



Charge Management System

Evaluation Guide

A comprehensive guide for fleet operators and their advisors electrifying depots and evaluating charge management systems.

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Introduction

Public transport operators across Europe are electrifying their fleets, and charge management software has become a core part of making that transition work in practice. It determines whether buses are ready to depart on time, how much a depot spends on energy, and how well the charging infrastructure is used day to day.

Establishing effective charge management infrastructure is essential for a successful transition to an electric fleet, and choosing a system warrants a thorough evaluation. This guide is designed to support that evaluation, giving operators a framework for understanding what a Charge Management System (CMS) should deliver and how to assess it.

Tenix is used as an example throughout this guide because our approach reflects what we consider industry-leading practice in charge management. Readers are encouraged to weigh this up independently and decide whether Tenix fits their own needs.

Scope of the Guide

For technical and operational decision makers

This guide is for fleet operators, technical advisors, and consultants evaluating a charge management system for an electrifying bus fleet, at any stage between defining an initial requirement and running an existing deployment.

A practical approach to assessing technology

It addresses the practical questions an evaluation team needs answered during a market process, including how to weigh capabilities and integrations against a depot's operational requirements, how to model the full cost of a platform rather than its list price, and what to expect of a vendor once a contract is signed.

A framework for comparison

We look in detail at CMS capabilities and cost against an electric bus depot's operational needs. We do not address legal or commercial contract terms. Tenix is assessed against this same framework, so the methodology can be seen applied in full before deciding whether to apply it elsewhere.

PART ONE

Procurement Sequencing

The sequencing of a fleet electrification project can impact the quality of the resulting CMS decision. Early recognition of this gives operators the opportunity to structure a process that yields better outcomes for fleet reliability and management of the charging operation as a whole.

The typical sequencing in a depot electrification project puts infrastructure first: grid connection, depot layout, civil works, charger hardware, and vehicles. This makes sense, as physical infrastructure involves the longest lead times and requires early capital commitment. Charger vendors and infrastructure contractors are naturally engaged at this stage.

As a result, the CMS is sometimes considered later in the process and viewed as a component within a broader infrastructure package. By this stage, architecture decisions have already been influenced by vendors engaged during the infrastructure phase, and software evaluation becomes a comparison of what has already been brought to the table by those vendors rather than an open-market assessment.

Specialist software providers, whose platforms are designed specifically for managing and optimising fleet charging operations, may be excluded from the process. Operators who could benefit from their capabilities may remain unaware of available alternatives.

The Advantages of Early CMS Selection

Modelling the charging plan before finalising grid connection size and charger count lets operators right-size infrastructure investment to actual operational need. Vehicles don't all need to charge at once or at maximum power if their departure times are staggered across the day. A CMS that sequences charging against real schedules can meet the same operational requirements with a smaller grid connection and fewer DC fast chargers.

Defining CMS requirements alongside the infrastructure specification means the charging plan directly informs how much grid capacity and how many fast chargers are actually needed. This can meaningfully reduce capital cost, since grid connection upgrades and DC fast chargers are among the largest line items in a depot electrification project.

Bring Specialists into Procurement Structures

Operators should define the CMS specification as its own distinct set of requirements, separate from the charger or managed service package, including the eight core capabilities outlined in Part Three of this guide.

This is what makes right-sizing achievable in practice: the smaller grid connection and reduced charger count only hold up if the CMS requirements behind that plan are clearly defined and carried through, rather than left implicit within a hardware or managed service package.

Specifying these requirements explicitly, including OCPP compliance and multi-brand charger support, gives the operator a clear basis for comparing how different platforms perform against the fleet's needs. A well-specified CMS requirement set is the most effective way to ensure software evaluation aligns with fleet uptime, depot coordination, energy optimisation, and schedule adherence.

KEY TAKEAWAY

Defining CMS requirements before finalising grid connection and charger specifications allows operators to right-size their infrastructure investment and sets a clear foundation for vendor evaluation.

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PART TWO

Defining the Evaluation Criteria

A well-structured CMS evaluation begins with a comprehensive understanding of your operation, before engaging with vendors. Defining requirements in advance enables you to ask relevant questions, prioritise appropriate criteria, and ensure that operational needs guide the evaluation process.

Stakeholders who interact with the system daily, such as depot operations, maintenance, infrastructure, and IT managers, are best positioned to identify requirements that a procurement-led evaluation alone may overlook. Working together with a procurement lead, this team should map the depot environment against three criteria before engaging vendors:

1. INFRASTRUCTURE

Identify the number and brands of chargers at the depot, as well as the OCPP version in use. Assess the presence of both AC and DC charging and document any legacy chargers that predate OCPP support. The charger brand and OCPP version directly influence which CMS platforms can integrate reliably with the existing infrastructure and determine the availability of dynamic functions such as mid-session power adjustment. Evaluate the depot's grid connection capacity and determine whether it has been designed for a fully electrified fleet. Identify any planned grid upgrades, battery storage, or solar integration.

2. FLEET & OPERATIONS

Establish the number of electric vehicles the CMS will manage initially, along with projected fleet sizes for three and five years. Operational scale determines which capabilities are most critical and the value each capability provides. A platform suitable for 30 vehicles may not deliver equivalent performance for a fleet of 500.

Determine whether the fleet comprises uniform or mixed vehicle models, as mixed fleets require the CMS to apply per-vehicle charging logic. Identify the current scheduling system in use and confirm whether the scheduling team can share route and timetable data with the CMS.

