

Electrification: Smarter Energy for a Stronger Business

Learn how electrification works — and how it creates real business value.

PANDUIT®

15 Frequently Asked Questions About Electrification

Electrification converts fossil-fueled systems to run on electricity — and in the process creates ways for businesses to strengthen their competitive edge.

Why? Because electricity can be created from abundant low-carbon sources, which makes it more affordable — and more sustainable — by nature. As a result, it's a go-to strategy for businesses to reduce greenhouse gas emissions. What's more, electricity can be owned. Businesses can generate, store, and use electricity on their own terms, while minimizing unpredictable energy costs.

Electrification isn't just a process — it's a fast-growing movement. And with massive investment from both public and private sectors, it's ushering in a new era of innovation focused on making the air cleaner, people healthier, and buildings more comfortable.

We've assembled this eBook of 15 questions and answers on how electrification works — and why it's a smart move for your bottom line.



Why Electrification, Why Now

1 Electricity isn't new, so why is electrification considered a 'mega trend'?

While electricity has been around for well over a century, electrification — the process of converting fossil-fueled systems to run on electricity — has recently become a go-to strategy for achieving global decarbonization goals.

Why? Because electricity can be produced with low-carbon sources that don't produce emissions, and electrified systems tend to be more energy efficient than fossil fuel-based counterparts.

With the capability to reduce reliance on/usage of fossil fuels, cut greenhouse gas production, and reduce energy costs, electrification has become a worldwide movement backed by massive private and public sector investment.

Key factors contributing to electrification becoming a megatrend include:

Technological Innovations: Breakthroughs in battery storage and smart grid technologies have enhanced the feasibility and efficiency of electrifying transportation, heating, and industrial processes.

Environmental Policies and Goals: Global initiatives to reduce carbon emissions and combat climate change are accelerating the process of electrification. Replacing fossil fuels with electricity — especially when sourced from renewables — can significantly lower their carbon footprints.

Economic Incentives: The decreasing costs of renewable energy and electric technologies, coupled with the potential long-term savings on fuel and maintenance, make electrification an economically attractive option for both businesses and consumers.

Get more insights into electrification technologies.

Why Electrification, Why Now

2 Why is electrification a savvy sustainability strategy for businesses?

Electrification isn't just good for the planet, it's good for the bottom line, too. Several smart, interconnected reasons make electrification an ultra-effective approach for reducing energy expenses and realizing sustainability ambitions in one investment, including:

Regulatory compliance: Electricity can be sourced from renewable sources such as solar or wind, which enables businesses to reduce greenhouse gas emissions. As regulatory pressures increase, electrified systems (like electric fleets, HVAC, or machinery) are more aligned with long-term compliance. Investing now helps avoid costly retrofits and keeps businesses ahead of policy shifts and sustainability mandates.

Operational efficiency and cost savings: Electrified systems are often more energy-efficient than their fossil-fueled counterparts because they apply energy more directly and efficiently to the task at hand, which results in better energy conversion rates. Additionally, electrified systems are easily modulated and turn on/off quickly. More precise control and on-demand operation minimizes the losses that occur in many fossil-fuel based systems, which must run continuously or at fixed output.

Brand reputation and investor confidence: Customers, investors, and talent are all focused on sustainability — and they expect to see meaningful climate-related initiatives. Electrification is a bold, visible, and measurable strategy that elevates brand trust, attracts sustainability-focused investment, and creates a premium market position for businesses.

Smart technology adoption: Electric systems can be digitally monitored, optimized, and integrated into broader energy management platforms. Not only does this reduce energy costs, it also can enable real-time emissions tracking for sustainability reporting with less manual lift.

To learn more, see
Q5: How does electrification minimize unpredictable operating expenses?

