Solutions to power today and tomorrow

Eaton Connected Solutions

Powering Business Worldwide

September 2024

Powerful trends are driving change

Energy needs are changing, increasing and electrifying.

Residential energy storage annual installations by 2027

2.1 GW

EV passenger car sales by 2035

50%+

Forecasted range of EVs on the road in U.S. by 2030

30-42M

Solar estimated electricity generation in US by 2030

30%

Global automotive V2X market worth by 2030

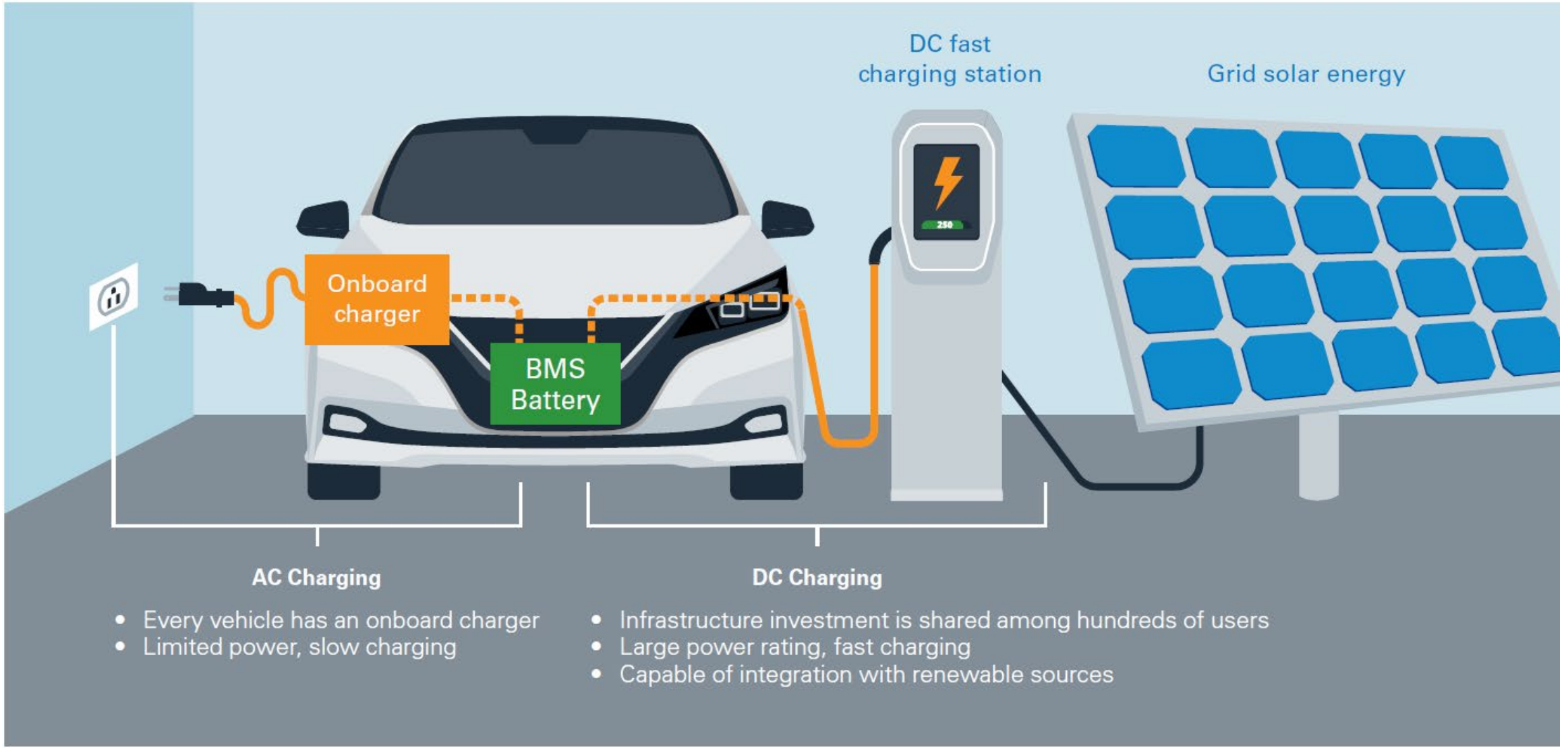
$9.5B

Resources: World Resources Institute, DOE, Clean Energy States Alliance, NREL, Wood Mackenzie

The Basics

- AC vs DC charging
- Connector types
- How long to charge an EV?
- Charger incentives

AC vs DC Charging



Common connector types

J1772 Port (AC)

CCS-1 Port(AC and DC)

CHAdeMO Port (DC)

J3400 / NACS/ Tesla Port (AC and DC)

Eaton to support NACS

The answer is… it depends

- Size of the battery
- Initial state of charge of the battery
- Ambient temperature
- Capacity of the charger
- Charge capability of the EV
- Battery Management System (BMS) is ultimate gate keeper

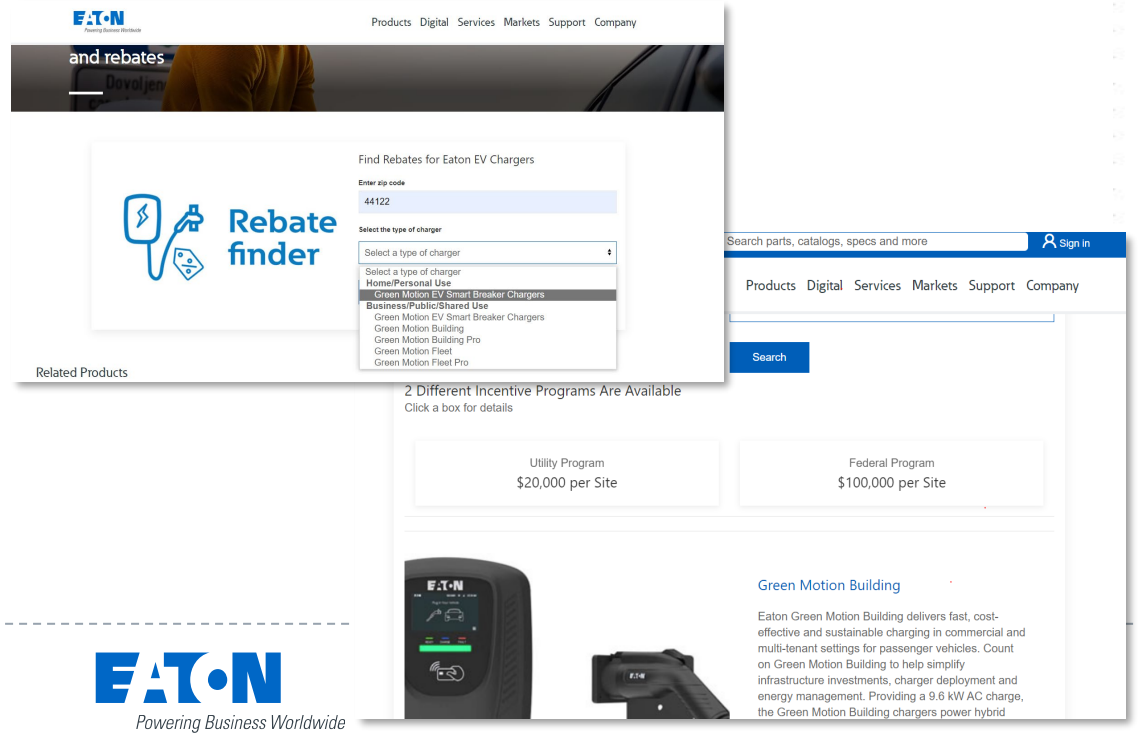
Charging time example chart

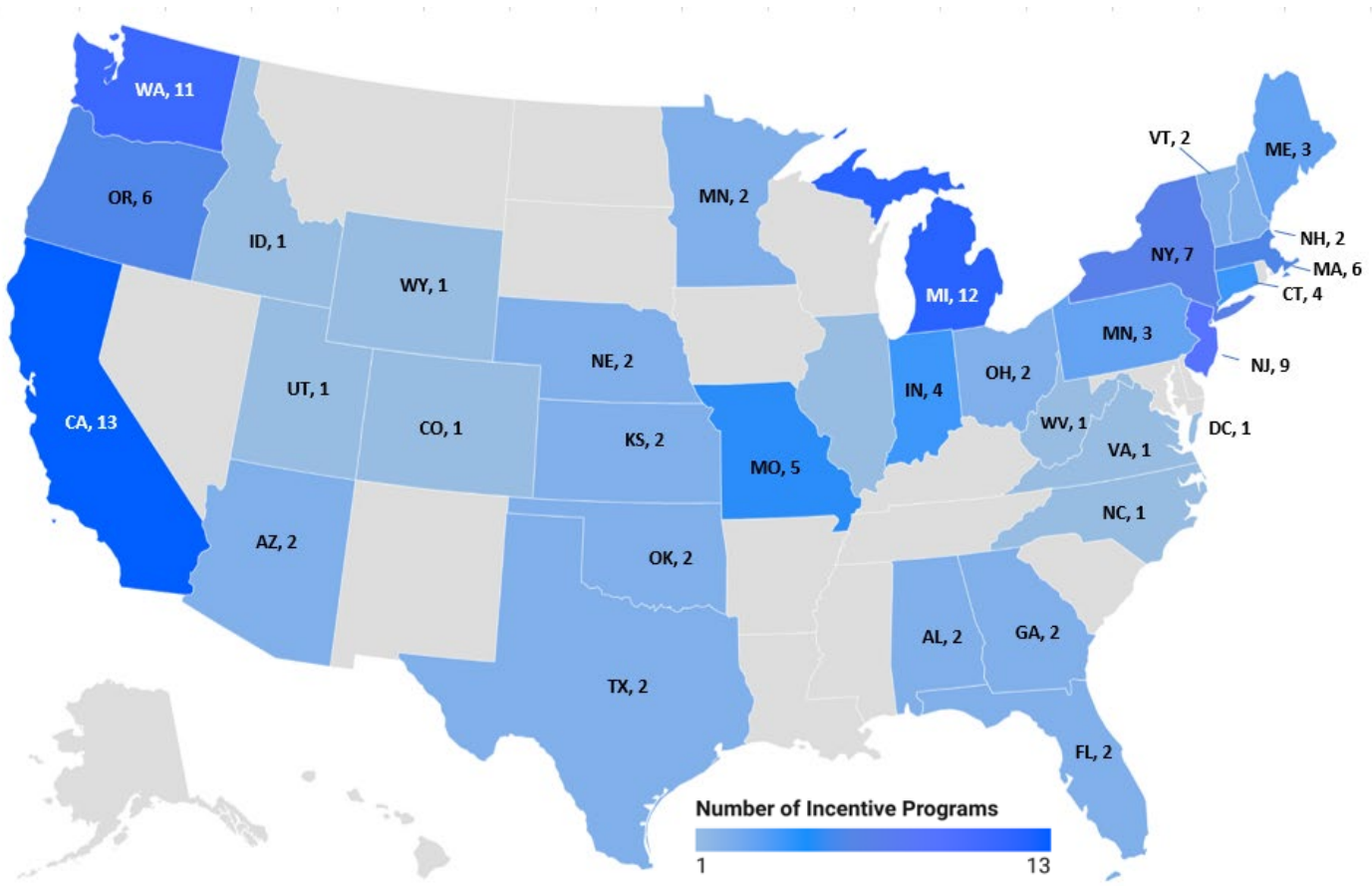
Example assumptions:
90 kWh battery (typically charge 20% to 80%)
Time (h) = 0.6 x 90 kWh / (rating of charger)