3. COMMERCIAL CONTEXT

Confirm whether the operation is governed by a public service contract with reliability KPIs and identify any penalty clauses for missed departures. These provisions define the cost of charging failures and should directly inform the weighting of departure readiness and fault detection in evaluation criteria.

Document any upcoming tender renewals that require charging reliability data. Assess the current energy tariff structure, including demand charges and time-of-use rates. Understanding the tariff in detail before engaging vendors enables more informed questions about the financial outcomes their platform can realistically deliver.

Weighting Your Criteria

Once the depot environment is mapped, translate those constraints into weighted evaluation criteria. Grid limitations, departure patterns, and fleet composition should each carry weight in proportion to how much risk they pose to the operation. Pay particular attention to integration requirements and long-term flexibility, since these influence future contract renewal costs as much as day-to-day performance. A platform that performs well on baseline functionality but falls short on the specific factors that matter most for a depot's operation, such as schedule integration, is unlikely to deliver the same value as one weighted correctly against those priorities.

Testing Through a Structured Demo

A structured demo should be defined by the operator and tested against situations the depot is likely to encounter, such as a charger going offline mid-session, a vehicle reassigned to a different route at short notice, multiple vehicle types requiring different charging targets, or a spike in non-charging power draw during a charging window. Each scenario should be run against the live platform, with the same stakeholders who mapped the depot environment involved, so the scenarios tested reflect how the system will actually be used, and each function has the opportunity to raise concerns before a vendor is selected.

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PART THREE

The Eight Key Capabilities

We have identified eight core capabilities for evaluating a comprehensive CMS. This section details how to assess systems against each capability, including baseline expectations and the characteristics of strong performance. Each capability closes with a table summarising which features to look for and why they matter.

1 Charger Monitoring and Fault Detection

The baseline capability is session-level monitoring, which provides an overview of when a charging session starts, ends, or deviates from expected behaviour.

An advanced system distinguishes between a charger that is online and one delivering the expected power to the vehicle. A charger may appear active but deliver only a fraction of its rated capacity due to cable degradation, connector issues, or firmware anomalies. Systems that monitor only charger status can miss these issues. Robust fault detection identifies partial failures before they affect vehicle readiness.

A comprehensive system identifies repeated charger disconnections within a short period, which may indicate network or power supply instability rather than a one-time outage. It should also detect when a charger rejects a power adjustment from the platform, causing it to charge outside the load management plan without notification. It should recognise connectors cycling between faulted and available states while the charger remains online, suggesting a hardware issue. Finally, it should alert to unrecognised vehicles attempting to charge at depots that share capacity with external users.

Alert design should also be carefully evaluated. If every fault is treated as equally urgent, operators may begin to ignore the alerts. Alerts should be tiered by severity, clearly distinguishing those requiring immediate action from those that can be reviewed later. Determine whether alerts can be delivered by SMS or email, and if routing can be configured by depot, vehicle, or fault type. When an alarm signals a problem without specifying the cause, the depth of diagnostic access determines how quickly the issue is resolved. The system should allow direct inspection of communication between charger and platform, rather than relying solely on alarm text.

The Tenix Approach

In Tenix Charge, alarms are tiered by severity. Errors requiring immediate attention include a charger going offline, a faulted connector, and a vehicle projected to miss its target charge. Warnings cover issues like rejected power profiles and unrecognised vehicles at shared depots. Alarms route by SMS and email to configurable contacts and clear automatically once resolved. The troubleshooting layer exposes the full protocol-level conversation between charger and platform, filterable by charger, connector, time, and message type, with a side-by-side comparison to isolate failing sessions.

What to look for	Why it matters
Session-level monitoring	Tracks every session from start to end
Power-deviation detection	Confirms vehicles receive their allocated power
Connectivity and hardware fault detection	Distinguishes a network or hardware issue from a one-off outage
Charging-control and access anomaly detection	Alerts to a charger operating outside plan, or an unauthorised vehicle
Tiered alarm severity	Ensures urgent faults are acted on before routine ones
Configurable notification routing	Directs each alert to the person able to act on it
Automatic alarm lifecycle	Keeps the alarm list accurate
Protocol-level diagnostics	Provides a clear, evidenced cause for every alarm

2 Load Management

The baseline capability sets a fixed power limit, capping total draw at a safe level to protect the grid connection. However, this limit remains unchanged throughout the day, so it does not optimise use of available power as depot conditions change.

An advanced system adjusts in real time, responding to vehicle movements, changes in equipment usage, and shifts in available capacity. It considers all power loads, including non-charging uses like workshop equipment or vehicle washing, to provide a complete view of depot power consumption. When a high-power device reduces available charging capacity, the system redistributes the remaining power among vehicles, even across chargers from different manufacturers, as most depots use mixed hardware.

Real-time control also manages peak demand, which is billed separately and can significantly impact a large depot's energy costs. Systems that only cap maximum draw prevent demand spikes but do not reduce overall peaks. More advanced systems distribute charging over the entire available window, lowering peak demand while ensuring all vehicles are charged on time. If battery storage or solar generation is available, using these resources during high-demand periods further reduces peaks without altering the charging schedule.

Several features distinguish effective load management systems from those that only enforce a cap. Confirm that the platform uses both a working limit for optimisation and a hard ceiling that is never exceeded, ensuring these functions do not conflict. Verify that limits can be set for specific groups of chargers, such as individual panels or feeders, to protect particular infrastructure components. Also, make sure that if server connectivity is lost, chargers continue to operate safely at a locally configured limit rather than shutting down or defaulting to an unsafe state.

