

Considerations in EVSE Networking, Communications and Specifications



We Are The Most Experienced Fleet Charging Company Worldwide



THE MOBILITY HOUSE >>>

Consulting

Designs optimal charging infrastructure and robust electrification strategies

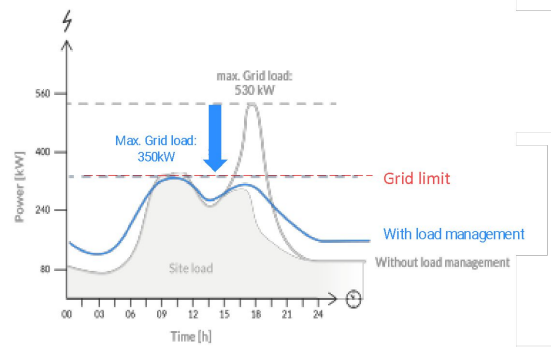


180+ Fleets Helped



VGI (Smart Charging)

ChargePilot - The world's leading EV charging and management platform



Trusted by 800+ EV Fleets (80 + MW)



VGI (Bidirectional)

EV Aggregation Platform for monetization of EV battery flexibility & energy markets.



10 V2G Pilots Operating

Stationary Storage

Largest developer of stationary storage solutions using EV batteries in the EU.



100+ MW of EV Batteries

Customers, Partners & Investors Include

DAIMLER



AlphaStruxure



Main Features

- > Resiliency
- > Interoperability
- > Ecosystem

Why

- > Working
- > Options
- > What you have now and in the future



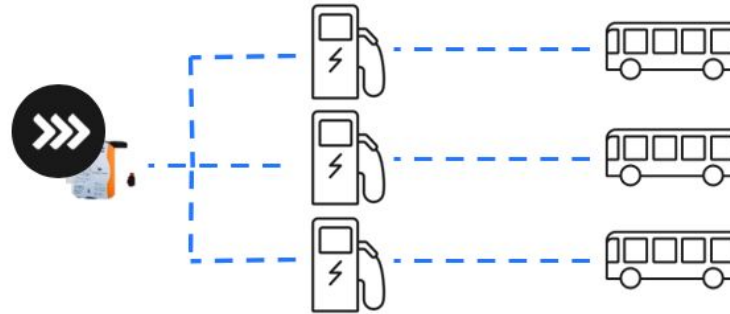
Resiliency

Local Controller



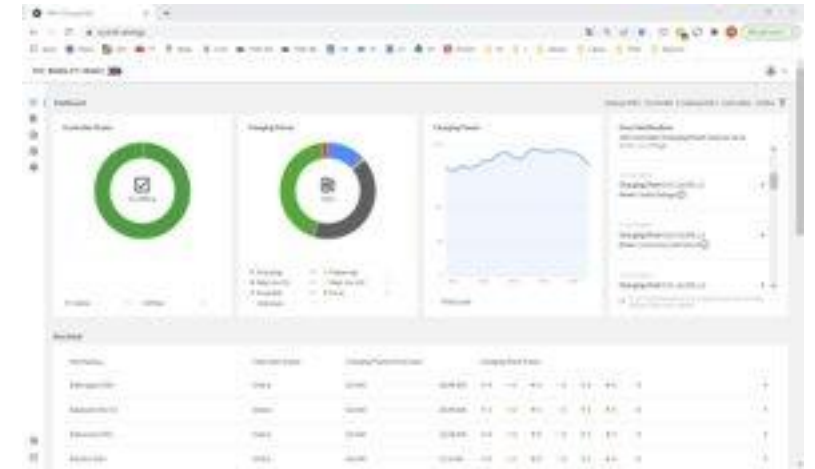
- > Enables system operation and data storage in case of internet outages
- > Lower latency
- > Over air updates

Ethernet Connect to Charger



- > One less point of failure
- > Better data transfer

Real Time Monitoring



- > Remote monitoring team
- > Notifications provide valuable trouble shooting information



Interoperability

What is OCPP?