Rating of charger	Location	Charger Type	Charger Ampacity	Supply Voltage	80% Charge Time	37 Miles Charge Time***
1.4kW	Home	Level 1	12A	120V 1Ph	38.6 hours	8.8 hours
7.7kW	Home	Level 2	32A	240V 1Ph	7.0 hours	1.6 hours
11.5 kW	Work / Public	Level 2	48A	240V 1Ph	4.7 hours	1.1 hours
19.2 kW	Work / Public	Level 2	80A	240V 1Ph	2.8 hours *	0.6 hours *
50 kW	Public	Fast DC	**	480V 3P	1.0 hours	15 minutes
150 kW	Public	Fast DC	**	480V 3P	21 minutes	5 minutes

* If onboard converter is 11.5 kW then the time will be 4.7 hours
** Varies as charger is rated 400-1000Vdc
*** Assumes EV efficiency of 3 miles / kWh and national average of 37 miles per day

Help customers benefit from local utility programs





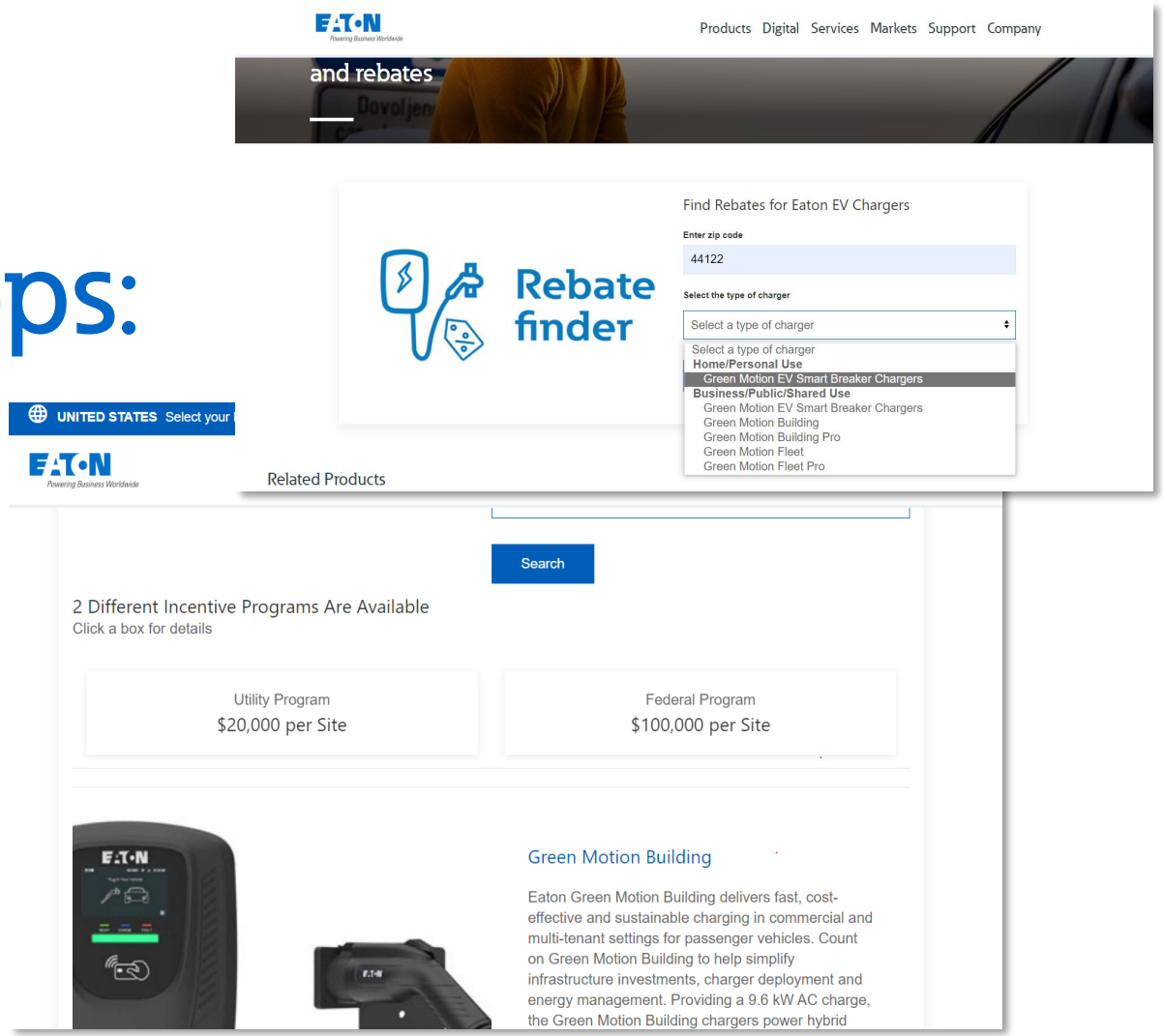
https://www.eaton.com/us/en-us/products/emobility/ev-qualified-programs.html

Find rebates in your region in 3 simple steps:

1) Go to www.eaton.com/rebatefinder
2) Enter the customer's zip code
3) Determine whether the customer is a residential user or a commercial user* and choose a charger.

Now browse rebates!

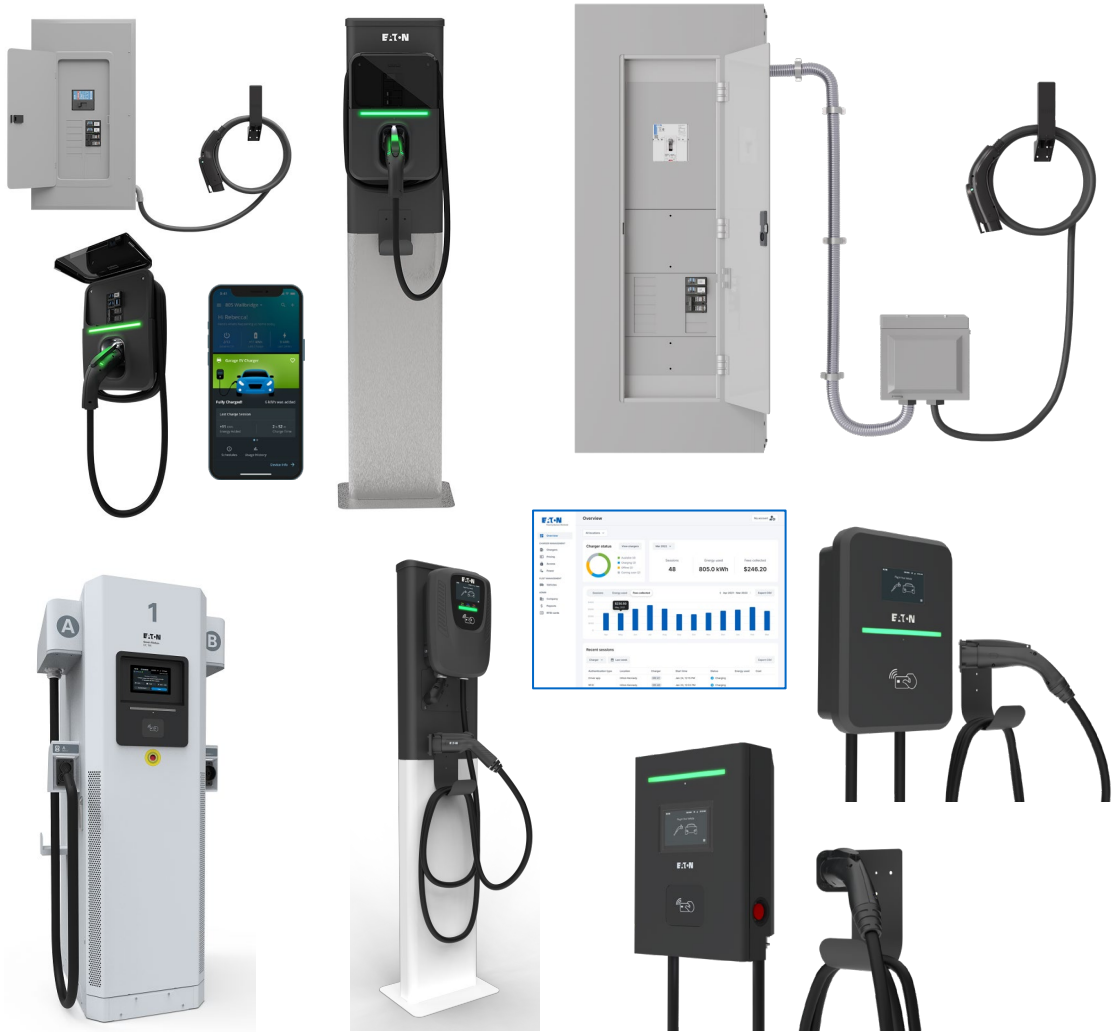
**Commercial use-cases include workplace, multi-families, & public/shared.*



Powering Business Worldwide

Eaton offering

- Overview
- EV Smart Breaker Charger
- Commercial Charging Stations
- Integrated Solutions
- DC Fast Charger
- Software

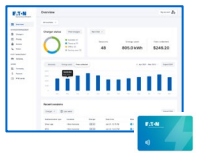


We have launched a comprehensive portfolio of hardware & software









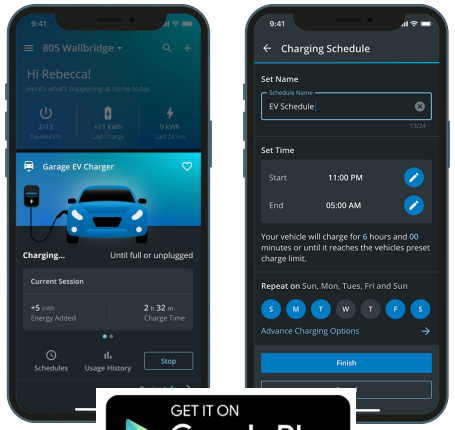
	GM EV smart breaker charger	Green Motion Building & Building Pro	Green Motion Fleet & Fleet Pro	EV charging panel and switchboard	EV charging busway	DC charging	Charging Network Manager
Residential	✓						
Multi-family / workplace	✓	✓		✓			✓
Commercial / destination		✓	✓	✓	✓	✓	✓
Fleet / public			✓		✓	✓	✓