Why Electrification, Why Now

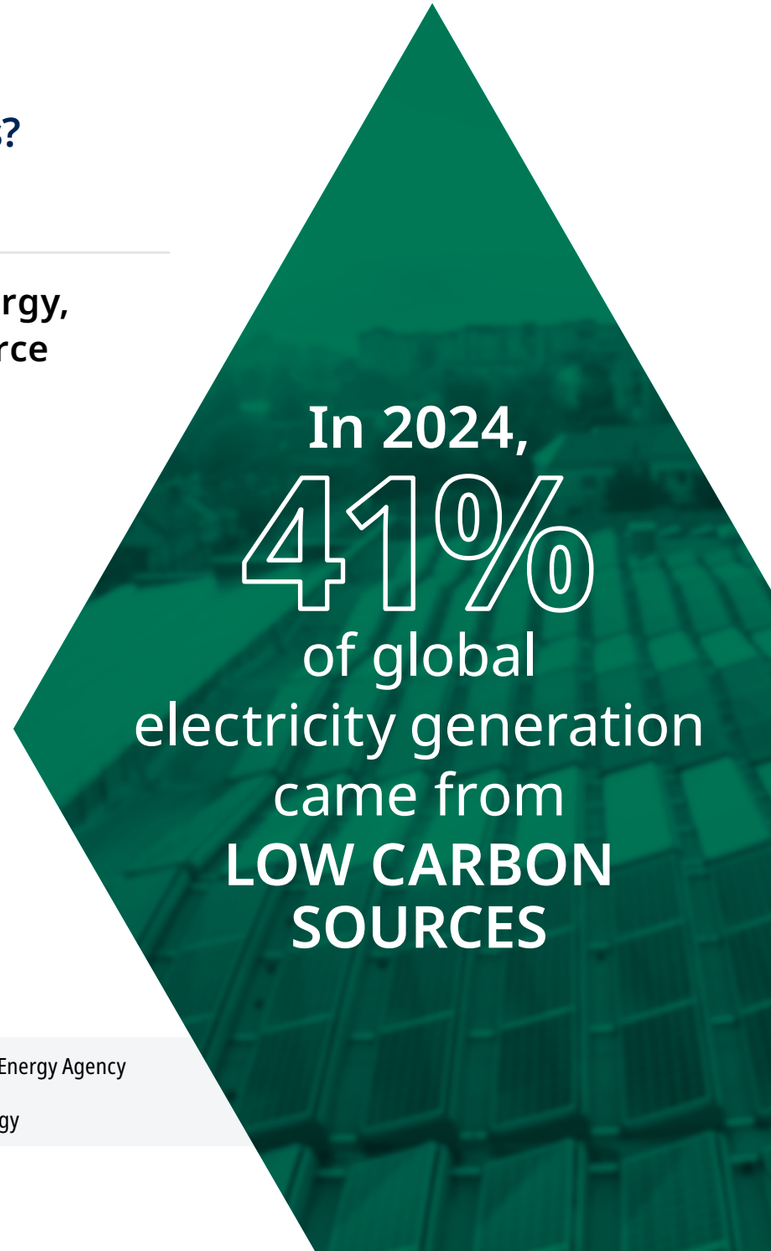
3 How does electrification accelerate the transition to low-carbon energy sources?

Electricity can be generated from low-carbon energy sources such as wind, solar, hydro, and nuclear power. Converting machines and processes that require fossil fuel combustion to run on electricity makes it possible for these systems to run on low-carbon energy.

Globally, fossil fuels remain the primary energy source, providing around 80% of global energy needs. 45% of this is from coal, about 35% from oil, and about 20% from gas.[1] Unlike fossil fuels, which release significant amounts of carbon dioxide when burned, low-carbon energy contributes only minimally to the greenhouse gas emissions that cause climate change. While less than half of electricity is generated from low carbon sources currently, additional capacity is being added each year. In 2024, 41% of global electricity generation came from low carbon sources, up from 39.4% in 2023.[2]

To accelerate the transition to clean energy, we must switch the primary energy source of the sectors driving demand for fossil fuels, which include transportation, commercial buildings, and industry.

- **Transportation,** which runs almost entirely on petroleum fuels, consumes ~30% of energy and contributes ~40% of energy-related CO_2 emissions.[3]
- **Commercial buildings,** which rely on direct fossil fuel use for space heating, water heating, and cooking, consume ~30% of energy and contribute ~26% of energy-related CO_2 emissions.
- **Industry,** which relies heavily on coal, oil, and natural gas, consumes ~30% of energy and contributes ~25% of energy-related CO_2 emissions.



Sources: [1]International Energy Agency
[2]Ember
[3]Stanford Energy

Why Electrification, Why Now

4 Does switching to biofuels provide the same benefits as electrification?

On the surface, biofuels might seem like a simple drop-in solution. However, biofuels and other combustion-based alternatives (like synthetic fuels, hydrogen blends, or renewable natural gas) typically:

- Reduce carbon intensity, but still emit CO_2, NOx, and other pollutants at the point of use.
- Often have high upstream emissions related to production, processing, and distribution.
- Rely on combustion, which inherently limits efficiency and always produces some form of waste or heat loss.

To be green, synthetic fuels need to be made from renewable energy, and renewable energy is all electric. Whenever energy is converted from green electricity into synthetic natural gas, for example, there is a significant energy conversion loss. As a result, more renewable generation is needed to do the same amount of work through a synthetic fuel.

Pursuing biofuels over electrification also misses out on one of the biggest benefits of new electrified systems: Innovation. For example, new heat pump technology warms a building three times more efficiently than a gas-powered furnace. And electrified transportation enables fundamental changes to fleet operation and management that improve working conditions and lower overall costs.

For hard-to-electrify-sectors like aviation, bio- or syn-fuels produced with low-carbon energy may be the best long-term decarbonization solution. But in most areas, the electrification technologies already in existence are a superior solution in terms of cost, resource consumption, and carbon reduction. And they are more compatible with decentralized energy resources like solar, batteries, EVs, and microgrids.

For more on decentralization, see **Q12: How do electrification technologies enable decentralized power generation?**

How Electrification Drives Competitive Advantage for Businesses



Electrification
ENABLES SMARTER ENERGY
management

5 How does electrification minimize unpredictable operating expenses?

Unpredictable expenses are a business liability. When operations depend on fossil fuels or legacy equipment, businesses are constantly exposed to fluctuating energy prices, unexpected maintenance, and compliance risks that can hit the bottom line with little warning.

Electricity prices are generally more stable than fossil fuels, and they're even more predictable for businesses that opt to generate their own energy through renewables like solar or wind. Doing so provides protection against global supply fluctuation and price volatility. Electrification also enables smarter energy management. How? Electrified systems integrate digital technologies that provide real-time visibility into energy usage patterns, identify areas for improvement, and implement strategies to enhance energy efficiency and sustainability.

