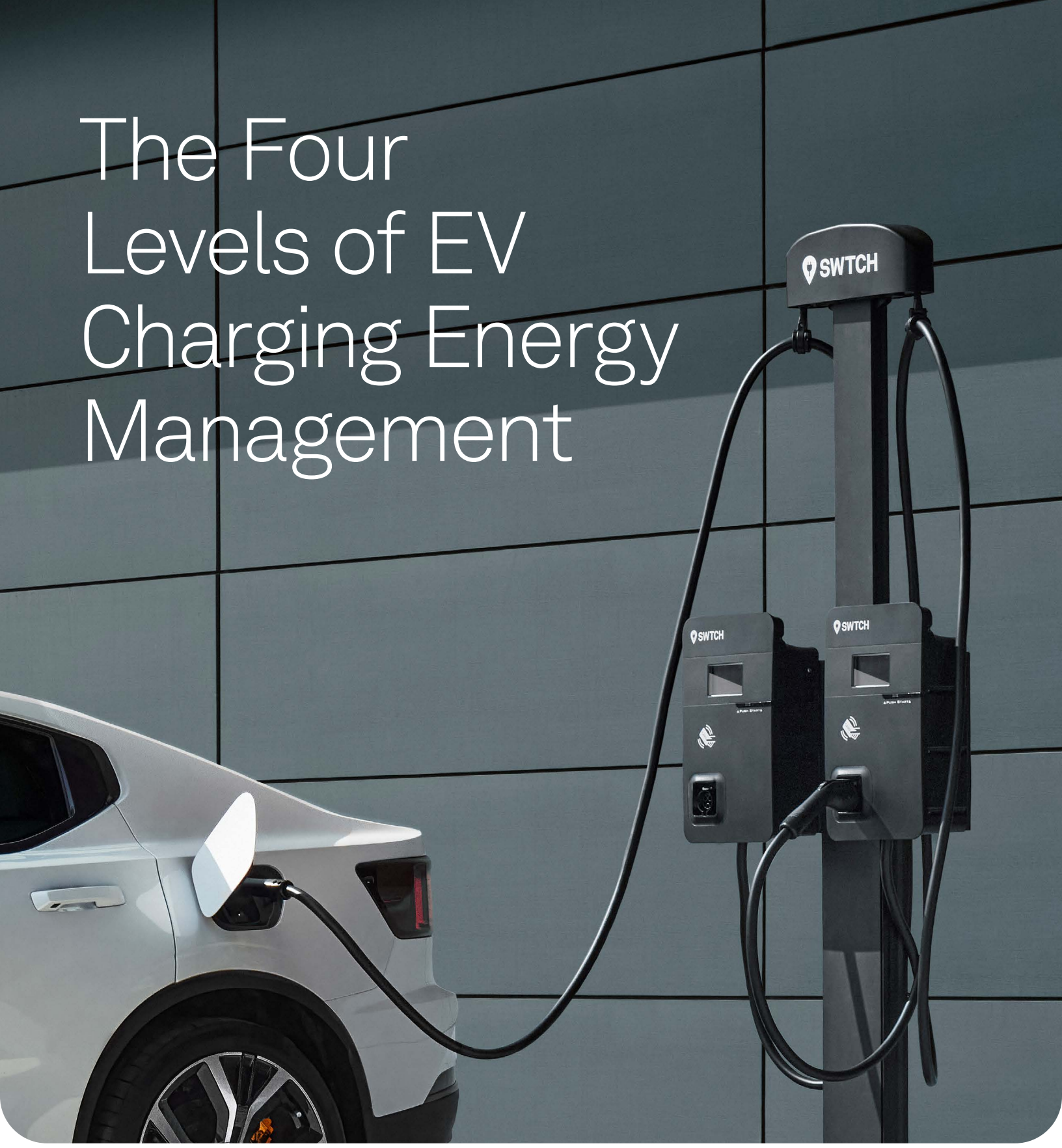
The Four Levels of EV Charging Energy Management



A Guide to Smarter EV Charging

SWTCH

TABLE OF CONTENTS

Powering your building's energy future with smart energy management	**03**
Level 1: Individual circuit load sharing	**04**
Level 2: Dedicated circuit with centralized management	**06**
Level 3: Panel-integrated dynamic load management	**08**
Level 4: Whole-Building Integrated Load Management	**10**
How to Choose the Right Level of Energy Management	**13**
Planning Your Project: Key Considerations	**14**
Electrical load management for smarter EV charging	**15**

Powering your building's future with smart energy management

For multifamily buildings, workplaces, and commercial properties, EV charging is no longer a nice-to-have amenity—it's essential infrastructure that tenants, employees, and visitors increasingly expect.

