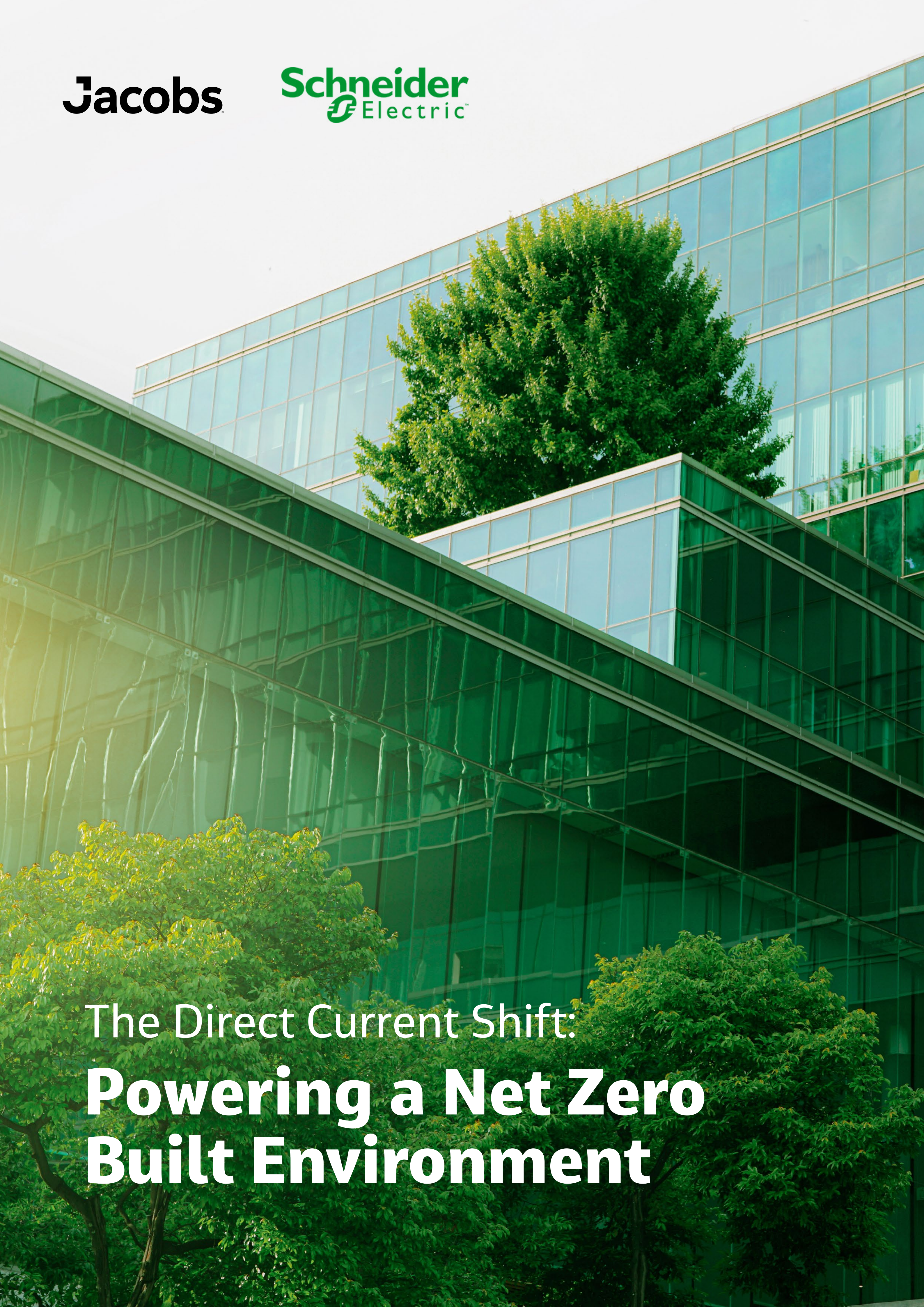


The Direct Current Shift:

Powering a Net Zero Built Environment

The Challenge: An Outdated Energy System

The U.K. and many countries are pushing hard to meet ambitious net zero carbon targets. These efforts are aligned with international commitments, including the Paris Agreement, which aims to limit global warming to well below 2°C above pre-industrial levels. At the national level, initiatives like the Clean Power 2030 targets aim to achieve 50% renewable energy by 2024 and progress towards 95% by 2030. Reflecting this momentum, building designs have already made important strides in reducing both operational and embodied carbon. However, the electrical infrastructure supporting these efforts remains rooted in a 20th-century model, built for fossil fuels and aligned around outdated assumptions of when and how energy is used.