6 How does electrification enable end-to-end energy ownership?

Unlike fossil-fuel energy systems, electricity can be owned. Businesses can generate it, store it, and use it — all while minimizing unpredictable operating expenses.

- **Generation:** Electrification opens the door to renewable power sources like rooftop solar panels that enable businesses to generate their own electricity onsite.
- **Storage:** Electricity storage systems, like batteries, enable businesses to hold and manage surplus energy for use when it's most valuable, such as when sun or wind aren't available, or when power demands spike.
- **Usage:** With electrified infrastructure that leverages intelligent energy management, especially in microgrids or smart campuses, businesses can control how energy flows across systems to power buildings, charge fleets, or operate data centers.

How Electrification Drives Competitive Advantage for Businesses

7 Why is electrification unlocking a new era of innovation?

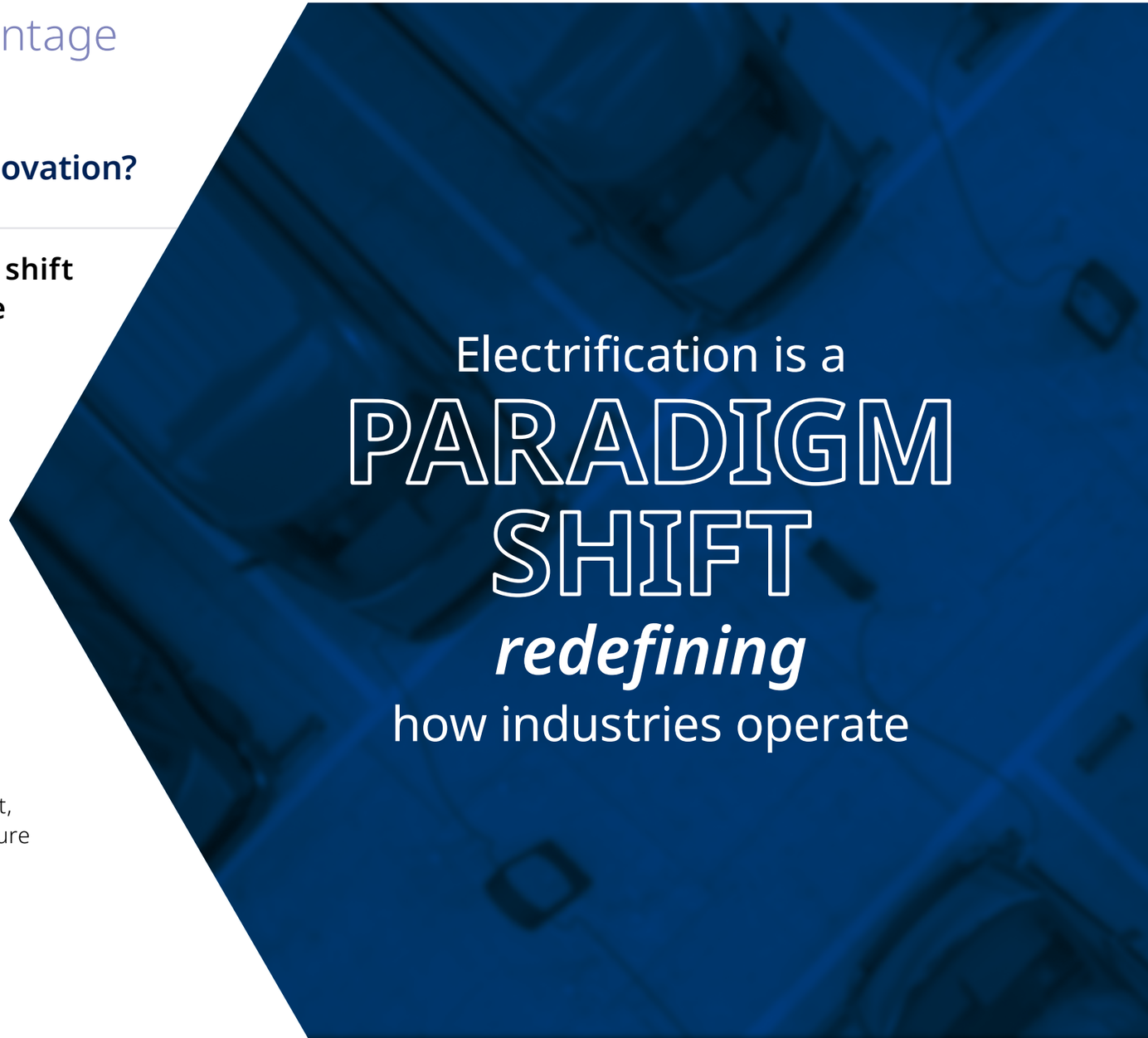
Electrification is more than just a process — it's a paradigm shift that is redefining how industries operate, how products are designed, and how value is created.

Here are some of the reasons why:

Shifting societal expectations: Energy efficiency, carbon transparency, and smart functionality have become core buying criteria, pushing manufacturers to design products that are not only high-performing but also digitally enabled and low-emission by design.