EV charging at home

EV smart breaker chargers (7.7 kw)

Single-family and multi-family applications

- 2-Pole 40A BR & BAB style circuit breaker
- Integrated level 2 AC charging (32A)
- Energy Star Certified
- Open approach through cloud APIs and OCPP
  - OCPP = Open Charge Point Protocol
- Eaton's **Bright layer Home app** let's you schedule charging, track usage and receive notifications
- **Ease of installation** with four out-of-the-box kits



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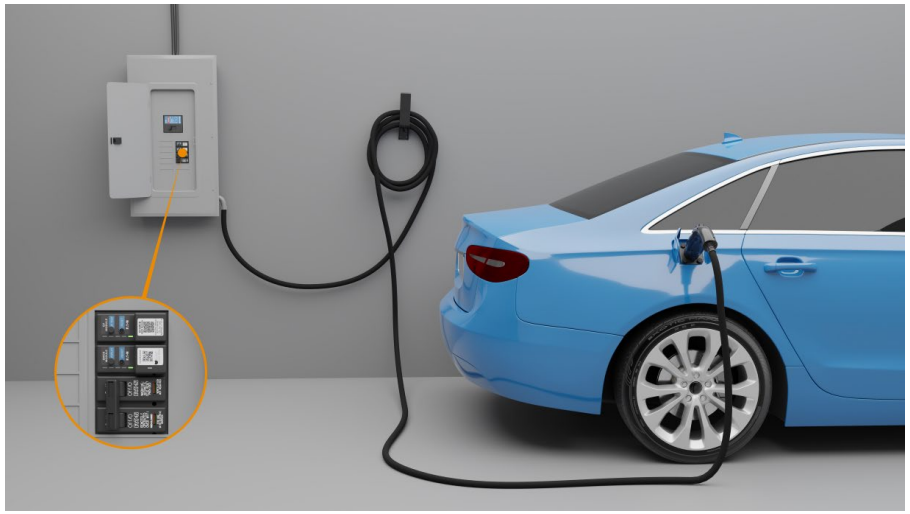
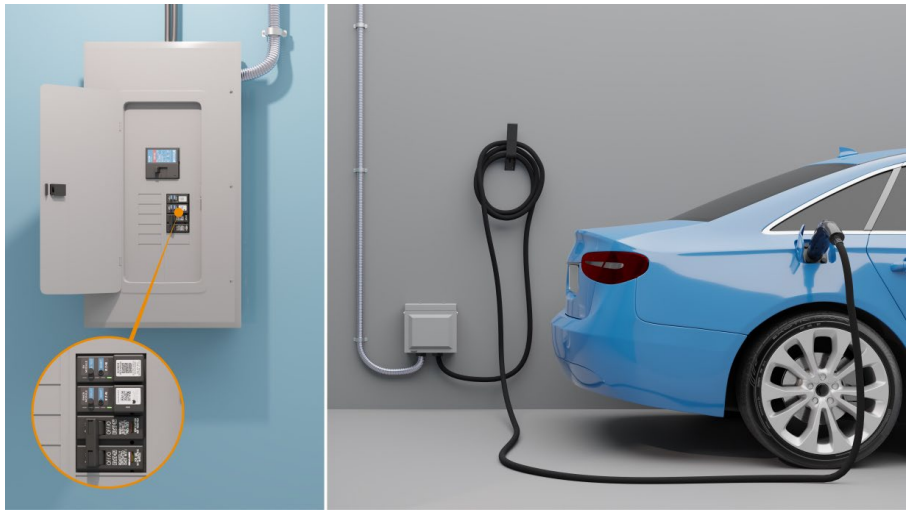
EV Smart Breaker Charger

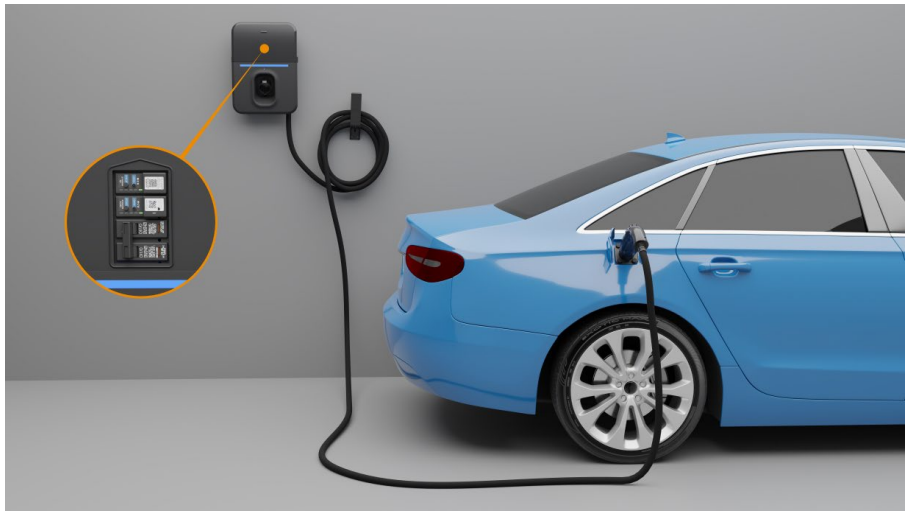


Direct connect kit (GMEVBR32-DC)

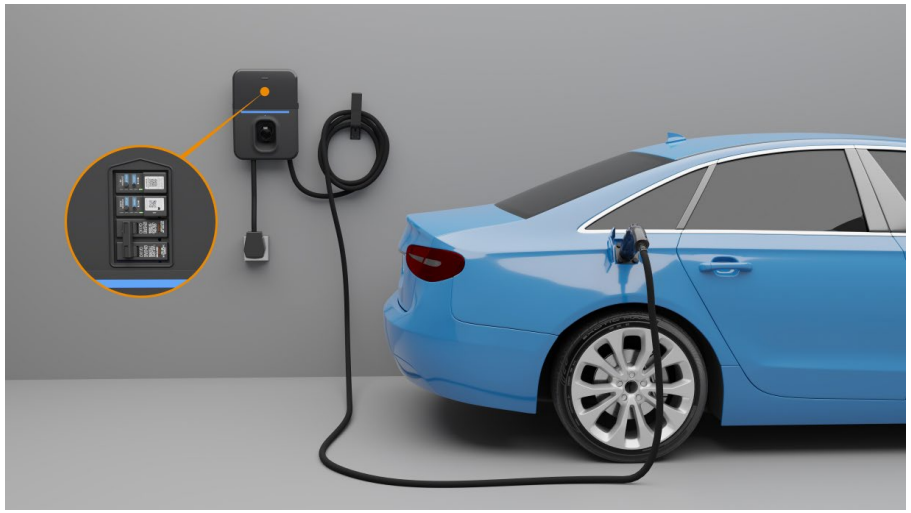


Direct junction box kit (GMEVBR32-JB)

EV Smart Breaker Charger



Wall charger kit (GMEVBR32-WC)



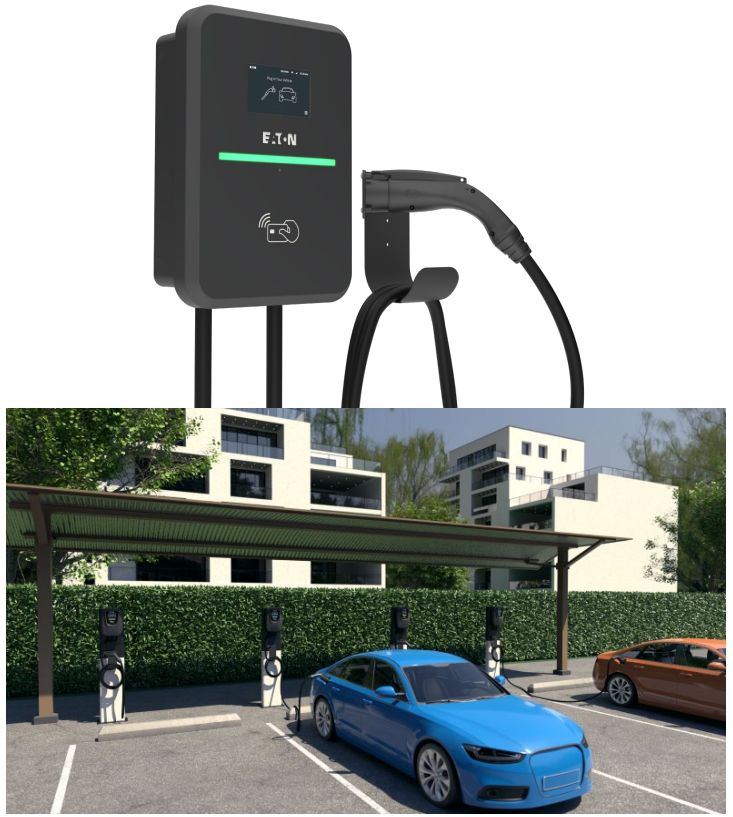
Plug-in Wall charger kit (GMEVBR32-WCPL)

Commercial / workplace charging

Green Motion Building & Building Pro (9.6 & 11.5 kW)

Commercial, work place, and destination applications

- **Display screen**
- **Secure access** for authorized users through QR codes and RFID
- **Pre-programmed to point to the Eaton CNM**
- **Flexible installations** including wall mount, single- or dual-pedestal mount
- **CTEP** certified
- **Connectivity** via Ethernet, Wi-fi, or Cellular (4G LTE)



Fleet / commercial charging

Green Motion Fleet & Fleet Pro (19.2 kW)

Fleet and commercial applications

- **Display screen**
- **Secure access** for authorized users through QR codes and RFID
- **Pre-programmed to point to the Eaton CNM**
- **Flexible installations** including wall mount, single- or dual-pedestal mount
- **CTEP** certified
- **Connectivity** via Ethernet, Wi-fi, or Cellular (4G LTE)

Eaton pedestal

- Single or dual mount
- Universal for all Eaton AC chargers
- Powder coated stainless steel

