3 Use Cases for Electric Port Terminals

2026

This report from **Ampcontrol** explores how port terminals leverage solar, batteries, and EV charging to electrify their equipment. Similar can be applied for drayage, logistics, and distribution centers.

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Executive Summary: Orchestrating the Electrified Port

Ampcontrol partners with global port operators to navigate the dual challenges of large-scale electrification and grid volatility. As ports transition to terminal tractors, straddle carriers, and shore-power systems powered by electricity, the traditional separation between maritime operations and energy management becomes unsustainable. Operational uptime now depends entirely on energy availability.

To address this, Ampcontrol provides an integrated orchestration layer that synchronises fleet logistics with grid constraints. We have identified three mission-critical use cases that represent the cornerstone of a modern, electrified port. This document explores the following three exemplary scenarios:

Use Case 1: Infrastructure Deferral – Reduce expensive grid upgrades by up to 40% and eliminate €2M+ in annual peak demand charges by bridging the 5-year utility infrastructure gap with BESS.

Use Case 2: Achieve a 60% reduction in charging hardware CAPEX (from 12 to 5 stations) by automating the "Continuous Rotation" charging strategy for 3-shift productivity.

Use Case 3: Energy Independence via Microgrid Orchestration – Seamlessly integrating onsite solar generation and storage to increase self-consumption and insulate the port from volatile energy markets.

Through these solutions, Ampcontrol transforms energy from an operational bottleneck into a strategic asset, ensuring that decarbonization targets are met without compromising port throughput.

We welcome the opportunity to model a customised value proposition for your specific port constraints. Please contact us to schedule a brief follow-up and discuss a path to realising these savings.

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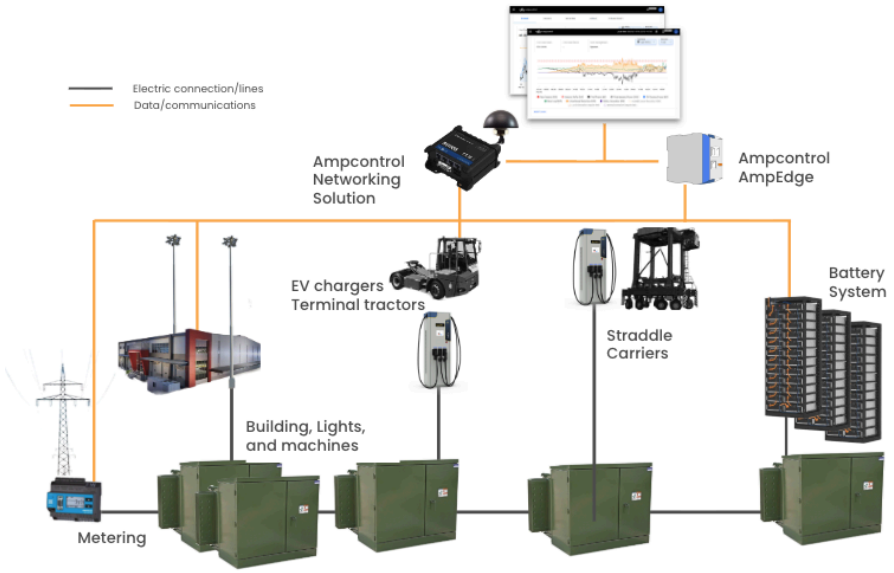
Use Case 1: Integrating Battery Energy Storage Systems (BESS)

Problem Statement

The Port is currently executing a multi-year electrification roadmap, targeting an 80% electrified operational footprint by 2040. While current peak demand is 20 MW, the simultaneous deployment of high-power shore power and heavy-duty mobile equipment is forecast to triple this demand.

This transition faces two critical bottlenecks: financial volatility and infrastructure lag. Current peak demand charges and capacity penalties already exceed **€2M annually**, driven by a highly volatile load profile featuring two distinct daily "spikes." Compounding this, the local utility has confirmed a 5-year delay in interconnecting additional capacity due to upstream grid congestion. This "infrastructure gap" threatens to stall the Port's decarbonization targets and inflate operational expenditures (OPEX) through punitive over-limit fees.

Ampcontrol Solution



Exemplary integration of AmpEdge controller to energy assets

To bridge the 5-year grid delay and limit additional grid costs, Ampcontrol provides an intelligent **Energy Management System (EMS)** to orchestrate the port's microgrid.

The AmpEdge onsite controller serves as the central "brain", integrating energy meters, BESS, building systems, and charging infrastructure via industry-standard protocols.

Capabilities:

- **Active Peak Shaving:** Ampcontrol monitors the port's volatile load profile in real-time, charging the BESS during operational troughs and discharging during busy periods to reduce peak power consumption.
- **Dynamic Asset Orchestration:** The system manages multiple charge/discharge cycles daily, balancing high-power vehicle charging and shore power demands against fixed grid constraints.