The International Energy Agency forecasts that nearly 90% of global electricity will come from low-carbon sources by 2050. This transition creates a fundamentally new challenge. Energy generation will no longer align with energy demand. Sectors like buildings, transport and industry are electrifying simultaneously, causing the demand on the grid to increase, particularly during peak hours in winter. This mismatch is creating what we call the “great supply and demand crunch.”

The Consequence: Inefficiency and Overload

Current Net Zero Carbon Building (NZCB) standards largely focus on reducing energy consumption, or Energy Use Intensity (EUI). Consumption alone is no longer the core problem. The shift to electric heating, electric vehicle (EV) charging and other technologies increases peak demand, straining a grid that was never designed for this level of concurrent use. Although renewables can generate large volumes of electricity, much of it arrives when demand is low, particularly during summer months or overnight. Building a larger Alternating Current (AC) grid to handle these peaks is costly and inefficient. Distribution Use of System (DUoS) charges, which fund grid infrastructure, are rising, meaning users pay more for using less energy. In the U.K., particularly in the South of England, up of 67% of grid supply points and 60% of bulk supply points are already at or near capacity. Meanwhile, grid reinforcement projects typically take over a decade to complete. This creates an unacceptable delay when net zero deadlines are approaching fast.

The Solution: Net Zero Carbon Power

To solve this, we must shift to a new model, “Net Zero Carbon Power”, that balances energy demand, consumption and storage at the building level. This requires rethinking how power is generated, delivered and used.

Core principles of Net Zero Carbon Power:

1. **Eliminate inefficiencies in the system**
2. **Smooth demand on the national grid**
3. **Create hybrid AC/DC buildings**
4. **Embed local generation that can isolate from the grid**
5. **Decouple the pace of infrastructure upgrades from the built environment**

Instead of continuing to design buildings that increase peak demand on the grid, we must design hybrid AC/Direct Current (DC) microgrids that match the needs of our renewable future.

Why DC Microgrids?

While Tesla's AC model won the "War of the Currents" in the 20th century, the 21st century favours Edison's vision of a DC-powered world. Most modern technologies, like PV panels, batteries, computers, smartphones and LED lighting, naturally operate using DC. However, current AC-based buildings require multiple conversions, losing up to 20% of energy in the process. Adopting a DC microgrid system allows buildings to capture and store renewable energy directly, minimize conversion losses, improve efficiency and smooth peak demand by storing off-peak energy.

For example:

- DC-connected devices reduce conversion losses
- Both battery and thermal storage (e.g., ice or heat storage) can shift loads away from peak times.

DC microgrids also allow embedded generation (e.g., rooftop photovoltaic system) and storage to operate independently from the utility grid. This solves voltage constraint issues and speeds up project delivery without needing costly upgrades or lengthy utility approvals.

The Opportunity: Smarter Buildings, Faster Decarbonization

If every building acted as its own optimized microgrid, balancing generation, demand and storage, we could unlock:

- Greater site viability and faster development timelines
- Lower infrastructure costs and DUoS charges
- Reduced dependence on a slow-moving national grid
- A path to integrate more renewables into the system without destabilizing the grid

This requires a phased transition to hybrid AC/DC buildings, where DC-ready devices (like computers, LED lighting, and DC EV chargers) are connected to a shared DC bus, while legacy AC systems remain in use as needed.

Moreover, DC microgrids enable buildings to smooth their demand curves, creating a stable and predictable load for utilities. This helps prevent blackouts, reduces the need for oversized infrastructure and optimizes long-term grid investments.

Call to Action

The U.K. cannot afford to wait until 2035 for the grid to catch up with our decarbonized energy needs. We must act now.