The Tenix Approach

Load and peak demand are managed dynamically across all OCPP-compliant chargers, using a configurable soft cap alongside a hard fuse limit, with support for grouping chargers to protect specific panels or feeders independently. If server connectivity is lost, chargers default to the power limit set locally on the charger.

What to look for	Why it matters
Dynamic load balancing	Uses available power fully as conditions change
Non-charging load awareness	Captures the depot's true power draw
Multi-brand compatibility	Keeps load management consistent across mixed hardware
Dual power limits	Protects the grid connection without wasting available capacity
Sub-depot grouping	Protects individual panels and feeders directly
Peak shaving	Lowers demand charges without cutting energy delivered
Fail-safe offline behaviour	Keeps chargers running safely if connectivity drops

3 Energy Price Optimisation

Energy prices change throughout the day, and charging at the cheapest times lowers fleet operating costs. The baseline is manually shifting charging to known lower-cost periods.

A strong capability connects to day-ahead energy pricing data automatically and builds it directly into the charging plan, without anyone needing to update it by hand. It works from three inputs: the hourly day-ahead electricity price for the depot's local market zone, each vehicle's allowed charging window, and its target state of charge at the end of that window, placing charging in the cheapest hours that still deliver the target on time.

The width of the charging window is the single largest lever here. A vehicle with a real deadline of 05:00 but a configured window ending at 22:00 loses access to the cheapest hours of the night, since those fall after the window closes, even though the vehicle doesn't need to be ready until early morning. The system should support wide windows and, ideally, set them automatically from live departure data rather than a manual default. The tighter the link between real schedule data and the charging window, the more of the day's price curve you can optimise against.

Prices and planned charging should be shown together, so you can confirm cheap hours are actually being used. Cost savings should be automatically balanced against departure readiness, so a lower price never comes at the cost of a vehicle missing its shift, and a manual override should exist for a departure at risk. Costs and savings should also be reported over time, so savings are visible and can be used to calculate return on investment.

The Tenix Approach

Day-ahead energy pricing data is integrated directly into each vehicle's charging plan, placing charging in the cheapest hours within its window while keeping departure readiness the deciding constraint. The Scheduler view shows hourly prices alongside planned charging blocks, and a manual override remains available for at-risk departures. A cost savings report quantifies savings in both cost and peak load reduction over a selected period, and can be exported for customer or contract reporting.

What to look for	Why it matters
Day-ahead price integration	Updates charging plans automatically as prices change
Tariff-aware optimisation	Delivers the target charge from the cheapest hours available
Live schedule-driven windows	Widens the hours available to find the lowest price
Price and plan visualisation	Shows whether the plan is actually using the cheapest hours
Readiness-first cost balancing	Puts departure readiness ahead of cost when the two conflict
Manual override	Forces a vehicle to full readiness regardless of price
Cost and savings report	Makes the savings visible over time

4 Scheduling and Prioritisation

Typically, vehicles are plugged in for charging as soon as they return to the depot, but the CMS only knows which departure a specific vehicle needs to be ready for once it's assigned to a route, often just two to four hours ahead. Until that point, charging can't be prioritised against a real deadline.

An effective system connects directly to the scheduling platform, using real-time route, timetable, state of charge, and delay or route change data to automatically create and update charging plans. Systems that rely on manual departure times cannot adapt quickly, while live-connected solutions adjust automatically as conditions change.

If a vehicle requires cabin or battery preconditioning before departure, this process should be coordinated with the charging plan. Independent preconditioning can result in under-charged vehicles or unnecessary energy use. The most advanced systems enable direct, real-time status exchange between the vehicle and platform, using standards such as VDV 261, so both preconditioning and charging align with the same departure data.

Target state of charge and charging windows can be set for each vehicle and adjusted by day of the week, reflecting varying duty patterns. The system should provide a live fleet readiness view, grouping vehicles by charge state so at-risk vehicles are easily identified. Verify that vehicles without live schedule data default to a sensible, pre-configured setting rather than remaining unmanaged.

The Tenix Approach

Tenix integrates with all major scheduling platforms to receive real-time timetable and vehicle assignment data, and rebuilds charging plans automatically in response to schedule changes. Where a vehicle supports VDV 261, Tenix exchanges departure time, target state of charge, and preconditioning mode directly with the vehicle over its own connection, so preconditioning and charging run against the same schedule data. A live fleet readiness view groups vehicles by charge state in real time, and vehicles without live schedule data for the day fall back to manual charging preferences configured per vehicle or depot-wide.

What to look for	Why it matters
Live scheduling integration	Feeds real route and timetable data into the charging plan automatically
Dynamic plan updates	Rebuilds the charging plan the moment a departure time changes, without manual re-entry
Preconditioning coordination (VDV 261)	Prevents a vehicle departing under-charged because preconditioning ran independently
Per-vehicle and day-of-week charging preferences	Matches charging targets to duty patterns that differ across the week
Fleet readiness view	Highlights an at-risk vehicle before its departure time, not after
Manual fallback preferences	Keeps a vehicle managed even without live schedule data

5 Battery Health Monitoring & Optimisation

The baseline capability is state-of-charge (SoC) visibility, showing how full each vehicle's battery is at a given moment. SoC reflects current charge level, not battery condition, so it says nothing about degradation over time.

A more advanced system tracks battery state of health (SoH). Even with a 100% SoC, a bus may lack sufficient capacity if the battery is degraded. SoH provides a more comprehensive assessment than SoC alone. With battery replacement costs between 80,000 and 120,000 euros per bus, monitoring SoH offers significant financial incentive.