But here's the challenge: Done carelessly, adding enough EV chargers to meet the growing need creates substantial electrical demand that can overwhelm a building's existing infrastructure. Without proper planning, you risk overloading circuits or installing too few chargers, leading to frustrated drivers and, ultimately, costly infrastructure upgrades.

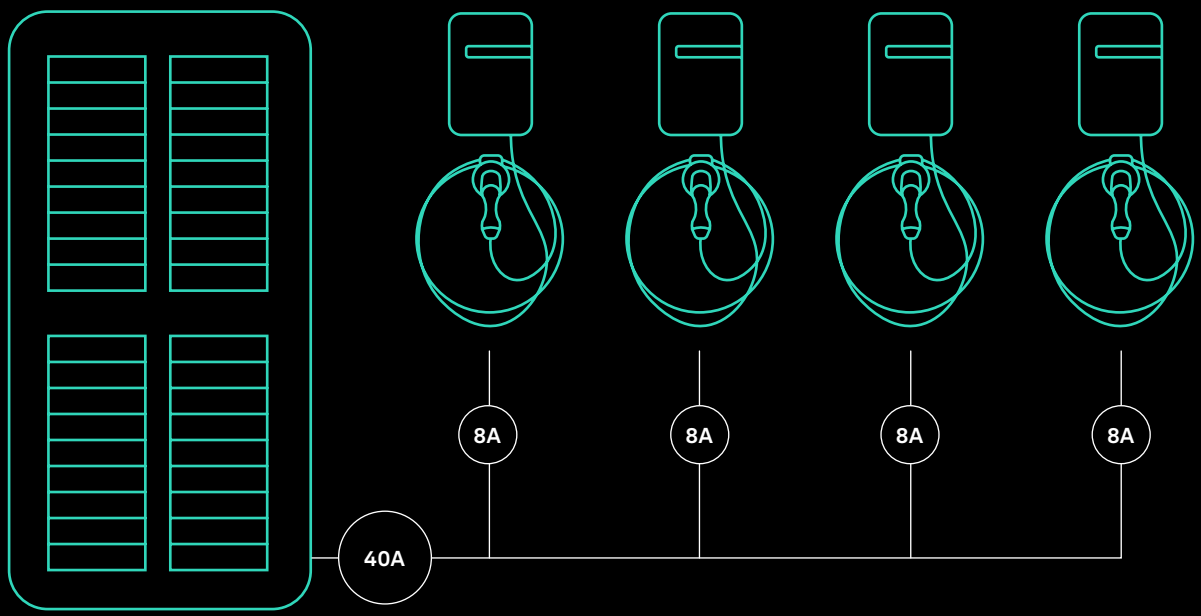
The solution?
Intelligent electrical load management.

Load management technology adds smarts to your charging network to allow your property to do more with fewer or no electrical upgrades. Rather than treating each charger as an uncontrollable power drain, these systems dynamically allocate available power where it's needed most. The result: you can install more chargers on existing infrastructure, significantly reduce upfront costs, and ensure every driver gets the charge they need.

This guide explores four distinct approaches to energy management, each designed for different situations and budgets. By understanding these levels, you'll make informed decisions that set your property up for long-term success in the electric future.

Level 1: Individual circuit load sharing

The most basic form of load management, circuit load sharing, allows multiple chargers to operate on the same electrical circuit by distributing the power among them.



How it works

Instead of running individual circuits to each charger, you connect multiple units together in series (called "daisy-chaining") on one shared electrical line installed on the panel. The chargers communicate locally to divide available power among active charging sessions.