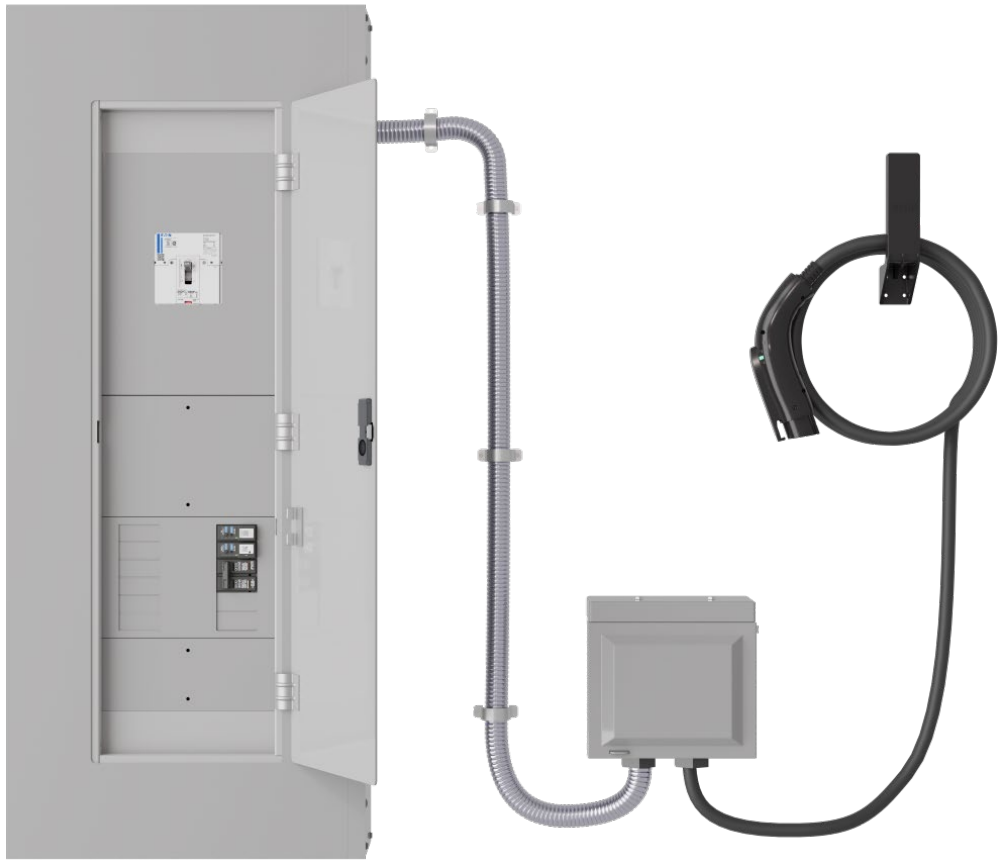
Integrated EV charging differentiator

EV charging panelboard & switchboards (7.7 kw)

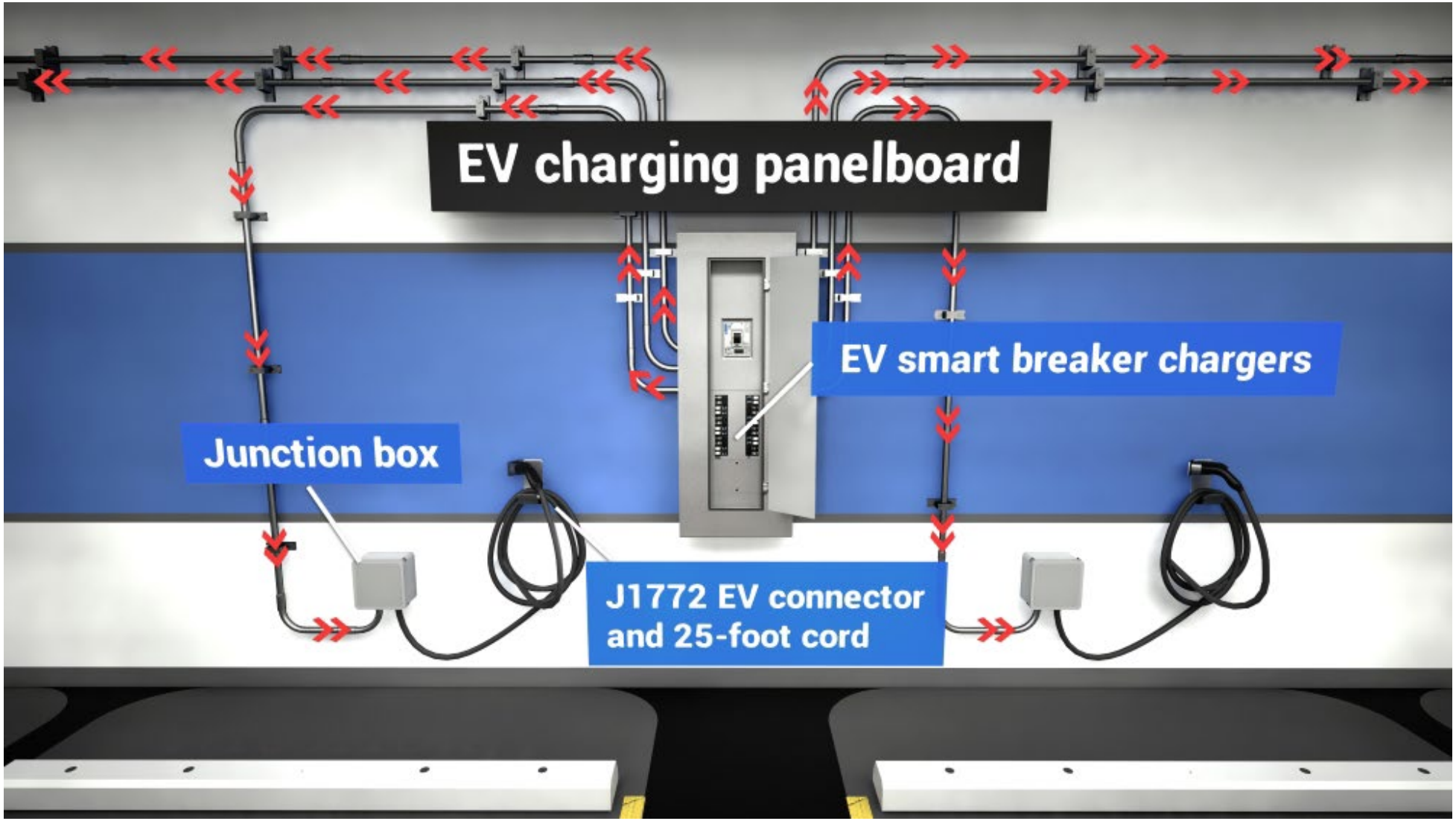
Multi-family, light commercial and commercial applications

- **Highly scalable solution**: adding new EV chargers is as easy as adding a new circuit breaker
- **Cost-effective*** and easy to service compared to traditional EVSE installation
- **Up to 16% savings*** in labor and **24% savings*** in material
- Eaton **Pow-R-Line 3X panelboard** supports up to **10 EV chargers** and the **IFS** supports up to **18 EV chargers**

**Per quotes from independent contractors*



Current offering EV charging hardware & software

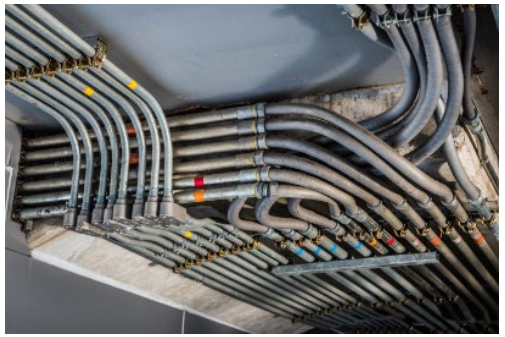


Providing differentiated solutions

Simplify and accelerate fleet EV charging

EV charging busway (19.2 kW)

- **Easy to install and service**. Does not require trenching or conduits, reducing installation time by 40%
- **Highly scalable solution** that is cost effective for fleets growing incrementally
- **Load management** provides ability to throttle rate of charge minimizing upgrades to grid infrastructure
- **Overhead EV charging** that does not disturb existing parking scheme or conveyor structure