Advanced CMS systems are able to derive SoH from charging data, without extra sensors or vehicle integration. Because individual charging sessions vary, long-term trends over several months are essential for identifying vehicles that require attention. Operators should ask each vendor how its SoH figures are validated and how it separates real degradation from normal variation between sessions.

The system should use SoH data to inform actions, not just display it. Charging vehicles only to the level required for their next assignment, rather than to full capacity, reduces battery stress and extends lifespan. Vehicles that fall below a set SoH threshold should be flagged automatically, enabling timely reassignment, replacement planning, or warranty claims before operational issues arise.

A strong capability also allows charging data to be shared with dedicated battery analytics platforms, where operators need degradation analysis or diagnostics beyond what session-derived SoH can provide.

The Tenix Approach

Tenix monitors SoH for each vehicle, building per-vehicle trends from charging data over time. Using AI-based SoC targeting, the platform can charge vehicles to the minimum state of charge needed for their next assignment and flags those below a configurable SoH threshold. This approach provides depot managers with timely information to reassign vehicles, plan replacements, or initiate warranty claims before reliability is affected.

What to look for	Why it matters
State-of-charge visibility	Shows how much charge each vehicle has available in real time
Charging-data derived SoH	Tracks real battery capacity with no extra sensors or vehicle integration needed
Trend-based SoH	Distinguishes real degradation from normal variation between charging sessions
Charge-to-route targeting	Reduces battery stress by charging only to what the assigned route requires
SoH threshold alerting	Flags a degrading vehicle before it fails to complete a route
Fleet-level battery reporting	Gives visibility into which vehicles will need replacement and when

6 Depot Management

The baseline requirement is to know which vehicles are in the depot. Operators also need precise information on each vehicle's location, status, and whether it is parked in an authorised area. This capability covers depot visibility and control as it relates to charging, for example, vehicle location, and parking enforcement tied to the charging schedule. It is not a substitute for a dedicated depot or yard management system, which typically covers a wider scope, including non-electric fleet operations, maintenance scheduling, and driver dispatch. Operators already running such a system should evaluate how well a CMS's depot features complement it, covered further in Part Four.

An advanced system offers a live graphical map of the depot, matching each vehicle to its parking or charging bay using geofencing and telemetry. Charge state and connection status are displayed directly on the map, eliminating the need for manual checks or radio calls by providing all information on a single screen.

Assess whether the system supports enforcement, not just visibility. This includes defining parking rules by vehicle type and time window, validating correct parking, and flagging violations, such as a diesel vehicle in an EV-only zone. Confirm that drivers are notified of their assigned spot upon return, which helps prevent delays during shift changes. These features are especially important in larger or high-turnover depots, where manual coordination is less effective and misparked vehicles are more costly.

The Tenix Approach

Tenix provides real-time mapping of the depot, matching vehicles to parking and charging bays using geofencing and telemetry. The map displays charge state, connection status, and vehicle type. Selecting a vehicle reveals details such as state of charge and current charging session. Parking rules can be set by vehicle type, time window, and spot, with violations flagged automatically and drivers notified of their assigned spot upon return.

What to look for	Why it matters
Real-time depot map	Shows every vehicle's position, charge state, and connection status
Geofenced bay matching	Confirms which vehicle is at which bay without manual checks
Vehicle detail on demand	Gives full session and charge detail for any vehicle
Colour-coded status indicators	Shows fault conditions and low charge visually
Parking rules and assignment	Defines which vehicle types are permitted where, and when
Violation detection and driver notification	Prevents a vehicle from occupying the wrong spot at shift change

7 Energy Management

The baseline capability treats the grid connection as a single fixed limit that charging must not exceed.

An advanced capability accounts for every source and consumer of power at the depot, providing real-time visibility of power distribution across the grid connection, chargers, non-charging consumers, and on-site battery storage. This approach identifies loads that a static configuration may overlook. For example, if a power group is rated at 250 kW but the feeder meter reads 350 kW, there is additional consumption outside the configured scope. A system that monitors only its own chargers will not detect this discrepancy.

Confirm that available charging capacity adjusts based on real-time measurements, with a secure fallback if live data is unavailable. Check that the system raises an alarm when measured load approaches the grid connection or substation limit, so staff can act before a breach occurs. Ensure the system supports multiple grid connection points, as larger depots often require this, and that on-site battery storage appears in the same real-time overview as the rest of the depot's power flows.

Idle capacity during the day, when the fleet is on route, should be utilised. Verify that the system can automatically open selected chargers to external vehicle groups using identifiers such as RFID or vehicle IDs, with unrecognised vehicles denied by default. Ensure each charger's access can be configured independently as open, fleet-only, or restricted to approved groups, and that external charging sessions are recorded separately from fleet sessions, so billing and reporting stay accurate without a separate invoicing system.

Energy management also extends to participating in flexibility markets, where a depot's charging load can be offered back to the grid operator for demand response or balancing services. This is covered in more detail as an integration type in Part Four, since the practical value depends heavily on the local market structure and the platform's connection to it.

The Tenix Approach

Tenix connects to the depot's energy management system to give operators real-time visibility of power flow across the grid connection, chargers, non-charging consumers, and on-site battery storage. It identifies loads outside the configured parameters by comparing allocated power with measured consumption, and raises alarms when measured load approaches substation limits. Charging capacity adjusts automatically based on live measurements, supports multiple grid connection points, and falls back to a secure configured limit if a metering feed is lost. Depot Sharing lets operators open selected chargers to external vehicle groups using RFID or vehicle identifiers, with independent access settings per charger and separate recording of external sessions that can be exported monthly for billing.

