



The Benefits of Managed Charging

An Introductory Factsheet

Credit: JUICE on Unsplash

What is Automatic Load Management System (ALMS) Charging?

As more vehicles and fleets transition to electric, buildings often do not have the capacity to simultaneously charge large numbers of electric vehicles (EV). Rather than upgrade a building's electrical systems, which can be impractical and expensive, an automatic load management system (ALMS) manages EV charging to reduce the electrical load, allowing it to be shared among several vehicles.

ALMS monitors the charging rate of electric vehicle supply equipment (EVSE) and dynamically varies it in order to manage a building's total electric load. When there is high electrical demand at the building and/or on the electric grid, ALMS reduces the charging rate of individual EVs to ensure they don't exceed the circuit or building's electrical capacity. When fewer EVs are charging, they can charge at the maximum rate. As more EV charging loads are added, the ALMS can reduce the charging rate for each EV, or turn off charging to specific EVs to reduce the total EV charging load.

ALMS is known by many names; Managed Charging, Active Load Management, Power Management and Load Management are all ways to describe this type of charging.

What are the benefits of ALMS Charging?

Capacity management

ALMS charging allows more chargers to share a building or circuit's given electrical capacity. More EV charging spaces can be installed at a site while lowering the impact on the electricity infrastructure—both on-site and for the grid—reducing the cost to implement EVSE and mitigating expensive upgrades.

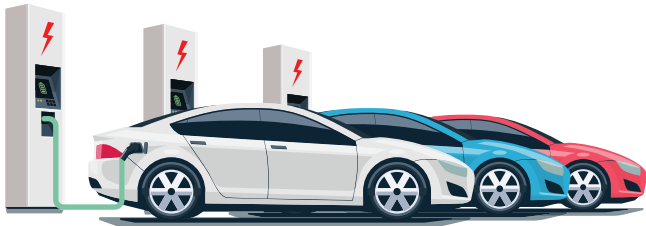


Figure 1. With ALMS each EV gets its own charger.

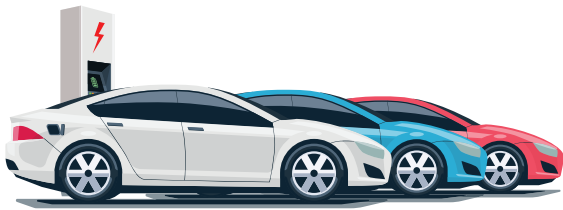


Figure 2. Without ALMS EV owners are forced to share chargers.

Load shaping

Some ALMS technology can also respond to overall building electrical demand or electric grid conditions, decreasing or increasing the EV charging rate based on the availability of renewable energy, cost or grid requirements. This load flexibility can provide value to the building owner by reducing demand charges and encouraging vehicle charging when electric costs are lower. ALMS load shaping also provides value to the grid by adding or subtracting electrical load to lower greenhouse gas emissions, reduce energy generation costs and improve grid stability.

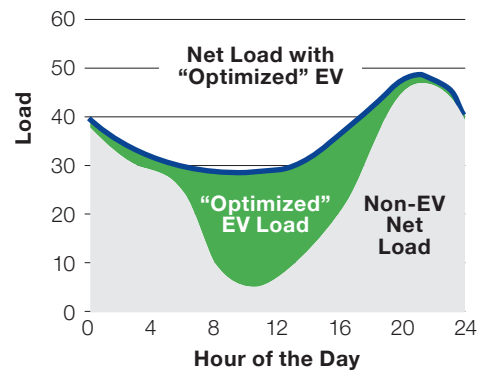


Figure 3. ALMS can shift EV charging to when the grid is greener.



How Does ALMS Charging Work?