Here's a practical example: four chargers share one 40-amp circuit. By electrical code, the maximum rating of this circuit is 80%, therefore 32 amps are actually available. When only one vehicle charges, it receives the full 32 amps—adding about 25-35 miles of range in an hour for a typical electric car. Two cars charging simultaneously? Each gets 16 amps, extending the time to add 20-30 miles to 90 minutes per car. Four cars? Power splits four ways at 8 amps each, requiring about 3 hours to add the same 20-30 miles of range.

The benefits

Serious cost savings over no load management. You'll reduce installation expenses significantly by cutting the number of required circuits, electrical panels, and conduit runs. For a 40-stall installation, this could mean dropping from 40 individual circuits to just 10 shared ones—substantial savings in electrical infrastructure, labor, and materials.

Technology requirements

- → Networked EV charger with an open communication protocol
- → A series of EV chargers installed on a single circuit circuit breaker
- → Basic internet connectivity for monitoring

The trade-offs and limitations

Unpredictable performance. A driver might experience slower charging simply because their neighbor plugged in, even when the rest of the building has abundant spare capacity. You create isolated "islands" of power constraint that can't see or respond to the broader electrical picture.

Limited scalability. Adding chargers means either creating more circuit groups or diluting power further among existing groups.

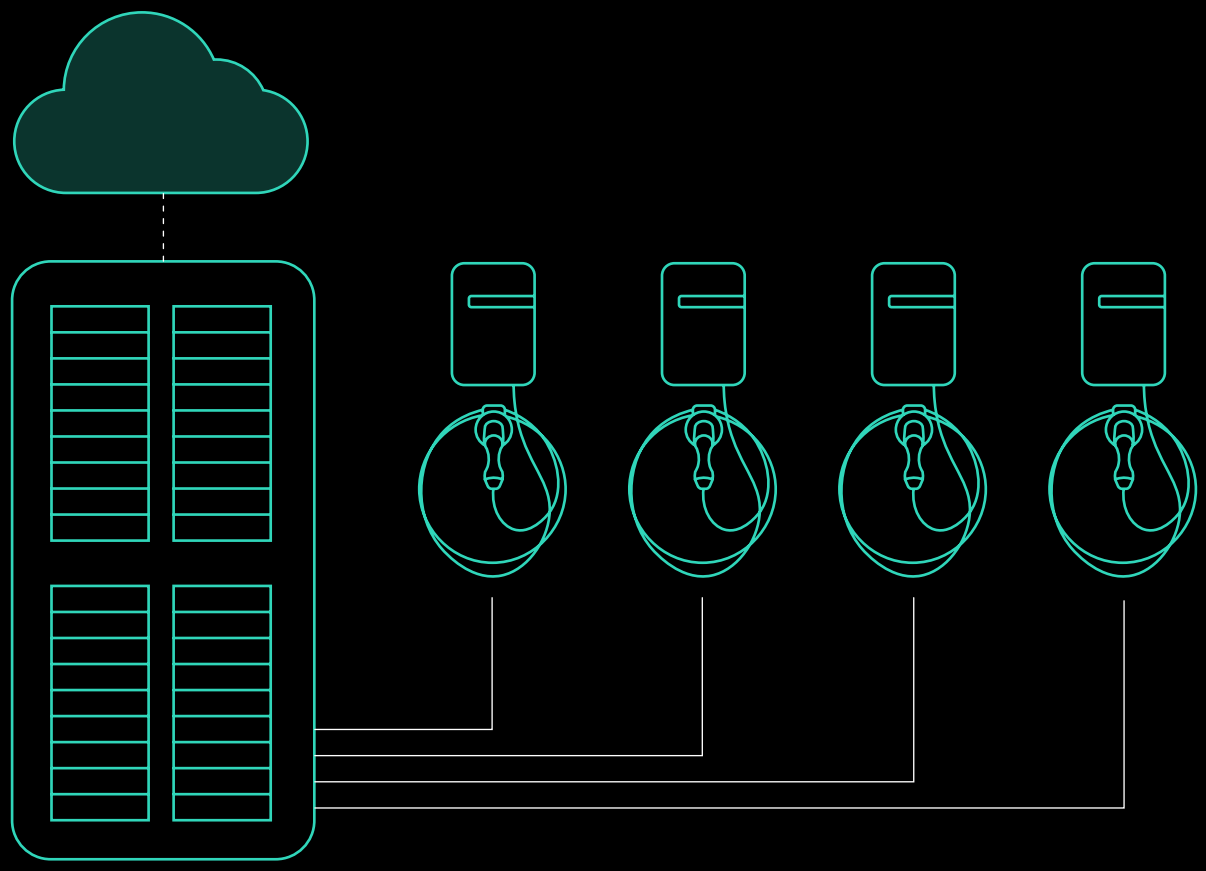
System failures impact multiple chargers. If the primary charger fails, all chargers on that circuit may stop working until repaired.