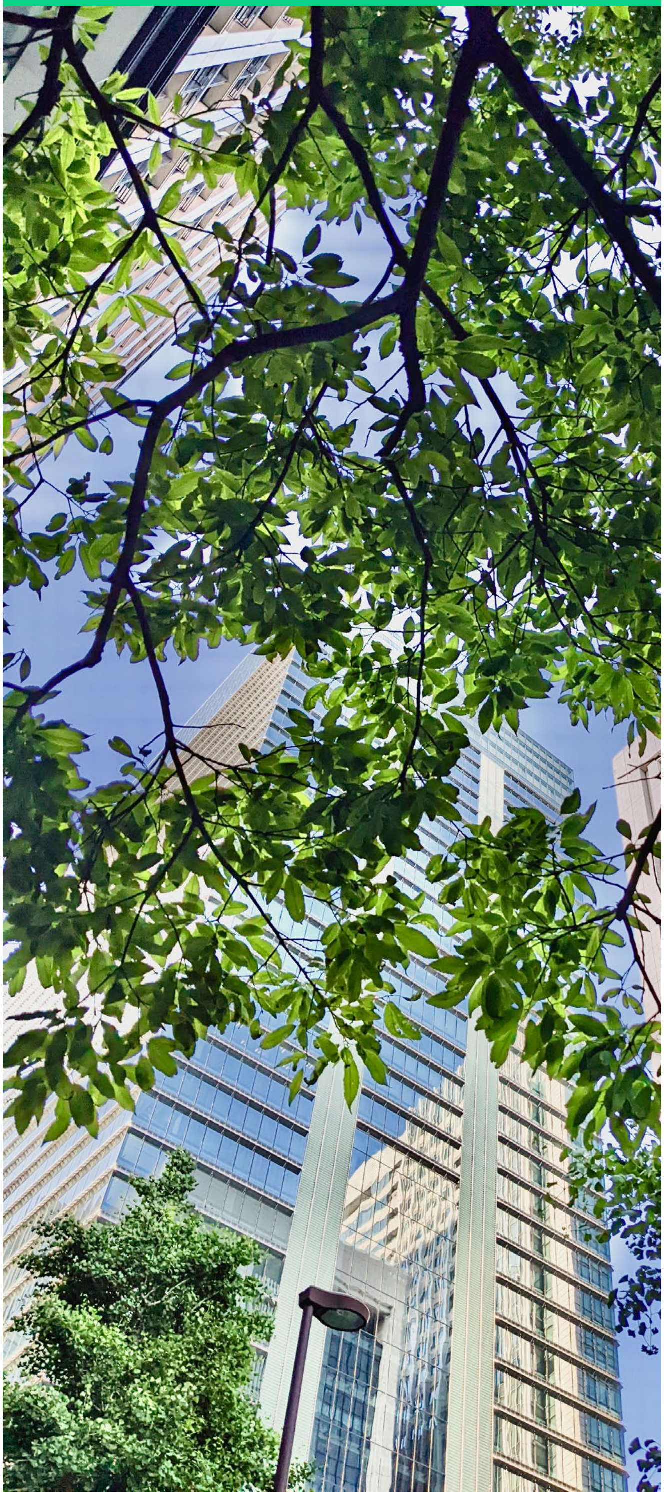
Policymakers must support DC microgrid standards, incentivize both thermal and battery energy storage and update NZCB standards to include demand as a critical metric, not just energy consumption.

Developers and engineers must begin designing for the realities of a constrained grid. That means:

- Prioritizing DC-ready equipment and systems
- Shifting peak demand away from stress points
- Integrating renewables and storage into local, flexible microgrids

Industry leaders must invest in technologies and supply chains that enable this shift, certifying DC-compatible products and scaling best practices from successful case studies.

The future will not wait. Those who act now will build not just greener buildings but also more resilient, future-ready energy systems.



Conclusion: A Smarter Path to Net Zero

The energy system of the 20th century, built around extraction, storage and consumption, is no longer fit for purpose. A new system based on local production, smart transmission and flexible consumption, is emerging, but to make it work, we must change how we think about energy, buildings, grids and power.

Net Zero Carbon Power is more than a concept. It offers a practical, scalable strategy to accelerate decarbonization. Redesigning buildings to act as active contributors to grid stability unlocks greater energy resilience, improved cost efficiency, and faster route to net zero. The technology is ready. The need is urgent. **The time to act is now.**

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