Public and private sector investment: Governments around the world are investing in electrification, clean energy, and grid modernization, which reduce the cost of R&D and deployment for new technologies.

Increasing demand for electricity: As the world becomes more electrified, so too does the risk of "browning" fragile power grids. Buildings, data centers, and EV transportation fleets need more efficient, resilient, and sustainable solutions than anything traditional infrastructure can offer — and they need it fast.



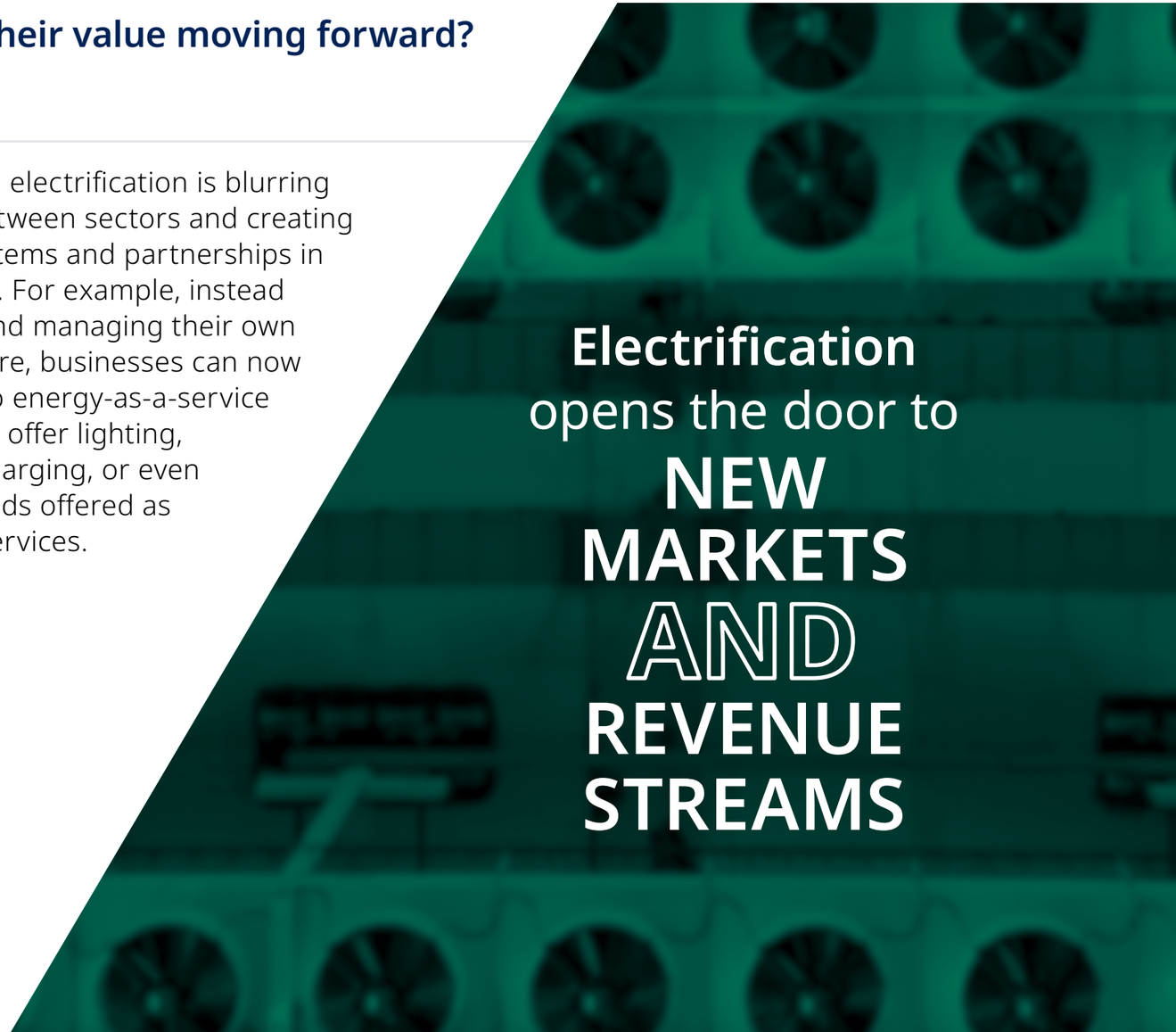
How Electrification Drives Competitive Advantage for Businesses

8 How can electrification help businesses maximize their value moving forward?

Electrification helps businesses unlock new value in multiple ways — operationally, financially, and strategically. By transitioning to electrified systems, companies can improve efficiency, reduce costs, and gain better control over their energy use through digital monitoring and automation. Electrification also enables compliance with emerging climate regulations and corporate sustainability goals, helping to avoid penalties and preserve brand reputation.

From a growth standpoint, electrification opens the door to new markets and revenue streams, particularly as demand surges for low-carbon products, clean energy solutions, and intelligent infrastructure. It also enhances asset resilience, especially in sectors where uptime is critical like data centers, logistics, and manufacturing.

Additionally, electrification is blurring the lines between sectors and creating new ecosystems and partnerships in the process. For example, instead of buying and managing their own infrastructure, businesses can now subscribe to energy-as-a-service models that offer lighting, HVAC, EV charging, or even full microgrids offered as managed services.