Best applications

Locations where usage patterns are predictable and infrastructure updates aren't available. Ideal for employee parking where most cars arrive in the morning and have 8+ hours to charge, and multi-family units with EV drivers leaving their car plugged in overnight.

Level 2:
Dedicated circuit with centralized management

This approach combines individual circuits for each charger with intelligent, system-wide control—delivering superior performance and driver experience.



How it works

Every charger connects to its own dedicated circuit, capable of delivering full power when needed. The key difference: a centralized software platform monitors all chargers and the electrical panel's total capacity. This "global brain" makes real-time decisions about power allocation based on system-wide conditions.

Unlike load management within a circuit, this system sees the complete picture. A driver typically receives 30-40 amps (adding 20-30 miles of range in 45-60 minutes) and throttles down as the panel approaches capacity limits. This guarantees a more quality charge experience, and ensures the system stays protected by the overall panel size as more EVs plug in.

Technology requirements

- → Network-connected EV chargers capable of receiving remote commands
- → Centralized load management software platform (cloud-based or on-premises)
- → Dedicated circuits for each charger on the panel
- → Reliable internet connectivity on the chargers for real-time load management

The benefits

Greater performance and fairness. Drivers aren't penalized by random circuit-mates. Power throttling only occurs when the entire system approaches capacity limits, maximizing available power utilization and ensuring more consistent charging experiences.

Scalability. Adding new chargers doesn't create new constraint islands—they integrate seamlessly into the intelligent management system.

System reliability. Individual charger failures don't affect others, and the central system can redistribute load automatically.