ALMS charging can be implemented in different ways:

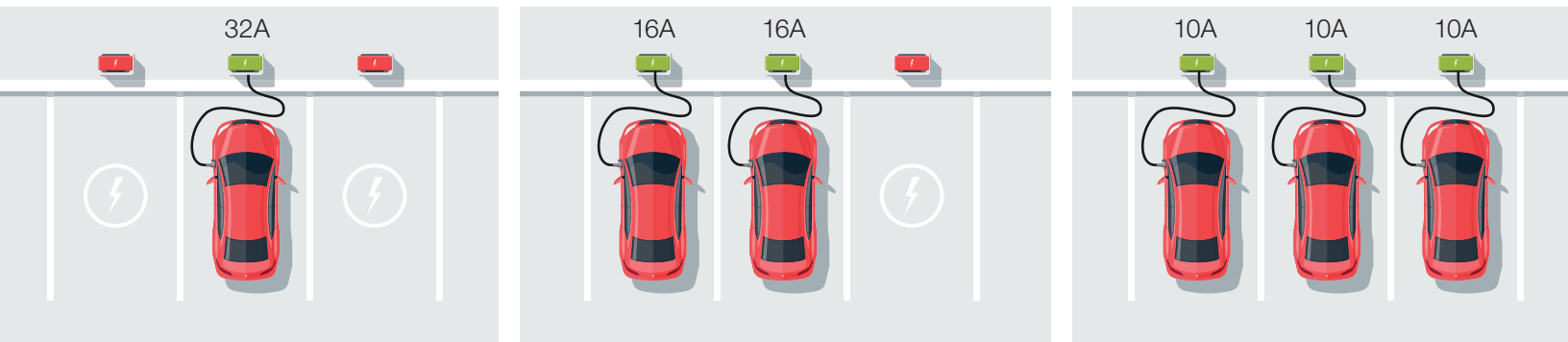


Figure 4. Example of equal capacity splitting ALMS.

Equal Capacity Splitting

Equal Capacity Splitting is based on allocating equal power across all charging stations connected to one branch circuit. For example, Figure 4 shows the case of when one vehicle plugs into a station connected to a 40-amp (40A) circuit, it will draw full power (or 80% of available capacity or 40A i.e., 32A). If an additional vehicle plugs in, both vehicles will receive 16A. If a third vehicle plugs in, the three will charge at 10A. Equal capacity splitting can be installed with charging stations that aren't smart and connected to a network.

Dynamic Capacity Sharing

This type of load management involves managing charging rates and electricity usage at the charging station and/or by an external party at any number of points like the circuit, panel, or transformer. Through monitoring, the ALMS can more efficiently manage power delivery to EVs through various methods. Intelligent load management requires a smart charger that is connected to the internet.

Equally Distributed vs. First In, First Charged

With equally distributed charging, each EV charger will get the same amount of electricity depending on how many cars are being charged. With First In, First Charged—the speed of charging depends on the number of cars charging and the order in which the cars arrived. The first car to plug in would charge at full capacity until full. Equally distributed is a common form of simple load sharing and First In, First Charged is capable with intelligent load management.



A Day in the Life of Five EV Charging Spaces Controlled by ALMS

The chart below shows a hypothetical day in which ALMS helps balance the charging loads at a five-space parking lot.