Technologies for an Electrified World

9 How do technologies such as smart grid systems improve energy efficiency?

Electrification significantly increases demand for electricity by design. And the integration of variable renewable energy sources like wind and solar into energy systems makes them more complex and dynamic. Smart grids help manage fluctuating supply and demands by coordinating distributed energy resources including renewable generation and energy storage, ensuring a more reliable and resilient power supply.

One of the key features of smart grids is active demand management systems, which continuously monitor and analyze power generation, distribution, and consumption. By bringing resources such as battery energy storage or EV charging online — or remotely turning systems such as hot water heaters, EV charging, or air conditioners down (or off) for short periods of time — smart grid technologies enable both energy providers and consumers to adjust usage in response to changing grid conditions. In doing so, they improve reliability and overall efficiency. And less need for costly infrastructure upgrades results in cost savings for businesses.

By enabling the seamless integration of renewable energy and supporting a more flexible and sustainable energy ecosystem, smart grids are central to the future of electrification. They not only help utilities and businesses meet environmental goals but also unlock new economic value by harnessing every available watt of clean energy through enhanced utilization and grid intelligence.



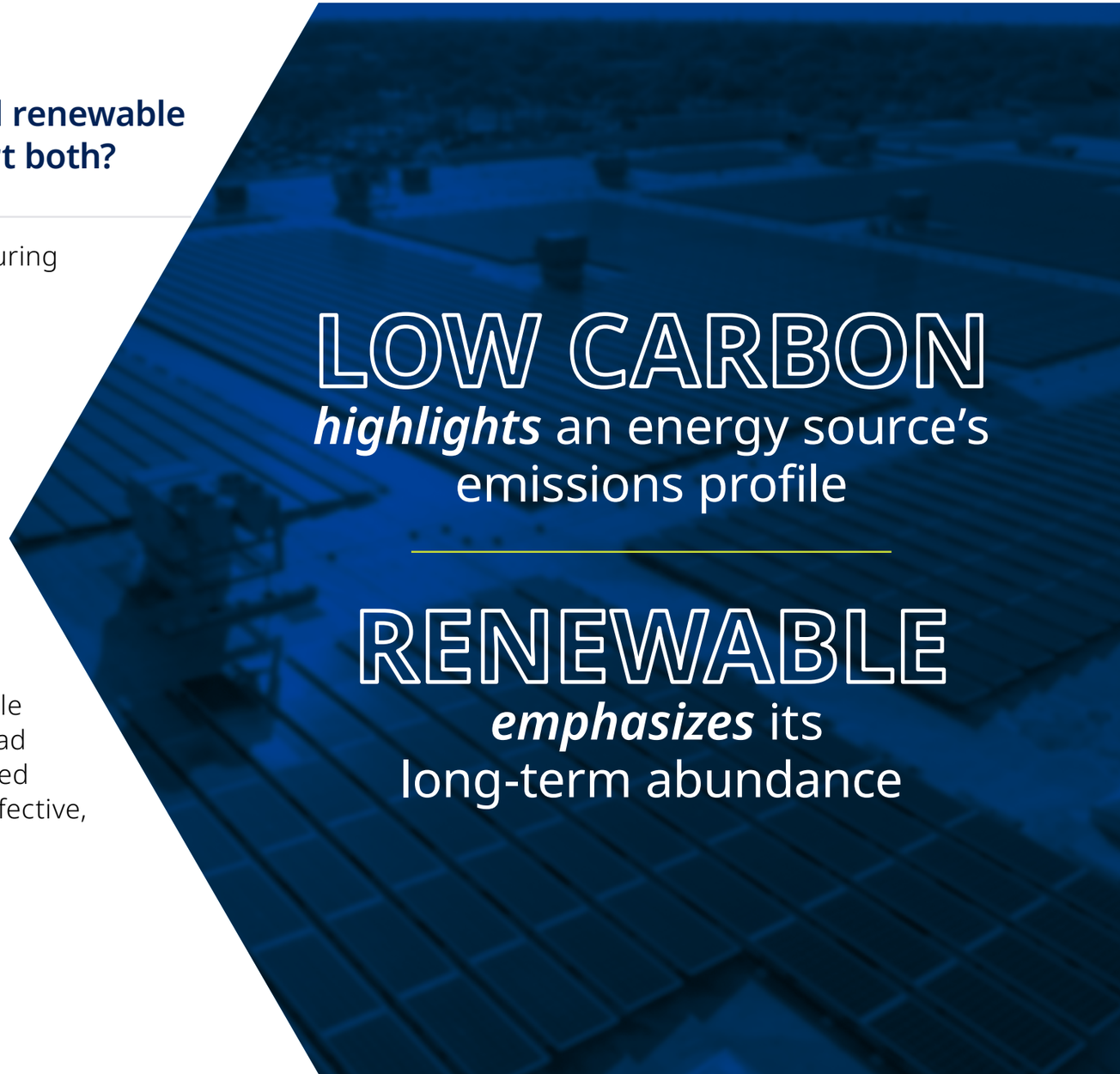
SMART GRIDS
help manage fluctuating **SUPPLY** and **DEMAND**

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10 What are the differences between low-carbon and renewable sources of energy, and how do smart grids support both?