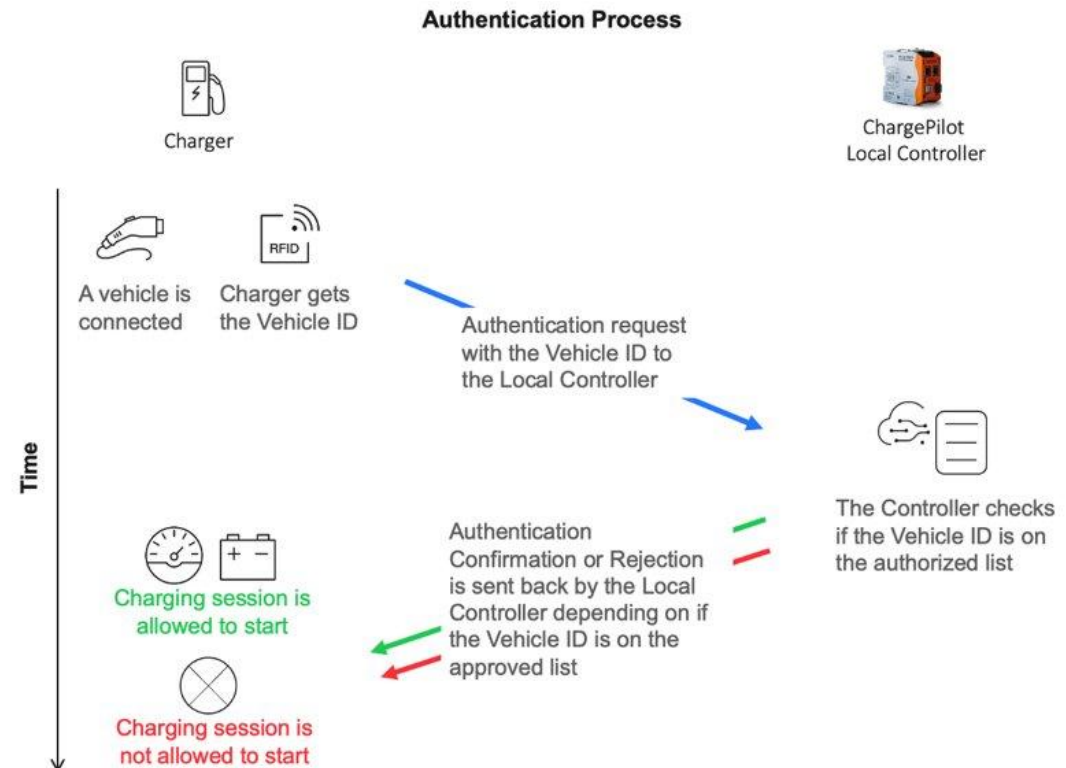
OCPP Stands for Open Charge Point Protocol and is a **manufacturer-neutral, license free communication protocol**. It was developed by the Open Charge Alliance (OCA), an international partnership of more than 160 companies. Currently, almost all leading manufacturers equip their charging stations with OCPP capable technology.

There are multiple versions of OCPP

OCPP 2.0: New standard, improved transaction handling, device management added security and other improvements such as requests by EV charging community

OCPP 1.6 : Current Standard, SOAP and JSON, allows Smart Charging for load balancing