Key Value

The Ampcontrol-managed BESS allows the port to **downsize expensive grid upgrades**, reducing required new capacity by up to 40%. Beyond peak shaving, the system unlocks **"Value Stacking"** by synchronising charging with Day-Ahead market pricing or Power Purchase Agreements (PPAs). This enables the port to shift heavy loads to low-cost windows, turning the battery into a tool for both infrastructure bypass and energy arbitrage.

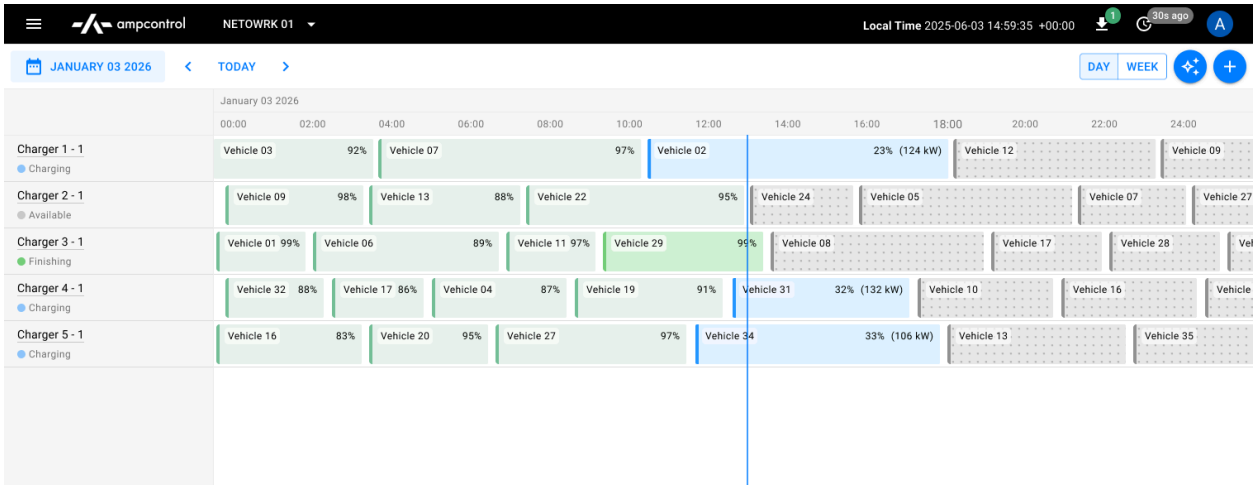
Use Case 2: Implementing Smart Charging Strategies

Problem Statement

The Port is transitioning its terminal tractor fleet to electric power, aiming to maximise **3-shift uptime** while minimising infrastructure CAPEX. The Port has adopted a **"Continuous Rotation"** strategy—maintaining 5 vehicles on high-power chargers while the remainder of the fleet operates in the field.

However, manual coordination of this rotation is unsustainable. Synchronising charging schedules with real-time **State-of-Charge (SoC)** and shift changes creates immense operational pressure on dispatchers and risks "deadheading" (power depletion) during peak hours. Without an automated orchestration layer, the Port faces a high risk of throughput delays and expensive, unmanaged demand spikes.

Ampcontrol Solution



Automated scheduling of rotation charging strategy

Ampcontrol's **Autoscheduler** serves as the central orchestration engine, automatically generating 24–48 hour optimised charging plans. By integrating real-time data from **vehicle telematics, charging hardware, and shift schedules**, the algorithm eliminates the burden of manual planning.

- **Predictive Sequencing:** The Autoscheduler identifies ideal charging windows for each vehicle, ensuring the "5-vehicle rotation" is always synchronised with driver breaks and operational shifts.
- **Grid-Aware Dispatch:** Seamlessly connected to the site's **Energy Management System (EMS)**, the scheduler dynamically adjusts power delivery based on real-time grid availability and site-wide demand.

- **Dynamic Re-optimisation:** If a vehicle returns with a lower-than-expected State-of-Charge (SoC) or a shift is extended, the system automatically re-optimises the plan and alerts operators to any necessary adjustments.
- **Operational Oversight:** Drivers and dispatchers can review and manually override the 48-hour plan at shift start, combining automated efficiency with human-in-the-loop flexibility.

Key Value

The primary value of the **Autoscheduler** is the reduction in capital expenditure. By intelligently rotating vehicles through a high-utilisation cycle, the Port **downsized its infrastructure requirement from 12 charging stations to just 5 fast chargers.** This 60% reduction in hardware, combined with the ability to operate within the existing power ceiling, **entirely eliminated the need for costly and delayed grid upgrades.**