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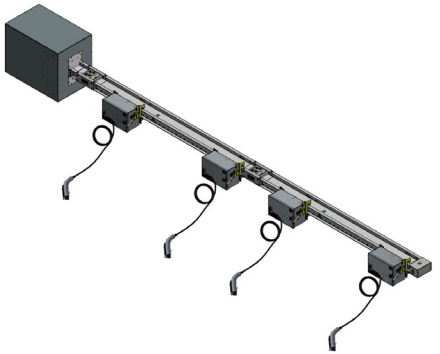
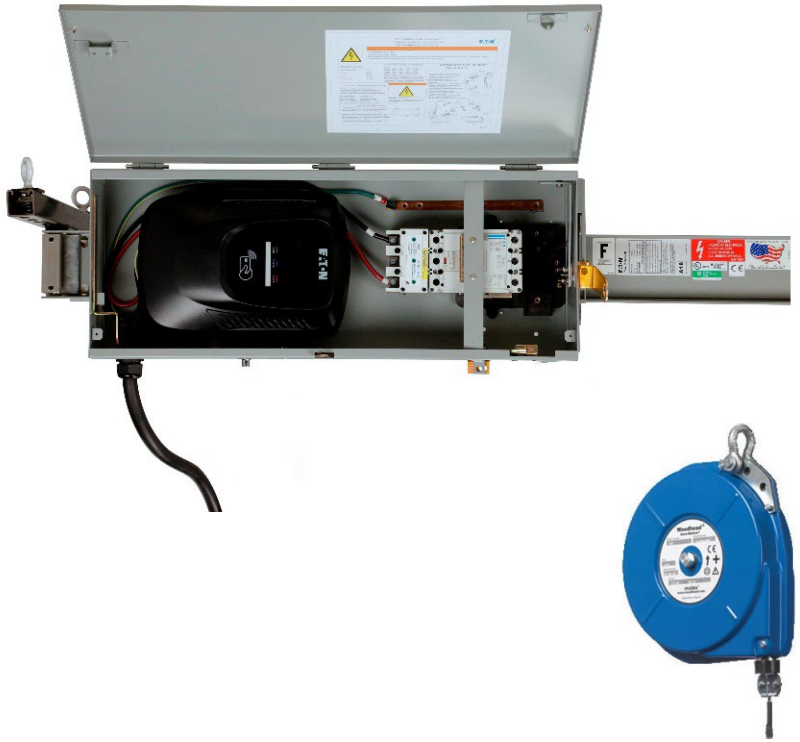
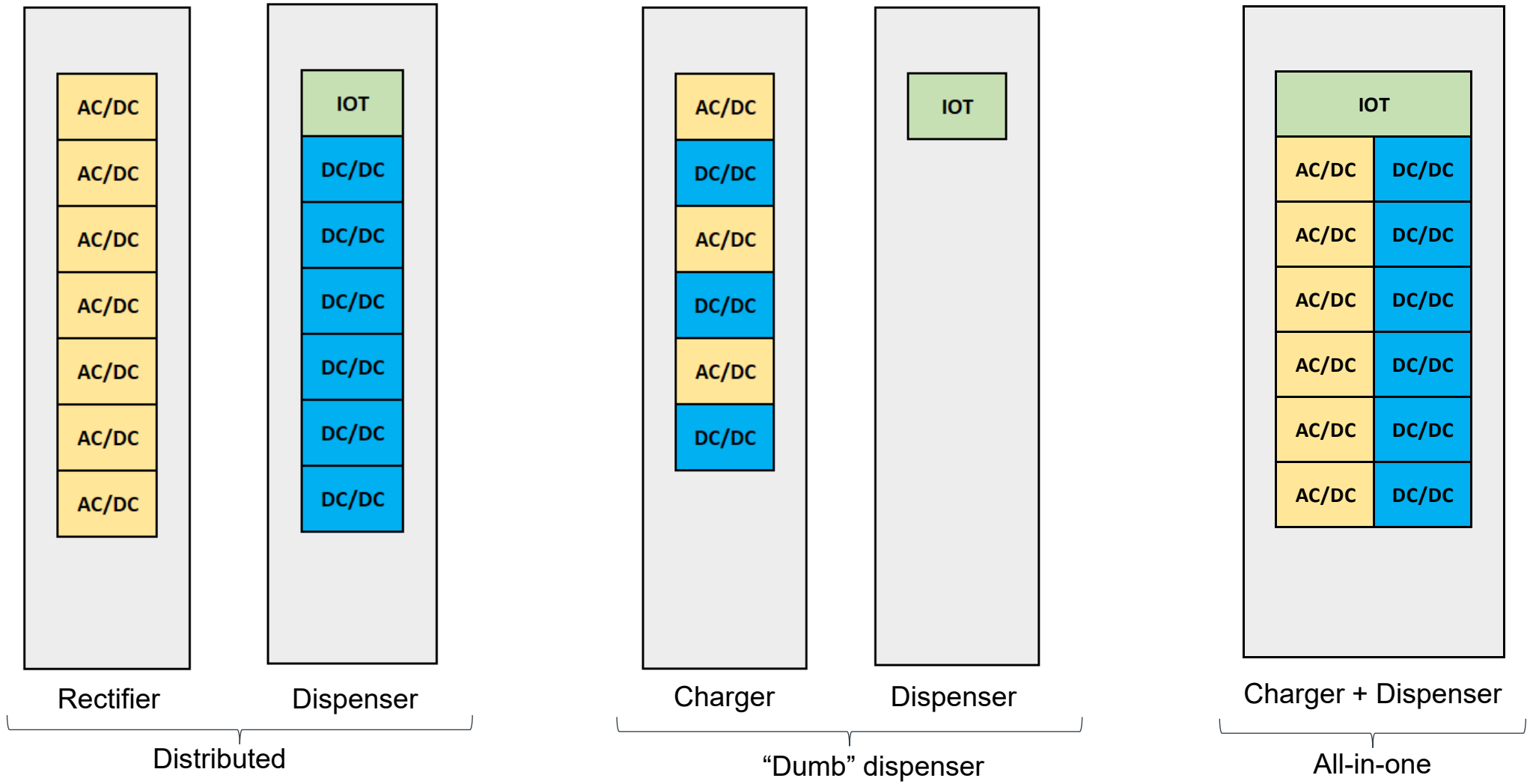


EV Busplug



DC fast charger architecture basics



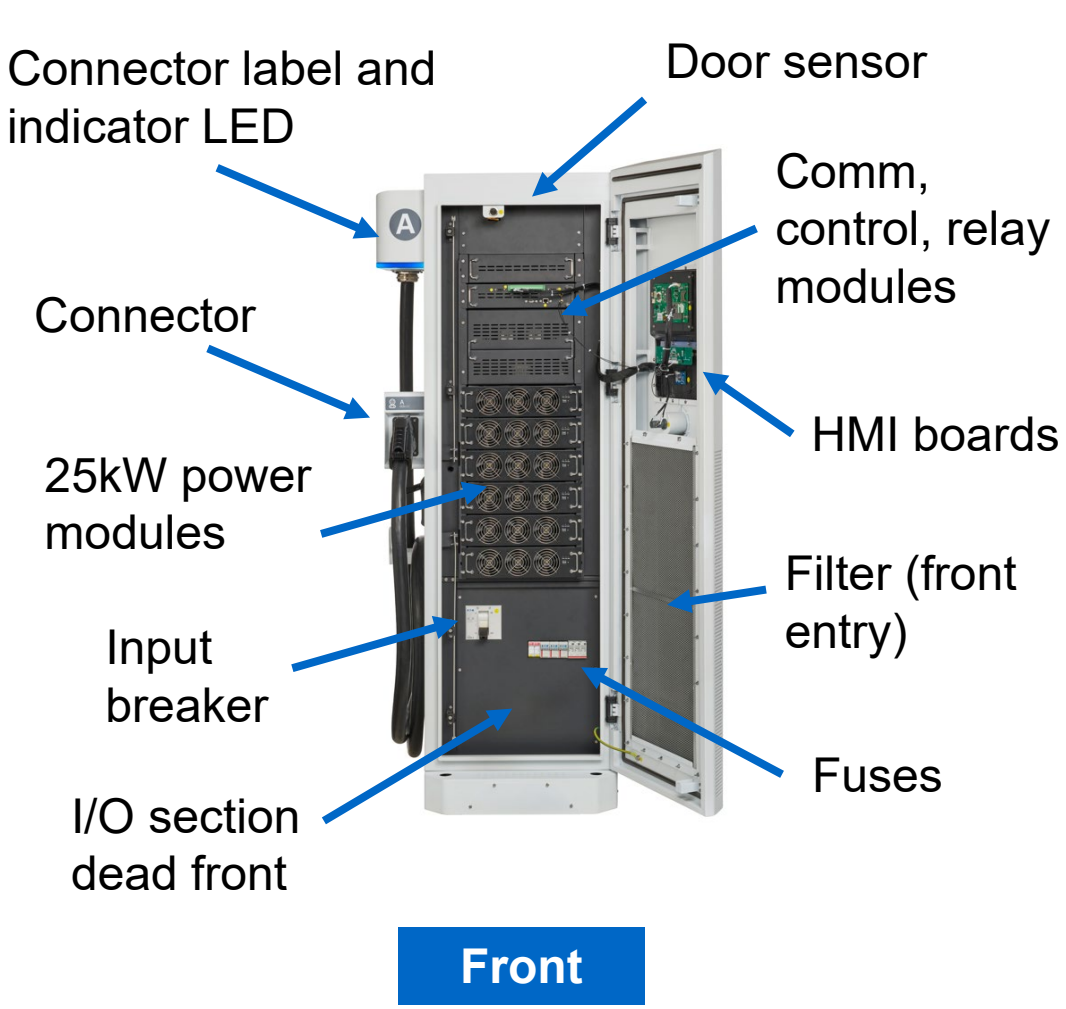
Fleet & On-the-go charging

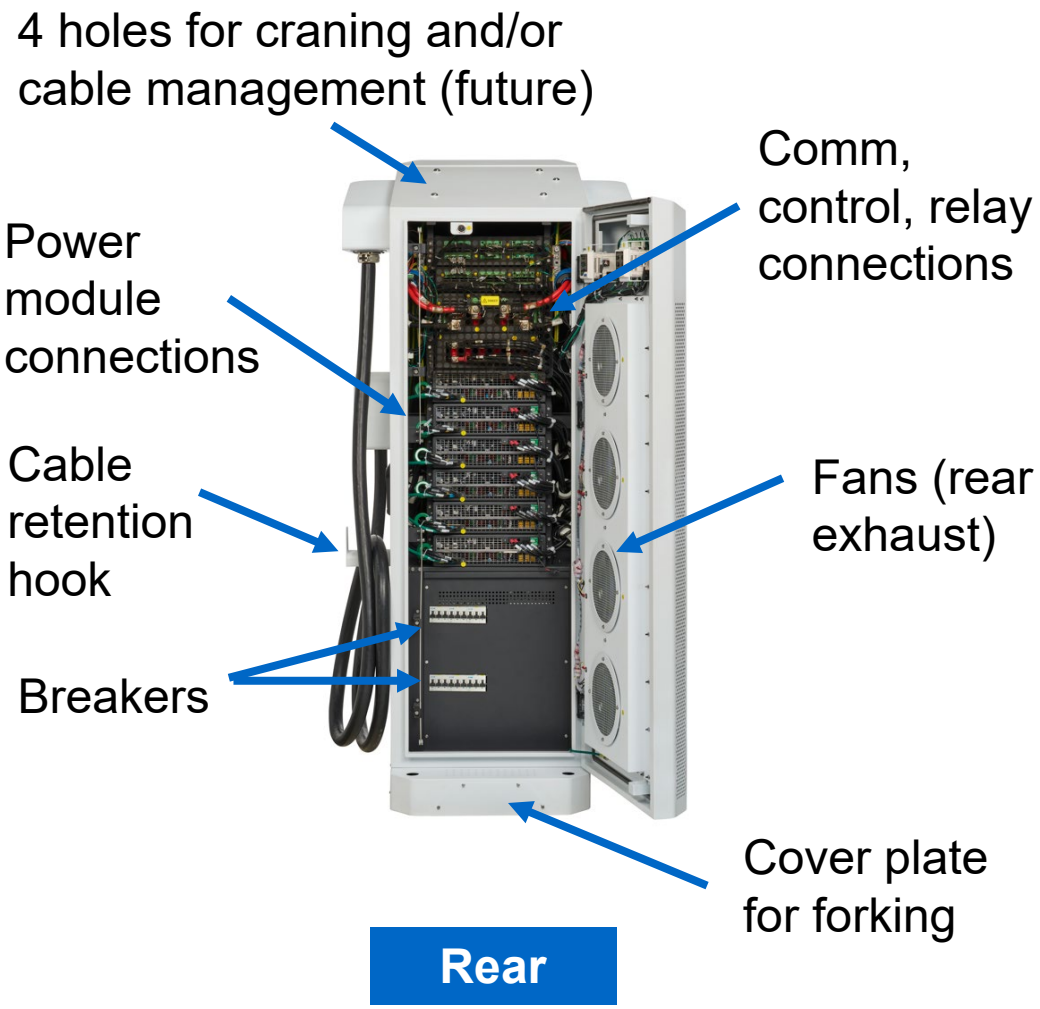
Green Motion DC Fast Charger (50 – 150kW)

