strategy.
- Maximize the power and cooling infrastructure efficiency by:
  - Optimizing airflow with containment and/or sealed IT cabinets.
  - Deploying a heterogeneous cooling strategy where hotspots are addressed with dedicated cooling infrastructure optimized for high-performance computing.
  - Replacing inefficient older power distribution and backup systems with efficient alternatives.
  - Monitoring electrical systems efficiency throughout the power distribution process.
- Reduce unnecessary site trips through remote management.
- Extend the useful life of power and cooling infrastructure by forming a design strategy anchored in durability, modularity, reliability, and compatibility.

These action items are all easy to achieve with off-the-shelf solutions and services from Legrand. In studying its portfolio and engineering philosophy, we found a strong focus on:

- Design optimization for low-power consumption (e.g., IT racks, rack PDUs, fiber solutions, RDHx, transformers, etc.)
- Engineering that increases operational efficiency (e.g., rack PDUs, busways, etc.)
- Modular design principles that enable fast deployment (e.g., busways, containment, etc.)
- Configurable, future-proof design and scalability (e.g., busways, IT racks, etc.)
- Customization capabilities with dedicated in-house engineering teams

Beyond engineering, we found that multiple teams within Legrand have focused on reducing the embodied carbon of their products and making them reusable and recyclable:

- Reducing carbon emissions during manufacturing
- Choosing to build products from recycled materials
- Making products from recyclable materials
- Using sustainable packaging
- Optimizing transportation and installation

Appendix

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Omdia consulting

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We hope that this analysis will help you make informed and imaginative business decisions. If you have further requirements, Omdia's consulting team may be able to help your company identify future trends and opportunities.

About Legrand's Data, Power & Control division

The industry-leading brands of Approved Networks, Ortronics, Raritan, Server Technology, Starline, and ZPE Systems empower Legrand's Data, Power & Control division to produce innovative solutions for data centers, building networks, and facility infrastructures. Our division designs, manufactures, and markets world-class products for a more productive and sustainable future. The exceptional reliability of our technologies results from decades of proven performance and dedication to research and development.

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