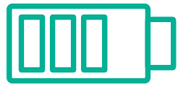
Low-carbon energy refers to sources that emit little or no carbon emissions during operation, such as solar, wind, and nuclear power. Renewable energy, on the other hand, comes from naturally replenished sources like sunlight, wind, and water. While renewables are also low-carbon, not all low-carbon sources are renewable — nuclear is a key example. The core distinction lies in that "low carbon" highlights an energy source's emissions profile, while "renewable" emphasizes its long-term abundance and sustainability.

Smart grid technologies enable the effective integration of both low-carbon and renewable energy into a modern, electrified economy. These technologies use real-time data, forecasting, and automation to balance supply and demand, maximize utilization, manage grid congestion, and coordinate energy storage and distributed resources. For utilities, smart grids enhance the reliability of variable sources like solar and wind, while also optimizing the role of consistent baseload power from nuclear. Combined with electrification — converting fossil fuel-based systems to electric alternatives — smart grids support a more resilient, cost-effective, and decarbonized energy system across sectors.



Technologies for an Electrified World

11 How do energy storage systems solve renewable energy availability challenges?



BATTERIES are being installed at an ***increasing rate,*** often **independent** of renewable energy generation

Sun and wind are inherently intermittent and inconsistent. As a result, energy storage is a crucial part of next generation smart grids, enabling greater reliance on renewable energy sources. When production falls short of demand, battery energy storage systems (BESS) can provide short-term back-up supply. These storage mechanisms are charged when electricity is cheap and plentiful (typically when renewables are generating more electricity than the grid demands), then discharged in the early evening when the sun starts to set and household demand surges. They act as an immediate, accessible, and effective cure for overburdened grids.

At the same time, individual businesses or residences can implement BESS solutions "behind the meter" — meaning on the energy user's side of the electric meter — which gives them more control over how and when they use electricity. In these cases, energy storage can provide backup power, reduce costs, and sometimes even provide revenue through programs where electricity is sold back to the utility when it's in high demand. Combined with other generating assets, BESS is often part of a larger microgrid system.

Energy storage systems solve other challenges as well. They can support the grid with localized power during peak usage events, which reduces the burden on ageing transmission lines. And with the ability to respond almost instantaneously to changes in demand, they are increasingly important for alternating current frequency regulation, which is another key contributor to grid stability. As a result, BESS is being installed at an increasing rate, often independent of renewable energy generation.

See how Panduit supports BESS

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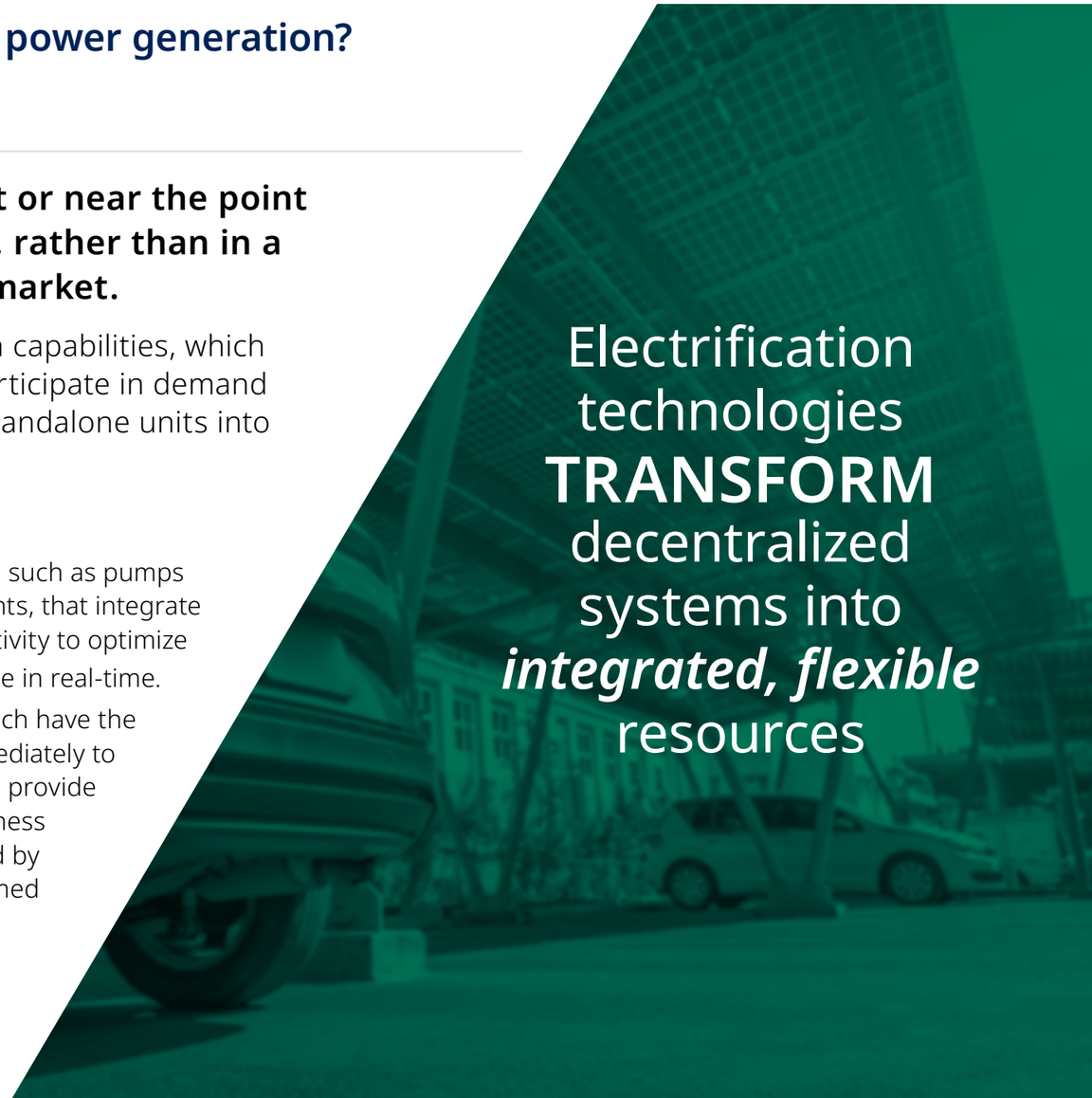
12 How do electrification technologies enable decentralized power generation?