(Charging times for illustration purposes only)		Current Capacity Allocated to Each Space EVSE advertises max current capacity in amps to vehicle, vehicle takes the current it needs below that maximum					Total Available Panel Capacity (in amps)	
							48	
Time of day	Activity	Space 1	Space 2	Space 3	Space 4	Space 5	Allocated	Unallocated
6:00 AM	Parking lot empty.	Empty	Empty	Empty	Empty	Empty	0	48
7:00 AM	Julie arrives in Space 3 and ALMS offers full current capacity.	Empty	Empty	48	Empty	Empty	48	0
8:00 AM	Fred arrives in Space 5, ALMS splits the current capacity equally.	Empty	Empty	24	Empty	24	48	0
9:00 AM	Jose arrives in Space 2, ALMS splits the current capacity equally.	Empty	16	16	Empty	16	48	0
10:00 AM	Julie's car is getting full in Space 3 and needs less current. ALMS "frees up" some current capacity and splits between the remaining two spaces.	Empty	19	10	Empty	19	48	0
12:00 PM	Tom parks in Space 1, Julie's car full in Space 3, ALMS splits current capacity equally.	16	16	Full ☺	Empty	16	48	0
1:00 PM	Sally parks in Space 4, Fred leaves Space 5, Jose's car is getting full in Space 2.	20	8	Full ☺	20	Empty	48	0
2:00 PM	Jose's car in Space 2 is now full, Tom leaves Space 1, ALMS offers Sally full current capacity in Space 4.	Empty	Full ☺	Full ☺	48	Empty	48	0
3:00 PM	Julie leaves Space 3, Sally's car getting full in Space 4, ALMS "frees up" current capacity.	Empty	Full ☺	Empty	10	Empty	10	38
4:00 PM	Sally's car nearly finished in Space 4, Lucy parks in Space 1, and ALMS offers Lucy remaining current capacity.	40	Full ☺	Empty	8	Empty	48	0
5:00 PM	Sally finished charging in Space 4. Fleet vehicles return filling Space 2,3,5. ALMS delays charging to reduce peak electrical demand and until prioritized sessions complete or 8pm whichever comes first.	48	Delayed per ALMS rule	Delayed per ALMS rules	Full ☺	Delayed per ALMS rule	48	0
6:00 PM	Sally leaves Space 4, Lucy still allocated full capacity for Space 1 per ALMS rule.	48	Delayed per ALMS rule	Delayed per ALMS rules	Empty	Delayed per ALMS rule	48	0
7:00 PM	Lucy's car is getting full and needs less capacity for Space 1. Rules allocate balance to fleet.	6	14	14	Empty	14	48	0
8:00 PM	Lucy leaves Space 1. ALMS splits current capacity evenly after 8pm based on rules. ALMS continues "long dwell" charging overnight for all Spaces.	Empty	16	16	Empty	16	48	0

Table courtesy of 2050 Partners

ALMS Project Spotlight

COMMUNITY
RESOURCE PROJECT
SACRAMENTO, CA

With less than an hour of effort for the utility to provide the required load schedule and no additional hardware, the customer could place their new fleet of EVs into service immediately and avoid an unexpected \$30-\$40k expense.



CRP electric box truck. | Sacramento, CA
Credit: CRP

Community Resource Project (CRP) is a non-profit which provides much-needed services to over 60,000 low-income community members in Sacramento.

CRP bought [nine electric box trucks](#) in 2020 to provide home energy audits, weatherization and HVAC services to low-income residents in an area where air quality is some of the worst in the country

After installing the charging stations and only days before receiving the vehicles, CRP's local utility realized that if all the shuttles were plugged in and charged at certain times of day, it would overload the local transformer and cause a local power outage. Furthermore, a transformer upgrade would cost \$30,000-\$40,000 and take six months to install.

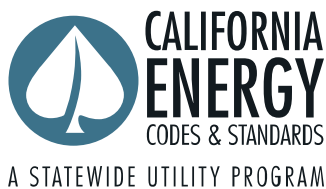
Charging installer OpConnect informed CRP that at no additional cost, the utility could use the load management functionality in OpConnect's platform to schedule the maximum allowable charging load for all customers' chargers. With less than an hour of effort for the utility to provide the required load schedule and no additional hardware, the customer could place their new fleet of EVs into service immediately and avoid an unexpected \$30-\$40k expense.



Resources:

Electric Vehicle Energy Management Systems, May 2019, https://www.csagroup.org/wp-content/uploads/CSA-RR_ElectricVehicle_WebRes.pdf

Chargepoint Power Management FAQ, <https://www.chargepoint.com/products/power-management-faq>



The Codes & Standards program is designed to improve compliance with the state's building and appliance energy codes and standards. The program aims to advance the adoption and effective implementation of energy efficiency measures and building practices to lock in long-term energy and GHG savings to meet California's ZNE, decarbonization and climate goals. The program recognizes that codes and standards are one of the most effective pathways to ensuring sustained market transformation—and that key to making them work well are well-informed industry professionals and consumers.



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