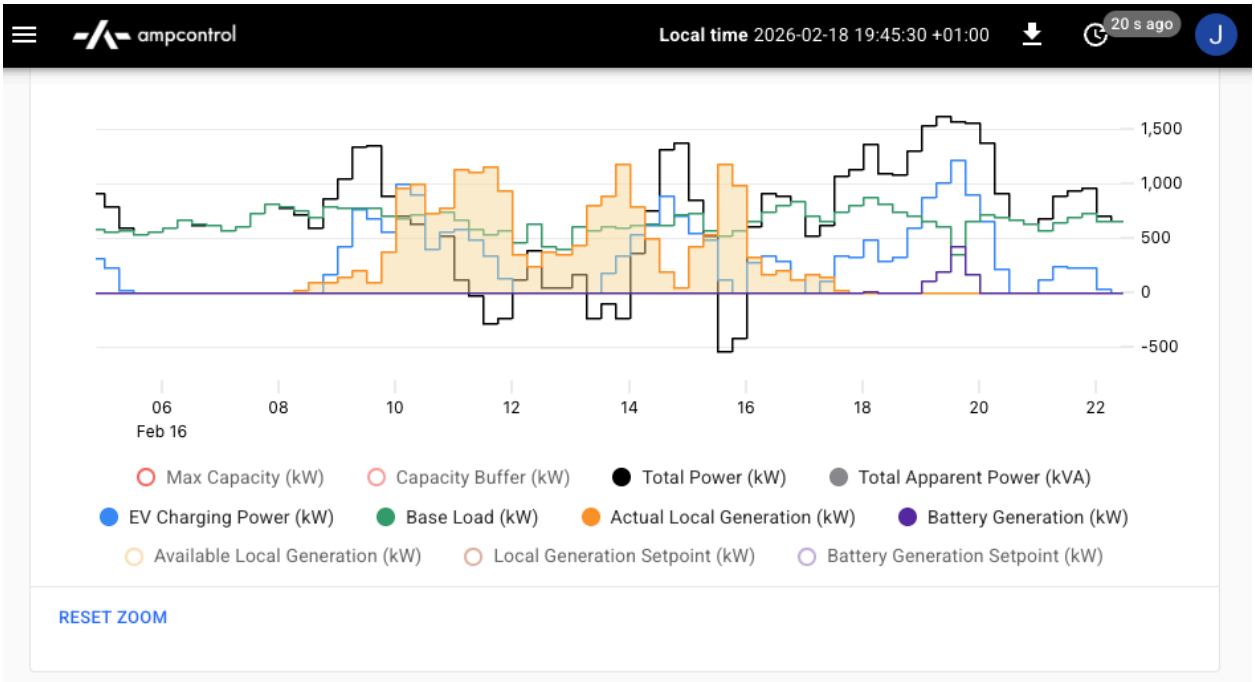
Use Case 3: Integrating Onsite Generation with Microgrids

Problem Statement

The Port has taken its first steps toward energy independence by installing depot charging, solar PV, and a Battery Energy Storage System (BESS). However, these assets operate in "silos," leading to two major inefficiencies:

- **Stranded Capacity:** The BESS currently follows a static schedule (charging in the morning, discharging at night), leaving it unable to respond to real-time operational shifts or weather-dependent solar fluctuations.
- **Non-Linear Demand Spikes:** The convergence of variable solar generation and "spiky" EV charging loads has created new, unpredictable peak demand charges. Without dynamic coordination, the port is paying for grid capacity it could otherwise provide itself.

Ampcontrol Solution



Microgrid optimization of EV chargers, port equipment, battery, and generation

Ampcontrol deployed a unified **Energy Management System (EMS)** to transition the port from static schedules to **predictive orchestration.**

- **Seamless Integration:** The **AmpEdge controller** connects the solar inverters, site meters, BESS, and EV chargers into a single, high-speed control loop.

- **Dynamic Set-Point Logic:** After rigorous validation in Ampcontrol's simulation lab, a custom strategy was enabled to prioritise **Solar Self-Consumption.** The system now "forecasts" midday solar surges and reserves BESS capacity to capture this free energy.
- **Coordinated Dispatch:** The algorithm simultaneously manages three variables: throttling chargers when solar drops, discharging the BESS to "shave" charging peaks, and ensuring vehicles meet their SoC targets.

Key Value

- 30% Increase in Self-Consumption: The port now uses significantly more of its own solar power, reducing reliance on expensive grid imports.
- Peak Elimination: The "Charging-to-Grid" peak has been entirely removed, as the BESS now acts as a buffer that absorbs high-power charging events.
- Operational Resilience: By automating the BESS response to weather and port activity, the operator no longer needs to manually adjust energy settings to avoid utility penalties.

About Ampcontrol

Ampcontrol is a leading provider of energy management and EV charging optimisation solutions, designed to streamline the deployment and operation of charging infrastructure. Its innovative software and hardware solutions cater to diverse requirements, enabling seamless integration, real-time monitoring, and intelligent management of EV charging networks. Ampcontrol's Energy Management system optimises energy usage across diverse sites, accommodating unique port and depot constraints such as transformers, grid connections, energy tariffs, and vehicle departure schedules. The system enables real-time monitoring and optimisation of both chargers and vehicles, integrating seamlessly with OEM telematics systems or third-party telematics devices, requiring no additional hardware installation.

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