The trade-offs

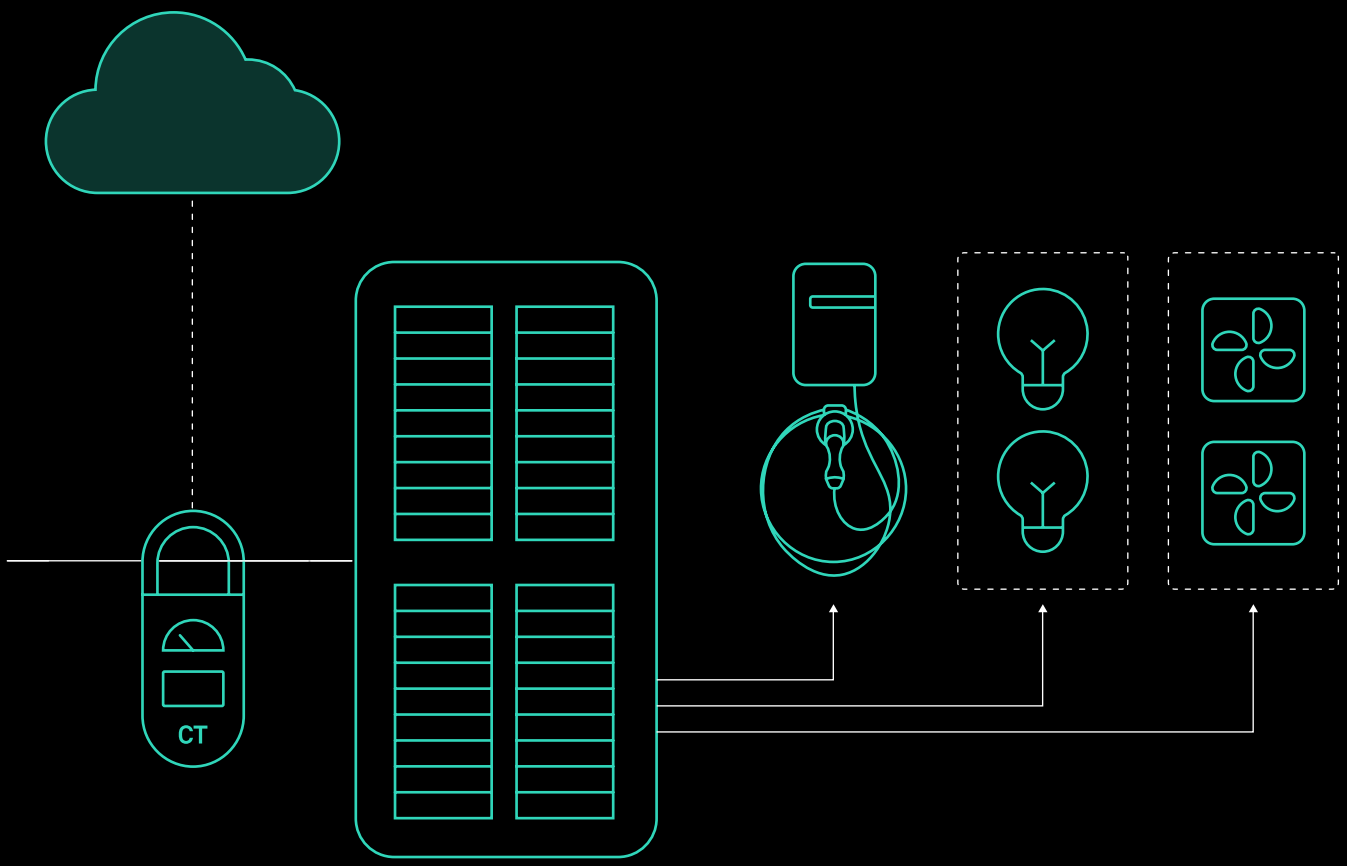
Higher upfront installation costs due to larger transformers/panels, increased conduit and electrical work. However, this cost premium typically pays dividends through better driver satisfaction, easier maintenance, and simpler future expansion.

Best applications

New construction projects where individual circuits are cost-effective to install. Properties prioritizing driver experience and charging reliability. Installations anticipating significant expansion within 5 years. Premium properties marketing superior amenities to tenants.

Level 3:
Panel-integrated dynamic load management

Perfect for retrofitting existing buildings, panel-integrated load management marries EV charging with a building's current electrical infrastructure without requiring major upgrades.



How it works

Current Transformer (CT) clamps—donut-shaped sensors that wrap around electrical wires—monitor real-time power consumption at specific electrical panels. These sensors measure electrical current consumed by the panel, feeding data to the central management system every few seconds.

The sensors actively read non-EV loads and allocate available power to EV charging.

Picture this scenario: a 100-amp electrical panel is used to power HVAC in a building, which typically runs at 40 amps during normal building operations.The management system dedicates the remaining available power to all EV charging, and as the non-EV loads fluctuate throughout the day, the chargers respond accordingly.

On a hot afternoon, when air conditioning consumes more power than usual, the system detects this instantly and temporarily reduces EV charging on active chargers. Later that night, when AC units cycle off, charging power automatically increases when more power becomes available.

The benefits

Maximize existing infrastructure. You can add substantial EV charging capacity to existing electrical panels without major upgrades—installations that would otherwise require significant investment in new panels and utility service work.

Fast deployment. This approach often provides the quickest path to getting chargers operational, addressing immediate tenant or employee demand while you plan longer-term solutions.

Intelligent adaptation. The system learns building patterns and can predict when more power will be available, pre-positioning charging schedules accordingly.

Technology requirements

- → All components from Level 2 (networked chargers and central software)
- → Current Transformer (CT) clamps connected to the network management system
- → Integration with existing electrical panels (requires licensed electrician)
- → More sophisticated software algorithms to balance competing loads

The trade-offs

Charging performance is directly impacted by the building's overall electrical consumption.

During peak demand periods—think summer heat waves or winter cold snaps—available charging power may decrease significantly for extended periods.