Fleet and commercial applications

- **Modular design** allows for quick maintenance
- **Cost-effective** all-in-one compact design
- Support **current and future EV's** with 200 – 1000VDC charging
- **Plug & charge** (ISO 15118) hardware ready
- **Single and dual** connector support (CCS-1)
- Future support for **NACS (J3400)**
- **OCPP 1.6** today, support for 2.0.1 capable
- **Ethernet** and **cellular** (4G LTE) connectivity

Eaton DC fast charger components



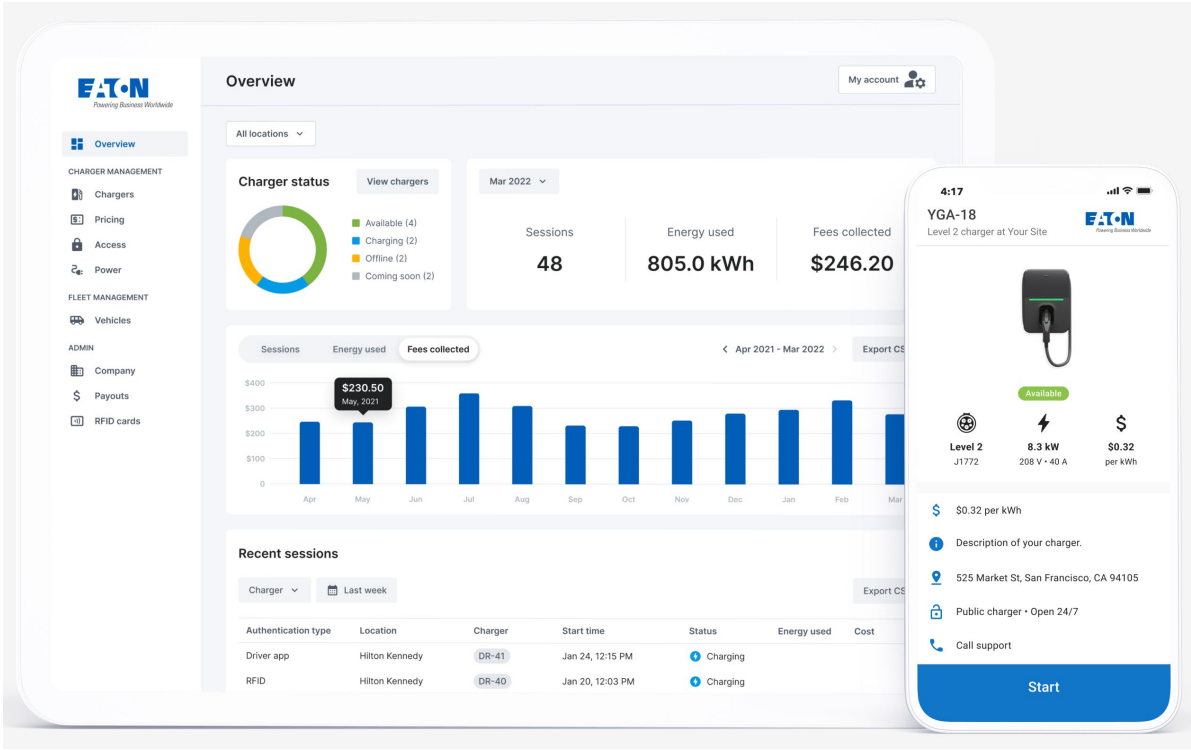


EV charger management done right

Charging Network Manager (CNM) platform

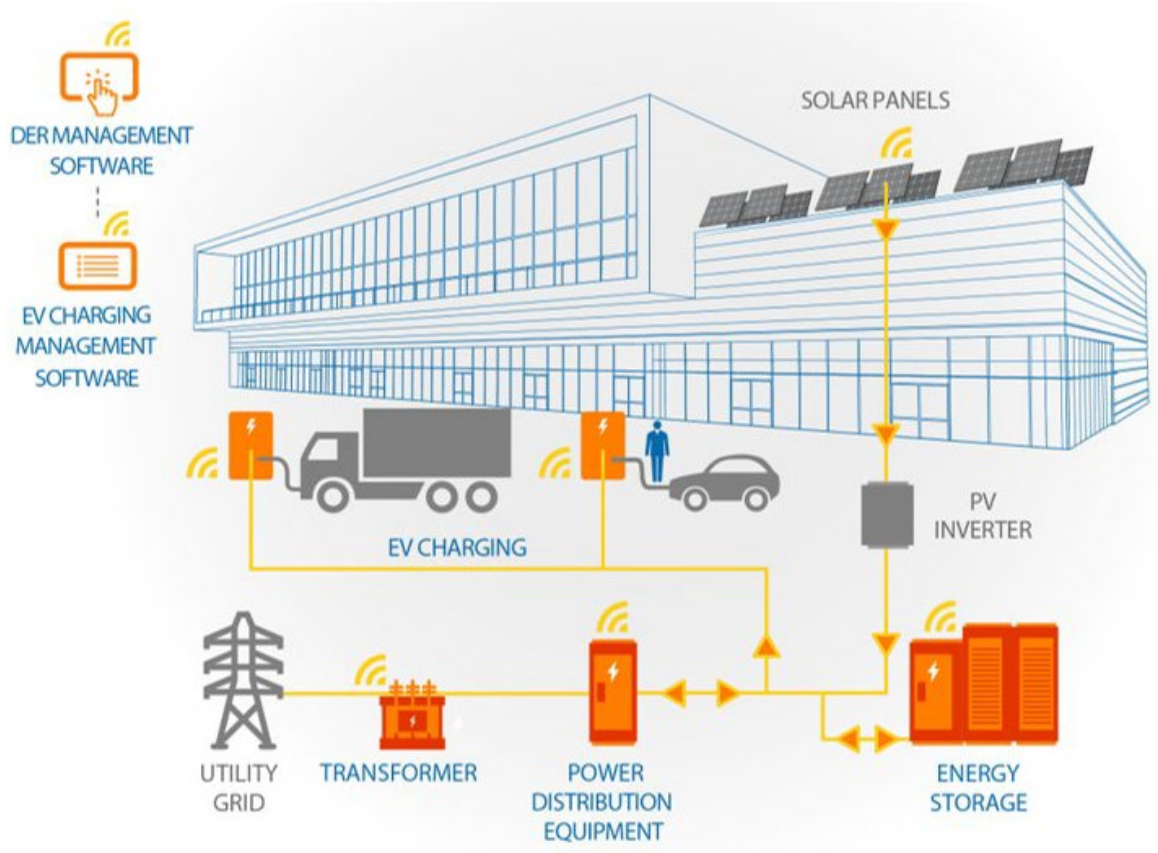
Fleet, commercial, and multi-family applications

- **All-in-one** management platform
- Supports **Eaton** charging stations as well as **many others**
- **OCPP** based solution
- Online **dashboard** provides quick access to feature
- **Seamless integration** with Eaton charging stations
- Provides **access control**, **pricing policies**, **load management**, reporting, and much more



Balance of system

- Questions to consider
- A holistic approach
- Putting it all together



Questions to consider

Determine customer use case:

- Multifamily?
- Commercial?
- Workplace?
- Fleet?

What features are important:

- Access control?
- Monetization?
- Power management?

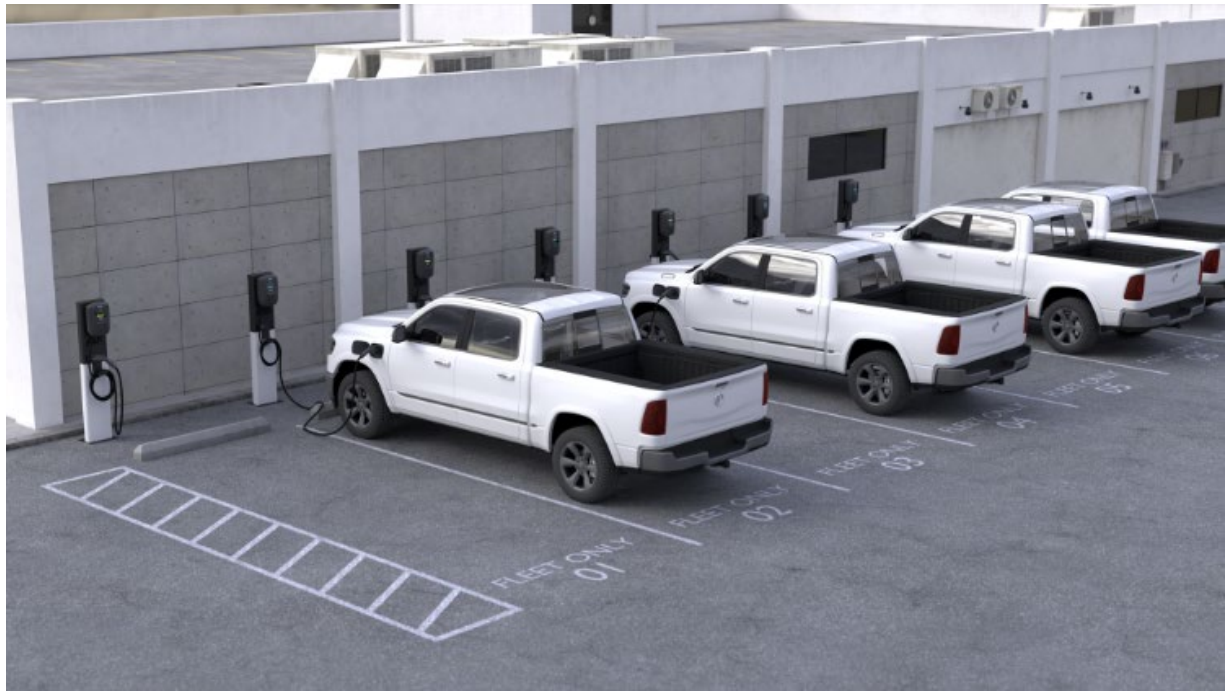
Questions to consider

How many chargers day 1? Day N (Future)?