What to look for	Why it matters
Live power flow visualisation	Shows where power is going across the grid connection, chargers, storage and other consumers
Grid limit alarms	Alerts staff before measured load breaches the connection limit
Multi-connection support	Manages depots with more than one grid connection point
Battery storage visibility	Brings on-site storage into the same live-power picture
Depot sharing	Turns idle daytime charging capacity into a revenue source
Charger-level access control	Sets each charger to open, fleet only, or restricted access
External sessions log and export	Keeps external billing separate from the fleet's own charging costs
Flexibility market participation	Earns revenue or reduces costs by offering charging load for demand response or grid balancing services

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Reporting and Analytics

The baseline capability includes session logs and basic uptime metrics. Operators also require actionable reports on charging costs and savings, charger reliability, and battery health, delivered in exportable formats suitable for integration with internal systems.

How uptime is defined, and whether it is reported separately from utilisation, is a common source of confusion. Utilisation reflects the time a charger actively delivers energy, which is typically low for overnight depots. Uptime measures the period a charger is connected and reporting to the platform. Reporting these figures separately prevents misinterpretation, as low utilisation can otherwise be mistaken for connectivity issues.

The level of detail behind summary figures matters. Reports that break down costs by depot, charger, or vehicle are more actionable than those showing only monthly totals. Alarms should be reported with sufficient context, including severity, type, and charger, to support maintenance prioritisation.

Environmental reporting, quantifying CO₂ savings from electrification, is increasingly required for ESG disclosures and tender submissions. Battery health reporting extends the per-vehicle SoH trends covered earlier into a fleet-wide view, so degradation patterns and replacement planning can be assessed at a glance rather than vehicle by vehicle.

Operators should be able to export operational data in standard formats for independent use, not just view it within the platform. For operators running multiple depots, reporting should also work across sites, not just within one. A platform that consolidates performance data into a single comparative view lets operators identify which depots are underperforming on cost, uptime, or battery health, rather than reviewing each depot's reports in isolation.

The Tenix Approach

Tenix offers exportable reports covering sessions, cost and energy, uptime and utilisation, alarms, battery health, and environmental impact, each broken down to depot, charger, or vehicle level. Utilisation and uptime are reported separately, and alarms are categorised by severity, type, and charger. Operators retain full data ownership and export access, with a unified view across sites for multi-depot fleets.

What to look for	Why it matters
Sessions log	Gives full cost and energy detail for each session
Power, energy and cost reporting	Tracks average and peak power and estimated cost over any period
Separate utilisation and uptime metrics	Distinguishes low activity from connectivity problems
Alarm log with severity and context	Ranks faults by severity, type, and charger for maintenance planning
Environmental reporting	Supplies CO ₂ figures needed for ESG and tender reporting
Battery health reporting	Extends the per-vehicle SoH detail to a fleet-wide view
Cross-site reporting	Compares performance across depots in one place
Standard-format exports	Ensures data is usable outside the platform

KEY TAKEAWAY

A CMS's real value is delivered through its advanced capabilities: fault detection, dynamic load management, price optimisation, live scheduling integration, battery health monitoring, depot management, energy management, and detailed reporting. Assessing a platform against these eight areas gives operators a clear, practical picture of what it can deliver for their fleet.

4

PART FOUR

Integration: Key Evaluation Criteria

The quality and flexibility of integration is a primary determinant of the practical value of a CMS and is an area with significant variation among vendors. This section outlines the three most critical integration types, and describes the characteristics of robust integration for each.

The Three Critical Integration Types

1. CHARGER HARDWARE - OCPP Integration

The Open Charge Point Protocol (OCPP) is the industry standard for communication between charging hardware and software. Compliance with OCPP is a baseline requirement for any CMS, and credible vendors will confirm it. What matters more in practice is how well that compliance actually holds up once a charger is running in daily use.

OCPP has several versions, including 1.6, 2.0, and 2.0.1, and charger manufacturers implement them with varying degrees of completeness. Basic commands, like starting and stopping a charging session, are generally supported everywhere. More advanced functions are a different story. Adjusting charging limits mid-session, for example, which dynamic load management depends on, is supported inconsistently across charger brands. Compatibility can also shift over time, since a firmware update on a charger can quietly change how it behaves under OCPP.

Real compatibility is proven through a documented track record of running a specific charger and CMS combination in live operation, not just in testing. A platform that has operated a charger brand in production over an extended period, and can show how it's kept working as firmware has changed, offers real evidence of compatibility rather than an assumption based on lab testing alone.

The Tenix Approach

Tenix maintains production deployments across more than 30 charger brands and all OCPP versions. A dedicated engineering team looks after the integration layer, keeping it compatible as charger firmware updates. New charger brands are validated against the complete Tenix feature set before being designated as supported, and mid-session power adjustment is tested individually for each hardware brand in production, with any limitations documented transparently.

2. ROUTE SCHEDULING - VDV 463 Integration

Route scheduling integration lets a CMS build charging plans around actual operational commitments. Of all the integration types, this one has the most direct effect on day-to-day value, and the quality of it varies the most between platforms.

A route scheduling integration supplies the CMS with route assignments, depot origins, and departure times. How this data reaches the CMS makes a real difference. In basic implementations, someone uploads a departure file manually once a day. Advanced systems connect through a live API instead, so charging plans update automatically whenever a vehicle assignment changes, without anyone needing to intervene.