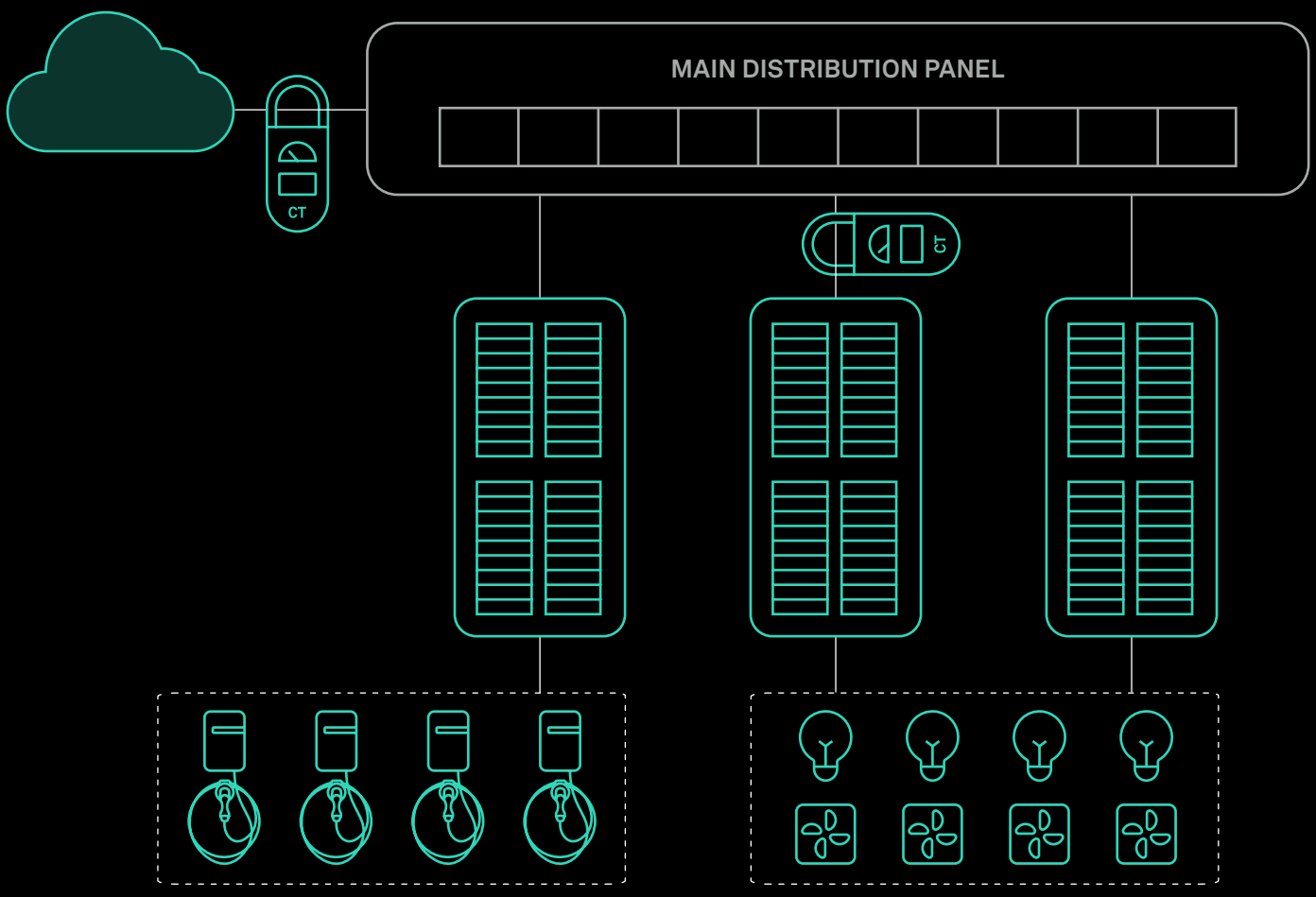
Some installations see 70-80% reduction in charging speeds during extreme weather events lasting several days.

Best applications

Existing buildings where major electrical upgrades aren't feasible. Properties needing operational chargers within 60 days to satisfy immediate demand. Buildings with physical constraints preventing new panel installations. Applications where longer charging times meet user needs.

Level 4:
Whole-Building Integrated Load Management

A whole-building integrated load management approach is the most comprehensive option, providing complete visibility and control over your property's entire energy ecosystem while delivering significant operational cost savings.