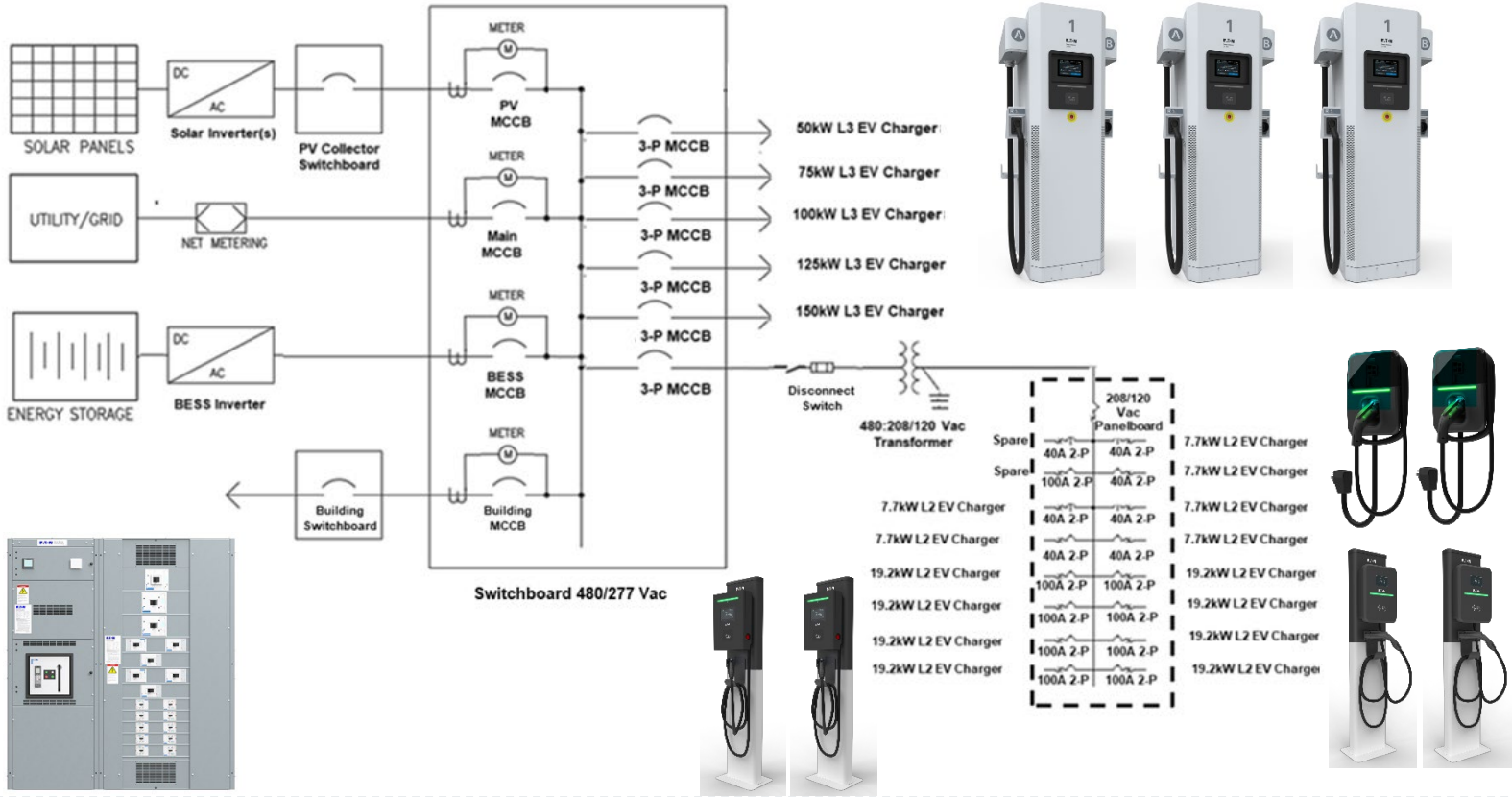
What type of charger is needed, Level 2? DC fast charger? Mix of both?

Where will chargers be located?

New or existing construction?

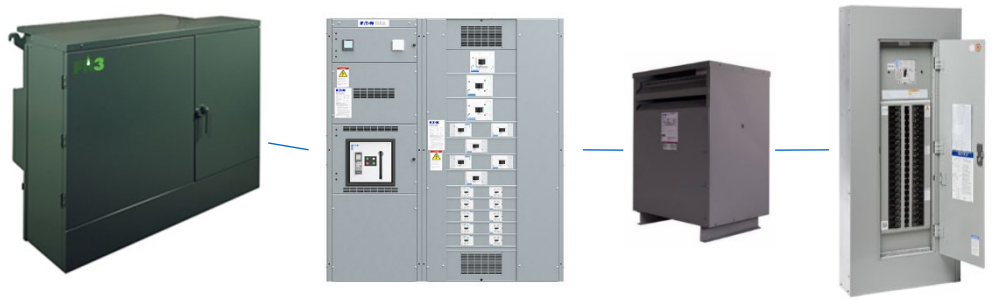


It becomes a holistic approach



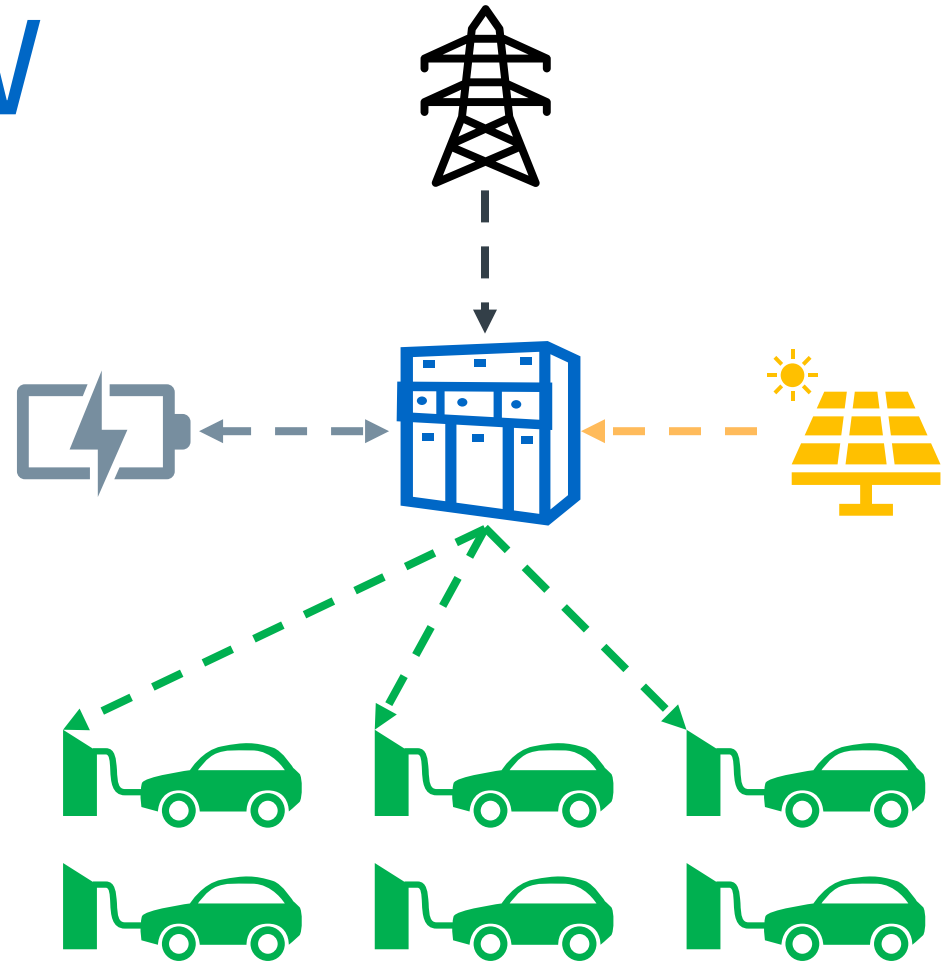
What to watch out for

- Level 2 AC EVSE are single phase loads – phase balancing
- 208VAC vs 240VAC – kW delivered changes with voltage
- DC fast chargers are typically 3-phase 480VAC input



Microgrid solutions for EV

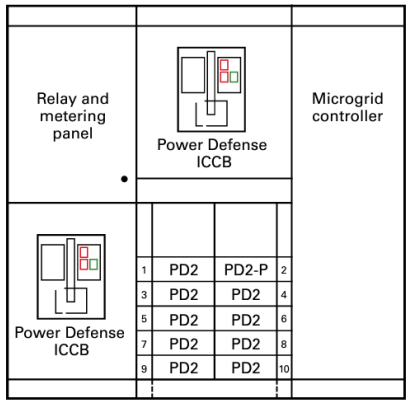
- The combination of DER management, energy storage and solar allows increased
  - **number of chargers installed**
  - **available power per charger**
- Leading to
  - **better user experience** at peak time
  - improved business performance
  - potential for **grid support**



Eaton Microgrid offerings

Eaton offers a wide array of products and service related to the Energy Transition, including…

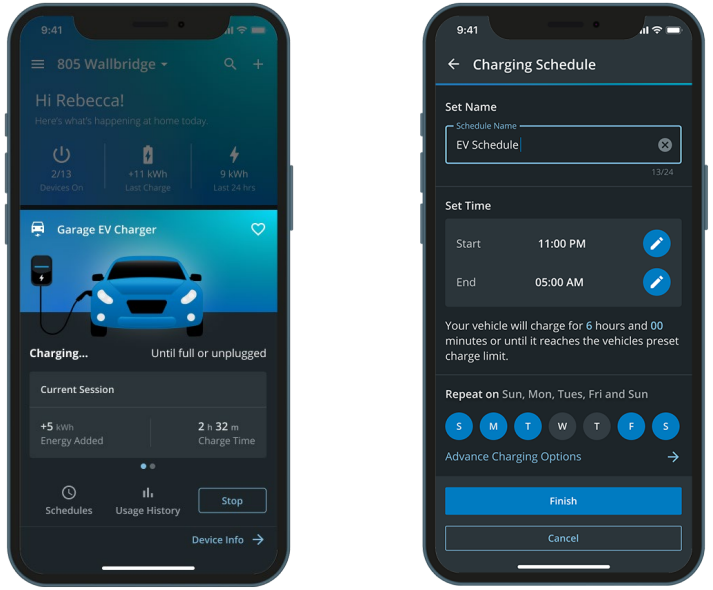
- Microgrid switchboards
- Controllers
- Integration and turnkey services (EESS)
- xStorage battery energy storage (BESS)



Eaton Energy Transition line card

The app for homeowners

Brightlayer Home (BLH) app



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Single family applications

- **Control multiple** Eaton wi-fi devices: receptacles, switches, dimmers, Smart Breakers, and EV Smart Breaker Chargers
- **Monitor** and **control** EV charging from anywhere
- **Schedule** charging sessions
- Available on **iOS** and **Android**

	EV Smart Breaker Charger	Green Motion Building	Green Motion Building PRO	Green Motion Fleet	Green Motion Fleet PRO
					
Output power	7.7kW	9.6kW	7.7kW, 9.6kW, 11.5kW	19.2kW	7.7kW, 9.6kW, 11.5kW, 15.4kW, 19.2kW
Output current	32A	40A	32A, 40A, 48A	80A	32A, 40A, 48A, 64A, 80A
Input breaker	40A	50A	40A, 50A, 60A	100A	40A, 50A, 60A, 80A, 100A
Display	Status LED	Status LED, 4.3” display	Status LED, 5” touchscreen	Status LED, 4.3” display	Status LED, 5” touchscreen
CTEP (California)	No	Yes	Yes	Yes	Yes
ISO 15518 (plug & charge)	No	Yes (optional)	No	Yes (optional)	No
Protocol	Cloud API and OCPP 1.6J	OCPP 1.6J	OCPP 1.6J	OCPP 1.6J	OCPP 1.6J
Communication	Wi-fi	Wi-fi, ethernet, cellular	Wi-fi, ethernet, cellular	Wi-fi, ethernet, cellular	Wi-fi, ethernet, cellular
Connection	Direct in panel, NEMA 14-50, hardwire	Hardwire	Hardwire	Hardwire	Hardwire
Enclosure	Wall charger is NEMA-3R	NEMA 3R	NEMA 3R	NEMA 3R	NEMA 3R painted stainless steel
Cordset	25ft with J1772	25ft with J1772	25ft with J1772	25ft with J1772	25ft with J1772

CNM power management

Eaton CNM's load management system enables site hosts to **defer or minimize costly investments** in electrical infrastructure by making the **most efficient use of power** to provide **maximum charging speeds** across chargers.