This difference matters most when something changes at short notice, a vehicle running late, an emergency substitution, or a schedule change from the transport authority. A manual or file-based integration is likely to be out of date in these moments, while a live integration adjusts the charging plan on its own. Identify who is responsible for keeping the integration working over time, since scheduling platforms update their own systems periodically, and a live connection needs to be maintained on both sides to keep functioning correctly.

The Tenix Approach

In Tenix Charge, scheduling integrations are API-based, using VDC 463 for data from an ITCS and dedicated connections to scheduling systems. The platform maintains a live model of vehicle route assignments and automatically rebuilds charging plans in response to schedule changes. The integration team ensures ongoing compatibility with the scheduler through regular platform updates.

3. VEHICLE TELEMATICS

Telematics integration gives the CMS direct access to vehicle state information, including location, SoC, schedule adherence, route information, and battery data, rather than relying only on charger-reported data. This data can come either directly from the Bus Original Equipment Manufacturer (OEM) or through a gateway onboard the vehicle.

How much value this adds depends on how open the vehicle manufacturer's data platform is. OEMs vary significantly in how accessible their telematics data is, so the practical benefit differs from one vehicle brand to another.

Where telematics integration is available, it enhances battery health monitoring and departure readiness prediction. Where it isn't, the CMS relies on charger-reported SoC instead, which is generally sufficient for charge management purposes.

Additional Integration Types to Evaluate

Vehicle Preconditioning with VDV 261

VDV 261 governs the communication of data between scheduling systems and vehicles, including departure times that trigger cabin and battery preconditioning ahead of service. A CMS with VDV 261 integration coordinates preconditioning with the charging schedule, ensuring that cabin heating or cooling is factored into the vehicle's departure readiness calculation. Without this integration, preconditioning and charging operate independently, which can result in vehicles departing with insufficient SoC. The value of the VDV 261 integration depends on whether it has a track record in production, which vehicle brands it supports, and how directly preconditioning demand is factored into charging calculations.

Energy Market Integration

The financial value of a CMS is significantly influenced by its ability to connect to energy pricing data and, where applicable, participate in flexibility markets. This depends on whether the system connects to live or day-ahead pricing APIs for the relevant market, which flexibility options are available for a given depot setup, and how reliably those connections are maintained as market structures evolve.

Yard and Depot Management System Integration

This is distinct from the native depot visibility covered earlier in this guide. A dedicated yard or depot management system typically governs the full site, including non-electric vehicles, maintenance bays, and driver dispatch, not charging-specific coordination alone. In larger depot environments, a CMS may need to integrate with this kind of system to receive slot allocation, parking assignments, and movement scheduling. This determines whether the CMS has reliable, real-time information about which vehicle is connected to which charger, a prerequisite for accurate per-vehicle charging plans. This depends on the CMS receiving slot and connection data from the yard or depot management system, and handling conflicts between planned and actual vehicle positions correctly.

KEY TAKEAWAY

Integration depth decides how much of a CMS's capability reaches daily operations. Ask each vendor for production evidence that your chargers, scheduling system and vehicle data sources are already standard integrations on the platform.

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PART FIVE

Total Cost of Ownership

Software licensing costs are the most visible and most frequently compared aspect of a CMS evaluation. However, licensing fees alone don't tell the full story. A complete view of total cost of ownership also depends on setup costs, how complete the platform is out of the box, and how it performs operationally over time.

Three Cost Categories to Model

1. CAPITAL AND SETUP

The initial costs associated with deploying a CMS extend beyond the licensing fee. Costs for onboarding and staff training vary depending on the complexity of the depot environment and the level of integration required. Operators should obtain a full breakdown of these costs from each vendor before signing, since some expenses may be folded into the headline fee, making later costs harder to predict. In managed service contracts, setup costs are often bundled, which can simplify initial planning but may obscure the cost of individual components.

2. ONGOING SOFTWARE COSTS

Ongoing software costs include licensing fees, support contracts, platform updates, and any per-session or per-vehicle charges. For managed services, this also includes the service management margin built into the monthly fee. Operators should request a full breakdown of what the recurring fee covers and what's excluded. It's also worth checking introductory pricing carefully: some vendors offer extended free or discounted trial periods, followed by a higher subscription fee once the trial ends. Understanding the full commercial terms from the point standard pricing applies, not from the start of the trial, gives a clearer view of the real ongoing cost.

3. PRODUCT COMPLETENESS

Not all CMS products fully address the operational requirements of complex fleet deployments. Some platforms need customisation for specific use cases, while others are still in active development. These factors carry cost implications that are often underestimated during evaluation, including customisation expenses and longer implementation periods.

Where a required integration, such as a particular scheduling system, telematics platform, or back-office system, is not already a proven, standard connection, the vendor typically scopes and prices it as custom work, quoted according to its complexity and sitting outside the standard implementation timeline. Operators should establish, before signing, whether the integrations they need are already standard for the platform or would require custom development, since the latter adds both cost and time that a headline licensing fee will not reflect.

During vendor evaluation, identify which capabilities are available as standard, and which require development. Platforms that meet core requirements, including integration requirements, without customisation carry lower delivery risk and more predictable implementation timelines and costs.

Understanding the Full Value Picture

Beyond these three categories, several other factors shape what a CMS actually costs to run over its contract life: how well it optimises energy costs, how it protects battery health, how much flexibility it preserves for future changes, how much manual effort it demands from depot staff, and whether the integrations required are standard or custom. These outcomes vary by platform and by depot, so operators are best placed to assess them directly with each vendor, based on their own tariff structure, fleet profile, integration requirements, and operational priorities, rather than relying on the subscription fee as a stand-in for the full cost picture.