How it works

This level expands on Panel-Integrated Management by adding CT clamps to the building's main distribution panel—the primary electrical feed from the electricity grid. Now the management system monitors total building power consumption in real-time, enabling sophisticated "peak shaving" strategies.

Peak shaving means keeping your building's maximum power usage below specific thresholds to avoid utility demand charges. Many commercial properties pay "demand charges"—fees based on their single highest 15-minute power usage peak during each billing cycle, regardless of total monthly consumption.

For example: if your building normally peaks at a certain level but adding EV chargers during maximum air conditioning load pushes you over utility demand thresholds, you could face significantly higher demand charges for the entire month based on that single peak—potentially adding thousands of dollars to your monthly utility bill.

Understanding Utility Demand Charges

Demand charges can represent 30-70% of commercial electricity bills, typically calculated as:

- → **Demand rate:** Varies significantly by utility and region (check your current bill or contact your utility)
- → **Peak measurement:** Your single highest 15-minute average power usage during the billing cycle
- → **Monthly application:** This peak determines your demand charge for the entire month

The impact of unmanaged EV charging: Adding multiple EV charging panels without setting limits on the overall consumption can create new building peaks during unexpected times, potentially triggering higher demand charges for months afterward. The magnitude of this impact depends on your utility's rate structure, your building's existing peak patterns, and the timing of EV charging relative to other building loads.

Level 4 management prevents these costly peaks by temporarily reducing EV charging during critical periods, potentially saving substantial amounts on monthly utility bills.

The benefits

Economic optimization. Properties with high demand charges (typically >$10/kW) see rapid ROI through avoided utility fees. The system actively manages EV charging loads to keep the entire building below predetermined peak thresholds.

Comprehensive energy strategy. This approach integrates EV charging into broader building energy management, opening possibilities for renewable energy integration, battery storage coordination, and utility demand response programs that can generate additional revenue.

Predictive capabilities. Advanced systems learn building patterns and weather correlations, pre-emptively adjusting charging schedules before peak events occur.

Technology Requirements

- → All components from Level 3
- → Additional CT clamps at the main electrical service entrance
- → Advanced integration capabilities with building management systems (BMS)
- → Utility coordination for main service access
- → More sophisticated software with predictive analytics

Performance Management and Optimization

Peak shaving in action: During a hot summer afternoon, the system predicts air conditioning will push building demand near the utility threshold. It automatically reduces EV charging from 40 amps to 15 amps across all chargers, preventing a demand charge spike while maintaining some charging capability.

Off-peak optimization: Late evening and early morning hours often provide maximum charging speeds (35-40 amps) when building loads are minimal and utility rates may be lower.

Seasonal adaptation: The system learns that winter months have different peak patterns than summer, adjusting charging strategies accordingly.

The Trade-offs

This represents the most complex installation, requiring careful coordination between multiple stakeholders—building management, electrical contractors, utility companies, and your EV charging solutions provider.

However, properties with substantial demand charges typically see attractive ROI through operational savings, making this level worth serious consideration for the right applications.

Best applications

Commercial properties with substantial monthly demand charges on utility bills. Buildings implementing comprehensive energy management strategies. Premium properties pursuing best-in-class building systems. Installations where controlling operational expenses is a primary objective.

How to Choose the Right Level of Energy Management

Selecting your approach depends on several key factors: budget constraints, performance requirements, building characteristics, and long-term operational goals. Here's a practical decision framework:

Choose Level 1 (Circuit Load Sharing) when:

- **Budget is the primary constraint.** You need the lowest possible upfront investment
- **Small-scale deployment.** Installing fewer than 15 chargers where usage patterns are predictable
- **Long dwell times.** Employee parking or residential applications where cars park 8+ hours
- **Temporary solution.** You need charging capability now but plan major electrical upgrades within 2-3 years

Choose Level 2 (Dedicated Circuit with Centralized Management) when:

- **Performance matters most.** Driver experience and charging reliability are top priorities for tenant satisfaction
- **New construction.** Installing dedicated circuits is straightforward and cost-effective during initial build-out
- **Growth planning.** You anticipate expanding your charging network significantly within 5 years
- **Premium positioning.** Your property markets itself as offering superior amenities