Decentralized power generation refers to the production of electricity at or near the point of use, or in far-flung locations where renewable resources are plentiful, rather than in a few large, centralized power plants that supply electricity for an entire market.

Electrification technologies provide distributed energy assets with real-time coordination capabilities, which allows them to communicate with the grid, optimize when and how they operate, and participate in demand response or grid balancing activities. Doing so transforms decentralized systems from standalone units into integrated, flexible resources that support overall grid stability.

Electrification technologies include:

- **Electric water heaters** that use electric resistance or heat pump technology to warm water, offering a cleaner and more energy-efficient alternative to gas-fired systems.
- **Heat pumps** that transfer heat rather than generate it, enabling them to efficiently heat and cool buildings using electricity instead of fossil fuels.
- **EV charging stations** for recharging electric vehicles. Like electric water heaters, smart chargers can be programmed to operate during off-peak times or in coordination with renewable energy generation.
- **Smart industrial equipment,** such as pumps and motors in wastewater plants, that integrate sensors, controls, and connectivity to optimize performance and energy usage in real-time.
- **Energy storage systems,** which have the ability to respond almost immediately to energy surpluses or shortfalls, provide valuable grid stability and harness every watt of energy produced by renewable sources not consumed in real time.



Technologies for an Electrified World

13 How does electrification help to power smarter buildings?

Commercial buildings have a lifespan of 50 to 60 years, after which they require extensive work to remain functional and safe. For investors and developers, maximizing returns means maintaining desirable properties. As a result, they're focused on retrofitting existing structures and constructing new ones to be more energy efficient and technologically up to date.

Electrification is a key enabler of smarter buildings, and smart buildings create long term value. Electrification allows owners to converge disparate building systems — such as lighting, HVAC, access control, and energy management — into a unified, digitized electrical infrastructure powered by advanced automation. These smart systems deliver measurable benefits:



Greater energy efficiency: Intelligent controls and real-time analytics optimize energy use across HVAC, lighting, and other systems, reducing both costs and emissions.



Lower operating expenses: IoT-enabled monitoring and predictive maintenance reduce equipment failures, unplanned downtime, and service costs.



Enhanced occupant experience: Smart buildings elevate indoor environmental quality through features like air quality monitoring, adaptive lighting, and personalized comfort settings — boosting tenant satisfaction and productivity.



Learn more about electrification and how it can help power more than just smart buildings.

Technologies for an Electrified World

14 How can data centers efficiently scale capacity through electrification?



EFFICIENCY

the third pillar of electrification

will become the ***defining north star*** for center design

As data centers race to support explosive growth in digital services — particularly driven by AI workloads — operators face a dual challenge: Rapidly scaling capacity while managing soaring energy demands. High density-compute environments now require rapid access to massive amounts of power, with some AI clusters demanding energy at levels comparable to small towns. At the same time, decarbonization pressures are reshaping how data centers source and manage their energy.

As a result, data center operators are laser-focused on preparing for the very near future when electrification is driving up demand for electricity — and their consumption comes under greater scrutiny.

Microgrid technologies, along with digital demand response systems and energy storage batteries, can help data center operators optimize their energy supply — and their cost savings. And by transitioning from gas-fueled generators to low-carbon energy sources, operators can realize sustainability ambitions at the same time.

In an environment where every watt counts, efficiency — the third pillar of electrification — will become the defining north star for center design. Operators can realize greater performance with less resource demand by leveraging next generation cooling systems, intelligent power supplies, and innovations like fault managed power. And by integrating on-site renewable energy generation, operators could run entire systems on DC power and reclaim the ~20% of energy typically lost during the AC to DC conversion process. So, while electrification will increase competition for electricity, it is also spurring innovations to reduce demand by increasing efficiency.