It does this through:

1. Efficient allocation of power across vehicles, and
2. Unique accounting for loss of internet connectivity during charging

Example – (4x) 32A Charging Stations

100A Main Breaker → 80A total limit

1) All stations available and online

Charge A	Charger B	Charger C	Charger D
--	--	--	--

2) Two drivers arrive and plug in. Each gets full power.

Charge A	Charger B	Charger C	Charger D
32A	32A	--	--

3) 3rd driver arrives and plugs in. All chargers throttle to share power

Charge A	Charger B	Charger C	Charger D
26A	26A	26A	--

4) 4th driver arrives and plugs in. All chargers throttle to share power

Charge A	Charger B	Charger C	Charger D
20A	20A	20A	20A

Example – (4x) 32A Charging Stations

100A Main Breaker → 80A total limit

1) All stations available and online

Charge A	Charger B	Charger C	Charger D
--	--	--	--

2) Two drivers arrive and plug in. Each gets full power.

Charge A	Charger B	Charger C	Charger D
32A	32A	--	--

3) Charger A loses network connectivity. Charger A power "reserved"

Charge A	Charger B	Charger C	Charger D
32A	32A	--	--

4) Two more drivers arrive. Load shared based on reserved power on A

Charge A	Charger B	Charger C	Charger D
32A	16A	16A	16A

Example – (4x) 32A Charging Stations

100A Main Breaker → 80A total limit

5A) Charger A reconnects and power is equally shared

Charge A	Charger B	Charger C	Charger D
20A	20A	20A	20A

5B) Charger A reconnects and charging is complete

Charge A	Charger B	Charger C	Charger D
--	26A	26A	26A

5C) Charger A reconnects and is charging at lower rate. Charger A limited to lower power and additional capacity shared with other charging stations

Charge A	Charger B	Charger C	Charger D
10A	23A	23A	23A

Eaton summary

Eaton snapshot:

- 2023 Revenue: $23.2B
- Net income: $3.22B
- Founded: 1911
- Business: global diversified power management company
- No. employees: 92,000

Pros:

- Stable company that has been in business over 100 years
- Solid financial position
- Large sales organization w/ strong customer relationships
- Full electrical distribution portfolio
- Differentiated EV charging integrated infrastructure offering
- Open Charge Point Protocol (OCPP)
- Cost competitive solution

Eaton services

Start up, warranty, and site services

- EV charger service lifecycle
- AC charging stations
- DC charging stations
- Site services

Eaton EV charging service lifecycle

Presales & Installation

- **Onsite services:**
  - Paid site survey, including drawings & equipment sizing
  - TCO calculator requested
  - Resiliency options
- **Budgetary quotes:**
  - Product only
  - Turnkey installation (via EESS teams)

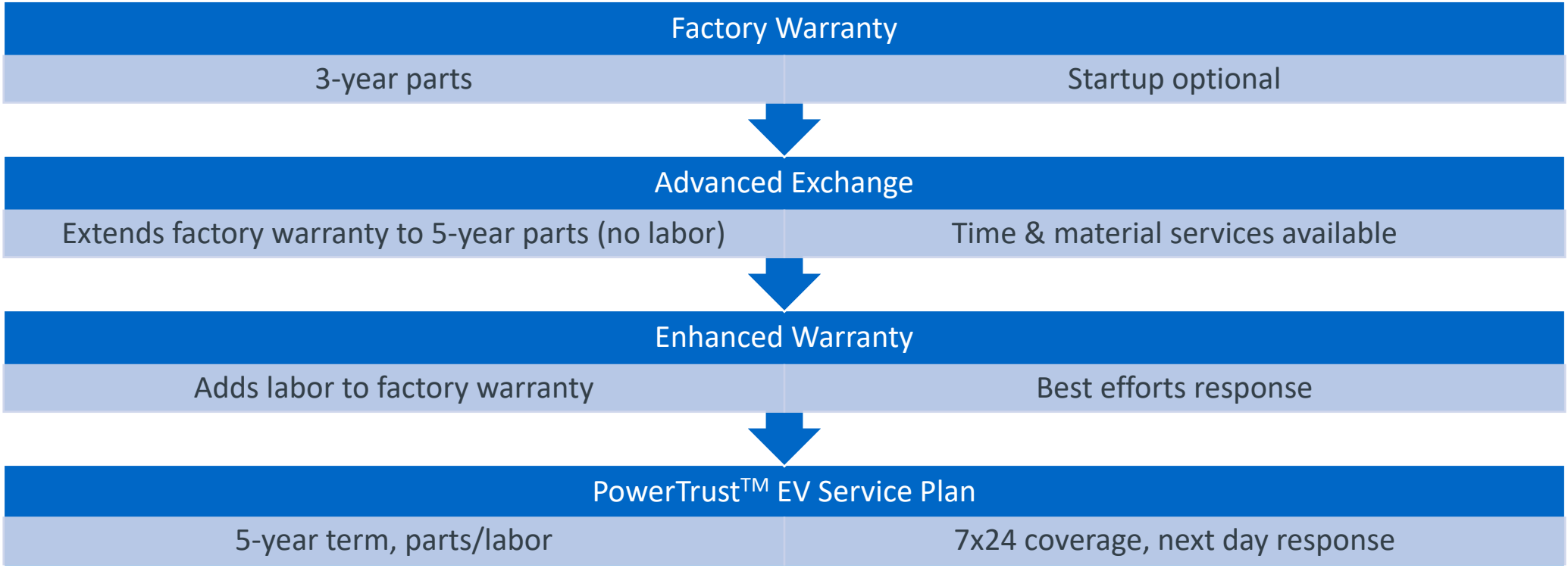
Activation & Warranty

- **Factory warranty:**
  - **DC chargers:** 2-years parts & 90-days labor
  - **AC chargers:** 3-years parts
- **Activation (startup)**
  - **Activation** (embedded for DC and optional for AC) Eaton IFSC configures CNM monitoring and charger

Maintenance

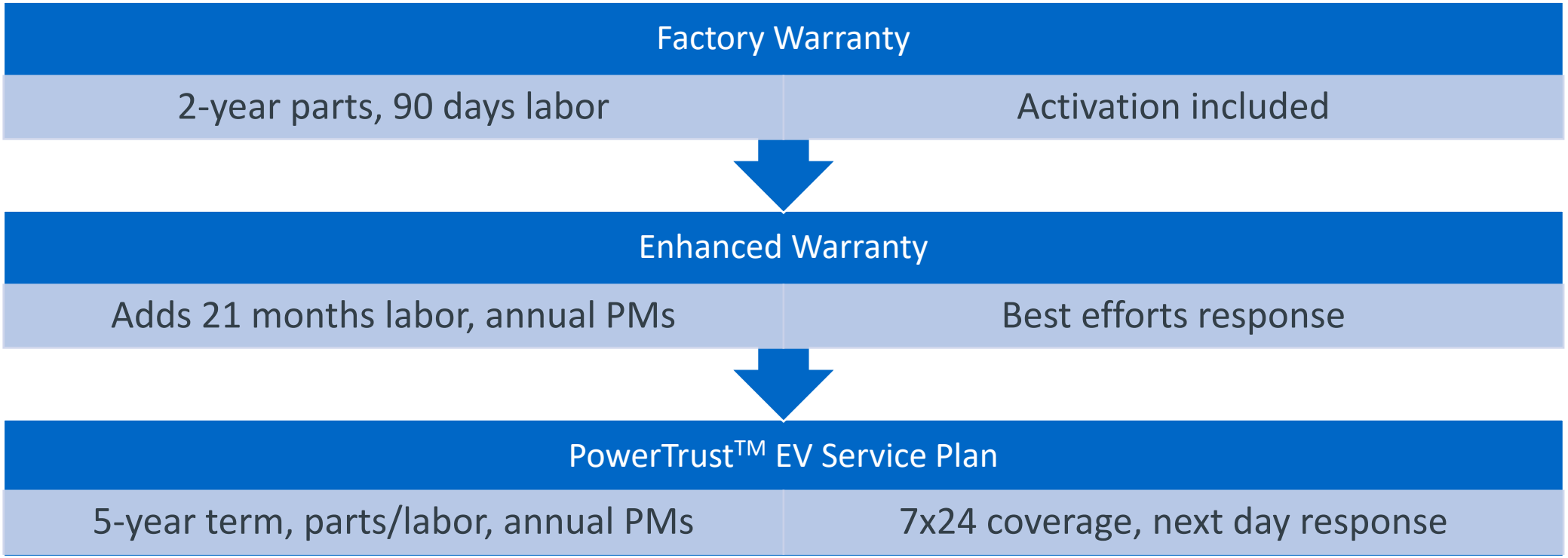
- **Remote monitoring:**
  - Eaton CNM cloud services
- **AC and DC Services**
  - **Enhanced Warranty**: adds labor coverage to factory parts warranty (best efforts response)
  - **Maintenance contracts** – 5-year option, 7x24 next day response with parts & labor
    - PowerTrust™ EV service plans (includes PMs for DC)
    - Preventive maintenance visits available

Start up and warranty services



Preventive maintenance and time and material services can be purchased a la carte as needed

Start up and warranty services



Preventive maintenance and time and material services can be purchased a la carte as needed

Electrical Engineering Services & Solutions (EESS)

Field services:

- Site survey
- Feasibility study
- Reliability & resiliency
- Microgrid solutions

Turnkey project:

- Design & engineering
- Project management
- Construction management