Choose Level 3 (Panel-Integrated Dynamic Load Management) when:

- **Retrofitting existing buildings.** Major electrical upgrades aren't feasible or would be extremely expensive
- **Speed to market.** You need operational chargers within 60 days to meet immediate demand
- **Infrastructure constraints.** Physical limitations prevent new panel installations
- **Moderate performance requirements.** Acceptable charging times of 1-3 hours for most users

Choose Level 4 (Whole-Building Integrated Load Management) when:

- **High demand charges.** Your utility bills include substantial monthly demand charges (review your bills to determine if this applies)
- **Energy cost optimization.** Controlling operational expenses is a primary objective
- **Comprehensive strategy.** EV charging is part of broader building energy management and sustainability initiatives
- **Premium commercial properties.** You're implementing best-in-class building systems

Planning Your Project: Key Considerations

Moving from theory to a successful real-world installation requires careful planning. While every property is unique, focusing on three key areas—budget, reliability, and rollout—will ensure you build a charging ecosystem that delivers long-term value.

1. Planning Your Budget

Your final project cost will depend heavily on site-specific factors like local labor rates, the distance from your electrical panels to the charging stalls, and the age of your existing infrastructure. To get a clear picture, always seek quotes from multiple qualified installers.

Look beyond the upfront price and evaluate the Total Cost of Ownership (TCO). A system with a higher initial investment, like one capable of Level 4 peak shaving, may offer substantial returns through ongoing operational savings on your utility bills. Weigh the upfront equipment and installation costs against ongoing software fees, maintenance, and potential energy savings to find the true best fit for your financial goals.

2. Understanding System Reliability

System design directly impacts the user experience when issues arise. It's important to understand how different systems typically behave during a failure.

Simpler Level 1 (Circuit Sharing) systems often rely on a single "primary" charger to manage a group. If that primary unit fails, all chargers on that circuit can go offline. In contrast, centrally managed Level 2, 3, and 4 systems are typically more resilient. An individual charger failure won't affect the rest of the network, and if the central management software temporarily loses connection, the chargers usually default to a safe, reduced-capacity operating mode, ensuring drivers can still get a charge.

3. Ensuring a Smooth Rollout

A successful launch goes beyond technology. To ensure a seamless integration for you and your users, focus on two critical steps:

- → **Plan for Permitting:** All electrical work requires permits. Timelines can vary significantly by municipality, so start the process with your electrical contractor as early as possible to avoid delays.
- → **Communicate with Users:** Set clear expectations from day one. Use signage and mobile app notifications to explain how the system works, especially the fact that charging speeds can vary based on building-wide energy use. Proactive communication is the key to high user satisfaction.

By working with a solutions provider who understands these nuances, you can navigate the complexities of installation and build an EV charging amenity that is reliable, cost-effective, and ready for the future.

Electrical load management for smarter EV charging

The electrification of transportation is happening now, and it's happening rapidly. Properties without adequate EV charging infrastructure risk becoming obsolete, while those with intelligent, well-planned systems gain significant competitive advantages and potential cost savings.

The key insight: simply installing chargers without proper load management creates more problems than it solves. Overloaded circuits, frustrated drivers, and skyrocketing infrastructure and operational costs can quickly turn an amenity into a liability.

Smart load management transforms this challenge into opportunity. The right system allows you to:

- → **Deploy more chargers with significantly less infrastructure investment**
- → **Provide reliable charging experiences with high user satisfaction rates**
- → **Control ongoing operational costs, with potential for substantial utility bill savings**
- → **Future-proof your property for continued EV adoption growth without major rewiring**

At SWTCH, we specialize in designing and implementing the optimal energy management solution for your unique situation. By understanding your goals, constraints, and long-term vision, we help you build charging infrastructure that's reliable, cost-effective, and ready for the electric future your tenants and employees expect.

The question isn't whether to electrify—it's how to do it intelligently, economically, and with confidence in your long-term operational success.

Contact us to learn how we can help you deploy load management technology for better, less expensive EV charging today.

Connect with us

Email us today at **sales@swtchenergy.com**
swtchenergy.com