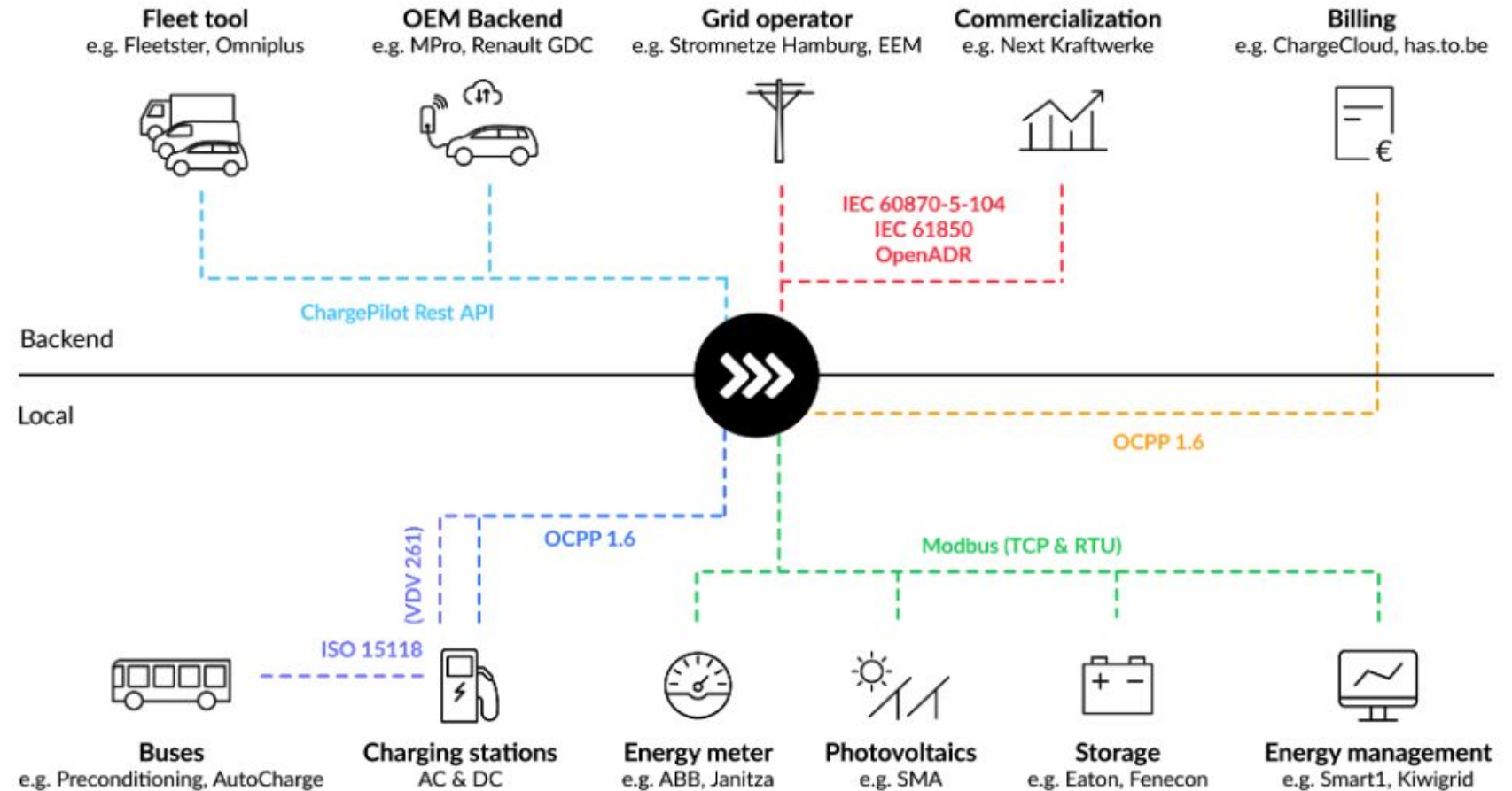
- OCPP offers several advantages over other standards and proprietary protocols: The charging points **can fully communicate with all OCPP-capable CPO/MSP back-end systems**, while the **data is protected by encryption**. Thanks to continuous developments, customers receive a **future-proof and cost-efficient** charging infrastructure and can add further software and hardware components from **various manufacturers at any time**.



Ecosystem



- > Open Standards allow for Charging Energy Management Systems to function in your already existing Ecosystem and in your future one.
- > This flexibility gives you options as you expand or select different suppliers.