A Depot-Level Example

Independent modelling for a European bus operator demonstrates how these categories apply at the depot level. Analysis of metered consumption, spot prices, and network tariffs from two depots with 40 and 55 buses over one month showed combined energy savings of 10 to 20 percent of the total energy bill. These savings resulted from shifting charging to cheaper price windows and reducing peak demand, rather than lowering overall energy use.

27%	of charging fell within the cheapest price hours before optimisation
~33%	of installed grid capacity was in use at peak demand
10–20%	reduction in total energy bill from timing and coordination alone

Most of the savings came from when charging happened, not from using less energy overall. This distinction matters when comparing vendor claims. A platform that reduces total energy consumption is solving a different problem than one that shifts consumption into cheaper hours or reduces peak draw. Both can lower a depot’s energy bill, but they depend on different underlying capabilities, tariff-aware scheduling in one case, load management in the other, and a depot with a flat energy tariff will see little benefit from price optimisation regardless of how well it’s implemented.

Modelling Your Own Depot

Building a credible TCO model starts with the same inputs used in the example above. Metered consumption data, ideally covering at least one month, provides an accurate view of the depot’s charging patterns. This data identifies charging during high-cost periods and highlights opportunities to shift usage.

The tariff structure, including time-of-use rates, demand charges, and network fees, determines the potential value of price optimisation and peak shaving. Depots with flat tariffs benefit less from shifting charging times, while those with high peak-hour rates may achieve significant savings.

Comparing installed and measured capacity reveals how much of the depot’s contracted grid capacity is utilised. A significant gap often indicates oversized infrastructure and presents an opportunity to adjust future grid connections or charger quantities based on actual demand.

Requesting Vendor-Specific Savings Models

After collecting these inputs, request that each vendor model savings using the depot’s actual data, not simple estimates. If a vendor cannot provide this or relies on headline figures without a clear methodology, consider this a concern during evaluation. The methodology is as important as the savings figure. Savings from shifting load to cheaper hours differ from those achieved by reducing peak demand, and a credible model should clearly separate these categories.

KEY TAKEAWAY

Total cost of ownership should be modelled for each depot rather than assumed from a generic percentage. Actual savings depend on tariff structure, current charging patterns, and the available capacity margin, all of which can vary significantly even between depots operated by the same company.

For a full business justification calculation, [download our free ebook](#).

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PART SIX

Deployment and Operation

Once a strong CMS is selected, deployment should be managed so that go-live is well-paced, staff are properly onboarded, and monitoring is set up in line with depot requirements. This section covers what to look for in deployment methodology, onboarding, and system monitoring.

Deployment

A robust deployment methodology uses staged phases, with each stage delivering a verifiable outcome before the next begins. Staging helps identify issues early, when they are less costly to address. For example, confirming charger firmware compliance on a specification sheet is not equivalent to verifying it live against the platform. Treating these as a single step risks uncovering incompatibilities during go-live instead of earlier, when they could be resolved without delaying the launch.

Multi-depot rollouts demonstrate whether a vendor has truly productised its deployment process. If the first and twentieth depots require the same time and effort, the vendor is repeating manual work instead of reusing a proven configuration. A mature methodology uses the first depot as a template, enabling faster integration and configuration for subsequent sites. Vendors should be able to provide evidence of this approach from previous rollouts, rather than relying on unverified claims.

It is important to verify the handling of historical operational data, as it is often overlooked until it is missing. Battery health trending relies on months of charging history. If legacy data is not migrated during cutover, this trend resets to zero, erasing valuable insights that operators may not realise are lost until they are needed.

Accountability for delivery should be explicit. Assigning a named individual to each deployment gives the operator a single point of responsibility from onboarding through to live operation. This is especially valuable when issues arise mid-rollout and prompt decisions are required.

The Tenix Approach

Tenix uses a staged process for each depot, verifying charger connectivity live before go-live instead of relying solely on vendor specifications. A named account contact is accountable for each deployment. Historical data from previous systems is migrated during onboarding, not discarded at cutover. The first depot in a multi-site rollout establishes the integration pattern, which is then reused to reduce delivery timelines for subsequent depots.

Onboarding

An effective programme aligns with the platform's permission structure. For example, dispatchers are trained on their specific tasks, rather than receiving the same material as administrators with system-wide access. Permission-blind training results in staff who have seen the entire platform but lack confidence in the workflows relevant to their roles. This often leads to hesitation or workarounds during live operations, rather than during training when issues are easier to address.

Timing is as important as content. If training occurs after go-live, staff must learn the system in a production environment, where mistakes can impact real vehicle readiness. Training should be completed before live operations begin.

For operators expanding across multiple depots or countries, the training delivery model can become a constraint. Programmes requiring vendor presence at each site limit rollout speed to the vendor's availability. A train-the-trainer model allows internal staff to onboard new depots independently. Confirming local-language delivery is also important, as training in only one language can exclude staff at sites where that language is not used, often revealing gaps only when issues arise.

Post-training support is also important. Staff turnover is common, and documentation that is not regularly updated becomes less accurate as the platform evolves. This can lead new employees to rely on vendor support for questions that should be addressed in documentation. Maintaining up-to-date, role-specific documentation helps reduce this dependency over time.