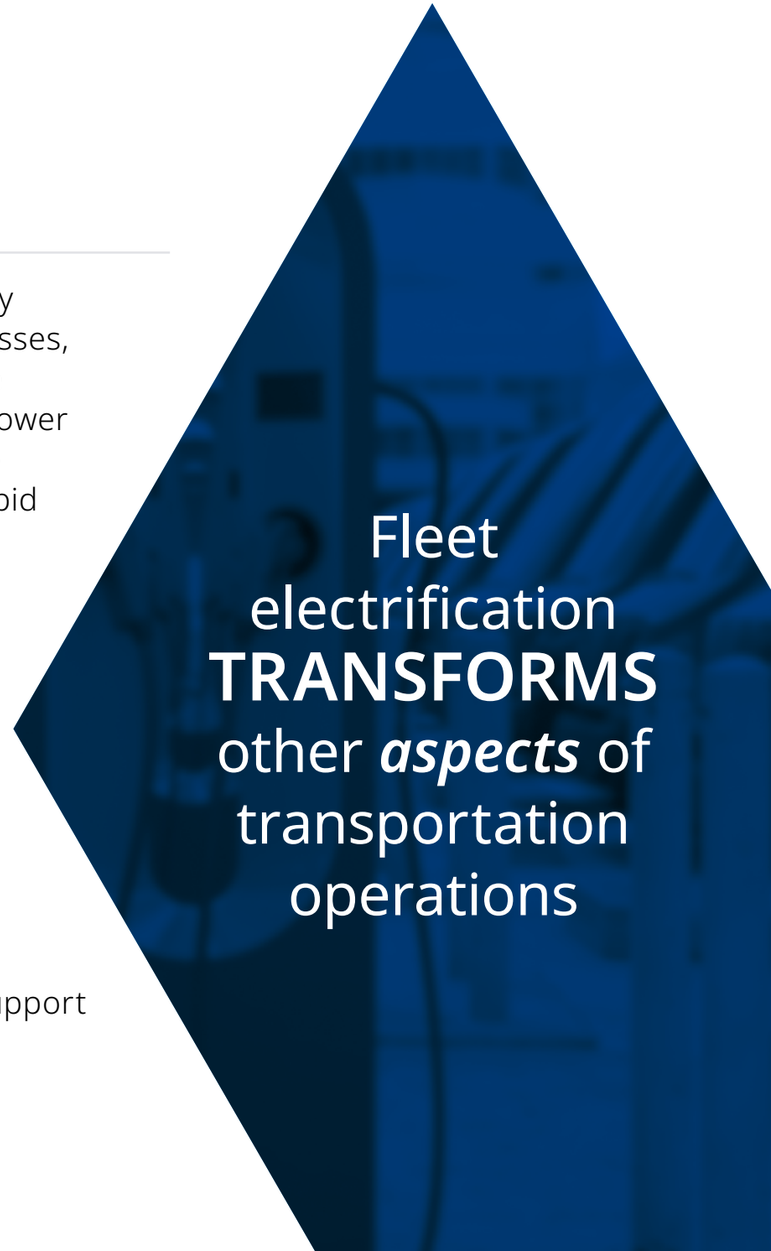
Technologies for an Electrified World

15 In what ways is electrification transforming transportation fleets?

Electrification is transforming transportation fleets by replacing internal combustion engine (ICE) vehicles with electric alternatives that are cleaner, quieter, lower maintenance, and more efficient. But EVs are more than just a change in vehicle technology — they represent a complete transformation of how energy, data, and infrastructure interact across the transportation ecosystem. For manufacturers, adoption of electric vehicles is driving demand for a range of entirely new on-vehicle and supporting infrastructure systems.

On-vehicle systems now require advanced battery management systems, high-voltage wiring harnesses, thermal management components, and real-time diagnostics — all engineered to support higher power loads and enhanced safety. At the same time, the supporting infrastructure must accommodate rapid charging, vehicle-to-grid (V2G) capabilities, and integration with renewable energy. This includes everything from fast chargers to load-balanced microgrids, energy storage, and upgraded electrical panels in depots and warehouses.

Fleet electrification doesn't just affect vehicles — it can transform other aspects of transportation operations as well. For example, by removing the need for ventilation of toxic exhaust, EV fleets enable enclosed, climate-optimized, and cost-efficient depots, all of which improve worker health, reduce HVAC load, and support sustainability and automation.



How Panduit Helps Businesses Embrace Electrification with Confidence

Many leaders aren't familiar with electrification's superpowers, or don't know what to electrify first — or next. As a technology-driven, customer-centric company, we keep our passion for innovation at the center of everything we do.

Panduit has provided electrical infrastructure solutions for over 70 years.

Working closely with visionary partners and organizations such as UL to develop and certify new electrification technologies, we have earned a reputation for quality and innovation, along with an unwavering commitment to safety. In fact, we're a founding member of the **Fault Managed Power Alliance**, which focuses on establishing and evangelizing safe, efficient, sustainable energy for organizations everywhere. We're also committed to minimizing our carbon footprint through environmentally sustainable business practices, and to enabling businesses to realize the sustainability and cost savings benefits of low-carbon energy sources.

Wherever your business is on the electrification journey, Panduit can help you go further, faster with proven physical and network infrastructure solutions that are purpose-built for performance and reliability.

Learn more at **panduit.com/electrification**

Missed something or want to read it again?

Head back to the start.

We have the knowledge and experience to help you make the most of your infrastructure investment.

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