The Tenix Approach

Tenix provides modular, role-based training before go-live, covering navigation, daily operations, smart charging, alerts and troubleshooting, and reporting. Each user is trained on their specific workflows rather than the entire platform. The train-the-trainer model supports multi-depot and multi-country rollouts without requiring vendor presence at every site. Training is available in eight languages, and role-based documentation is maintained for ongoing reference after go-live.

System Monitoring

System monitoring levels should be configured, and not set by default. Making every event visible to all users creates unmanageable alert volumes, while insufficient monitoring can allow faults to go unnoticed until operations are disrupted. Effective monitoring requires alignment with three factors: the intended audience, the organisational structure, and the operation's maturity.

Role alignment is essential because dispatchers and engineers require different information from the same data. Dispatchers need a clear answer on vehicle readiness, not raw protocol events. Engineers, however, need detailed event data to investigate faults. If a platform provides the same view to all users, it forces one group to ignore irrelevant information or leaves another without necessary detail.

Organisational scope is equally important, especially for operators managing multiple depots or countries. Alerts not properly targeted can overwhelm local staff with irrelevant notifications or prevent group functions from identifying cross-site issues due to siloed data. Implementing a true organisational hierarchy with appropriately scoped permissions and alerts prevents both problems.

Operational maturity is often overlooked. In the first year of electrification, a depot needs alerts for potential grid connection breaches. After five years, monitoring should focus on energy pricing or grid participation, as basic fault alerts are already established. Forcing all capabilities from the start adds unnecessary complexity. Monitoring should be able to evolve with operational needs.

Another important consideration is keeping raw protocol-level data separate from standard operational reports. Including every OCPP message in routine reports can obscure actionable items for operators with unnecessary technical detail intended for engineers.

The Tenix Approach

In Tenix Charge, permissions are assigned individually, not by fixed tiers. Roles such as dispatcher, partner, or administrator are defined by specific capabilities and scoped to the relevant company or depot, ensuring users see only what they need. Alarms are routed by role and channel, and dispatchers receive a fleet-wide readiness view without checking each vehicle. Reporting can be consolidated across depots while maintaining local views. Protocol-level diagnostic data is held in the troubleshooting layer for engineers, separate from standard operational reports.



PART SEVEN

An Assessment of Tenix

This section applies the framework outlined in this guide directly to Tenix, addressing strengths, the requirements it places on operators to achieve optimal results, and the types of operations for which it is best suited.

What Tenix Does Well

DEPOT AWARE CHARGING

Tenix is a charge operations platform that extends into the depot, with live parking visibility, and depot-wide power monitoring. It is brand agnostic, and compatible with all OCPP-compliant chargers. Schedule- and tariff-aware charging is integrated as standard.

END-TO-END INTEGRATION

Tenix has live API integrations with the most commonly used scheduling platforms across European markets. Charging plans rebuild in real time when the schedule changes, allowing depot teams to manage by exception rather than through constant manual oversight.

EVERY DELAY RISK ALERTED

Tenix keeps every vehicle ready to depart on schedule. The platform monitors each charging session, detects potential issues before they impact readiness, and alerts depot teams in time to intervene. Alerts can be customised by depot, fault type, and severity.

FAST ONBOARDING

For depots with OCPP-compliant chargers, Tenix enables operational monitoring and load management within 24 hours of connection, with no hardware installation dependencies.

TRANSPARENT PRICING

Tenix is priced as a recurring licence per vehicle or connector, with one-off fees for setup and any non-standard integrations.

ONGOING SUPPORT

Tenix assigns a named account contact to every deployment. That contact is responsible for onboarding, the optimisation period in the first 90 days, and ongoing platform support. Response times and availability are defined in the SLA at contract execution.

Which Operations Tenix is Best Suited to

Tenix provides the greatest value to operators managing large-scale or expanding fleets, overseeing multiple charger brands, operating under public service contracts with stringent reliability requirements, or encountering significant grid constraints.

What Tenix Requires from Operators

OCPP-compliant chargers

Tenix's capabilities depend on chargers implementing OCPP, and advanced functions such as mid-session power adjustment are tested and confirmed per hardware brand. Legacy chargers that predate OCPP support, or chargers with incomplete OCPP implementations, will operate with reduced functionality until upgraded or replaced.

Scheduling system access

The full value of live scheduling integration, energy price optimisation working from real departure times, dynamic charging plans, fleet readiness visibility, depends on the operator's scheduling platform exposing route and timetable data through

an API. Where a scheduling system only supports manual file uploads, charging plans update less frequently and lose accuracy around short-notice changes.

Depot and fleet readiness

Onboarding runs fastest when depot layout, charger inventory, and vehicle assignment data are collected and validated in advance. Gaps in this data are the most common source of delay in any CMS deployment, Tenix's included.

Stakeholder availability during onboarding

A named technical contact and depot operations input at each onboarding checkpoint keeps a deployment on schedule. Deployments without a consistent point of contact take longer to configure correctly, regardless of the platform.

Proven at Scale

More than half of Norway's electric buses run on Tenix, our home market and proving ground. Tenix is now expanding rapidly across Europe, with around 2,000 electric buses charging across 120 depots, and a large number of live scheduling, telematics, and charger integrations in production. The platform is proven in the complex, high-demand environments where operational reliability is critical.

Request a demo

This guide recommends a structured demo as the most effective way to test any CMS. It should be defined by the operator, use the depot's typical scenarios, and run on the live platform. Apply this same method to Tenix. Present the scenarios you use for other vendors, such as a charger going offline mid-session, a vehicle reassigned at short notice, or a spike in non-charging power draw, and request a demo to see how Tenix Charge handles them.

Book a demo at tenix.eu