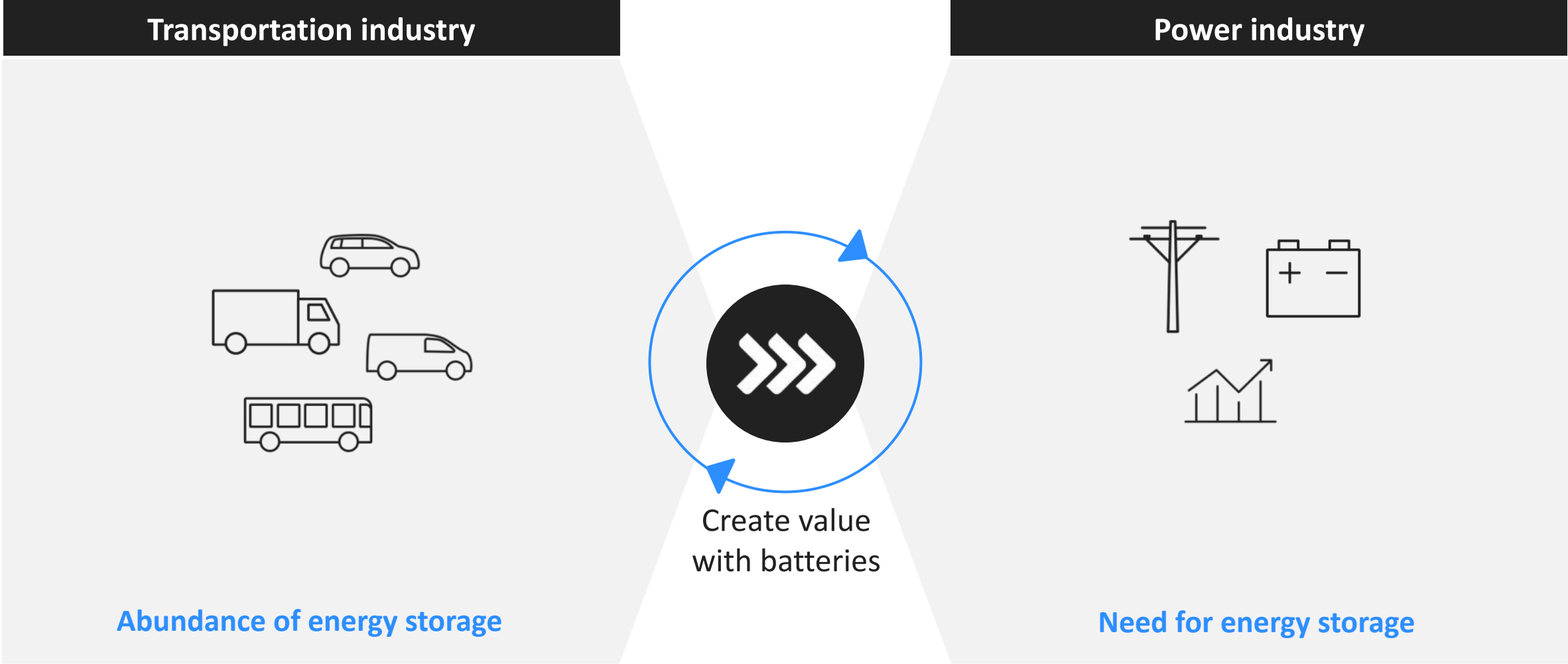


THE MOBILITY HOUSE

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The Mobility House was founded to create a zero-emission transportation and energy future



ChargePilot combines the power of remote control with the security and reliability of local connectivity

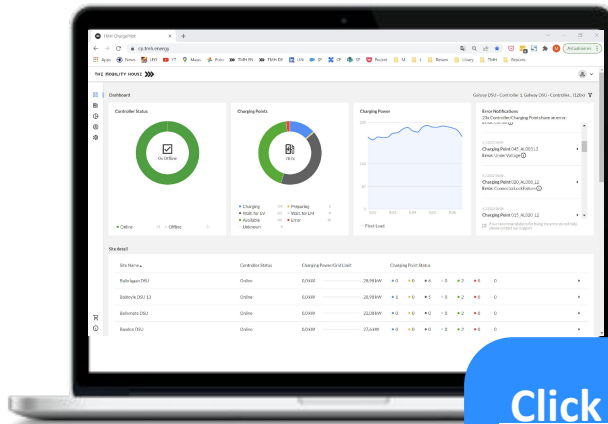


Cloud-based web-application

ChargePilot

The only dynamic fleet energy management software on the market combining local and cloud-based intelligence

Local controller*



[Click here to view Dashboard Video](#)



Secure & Local



Independent & Interoperable



Modular & Scalable



Simple & Intuitive

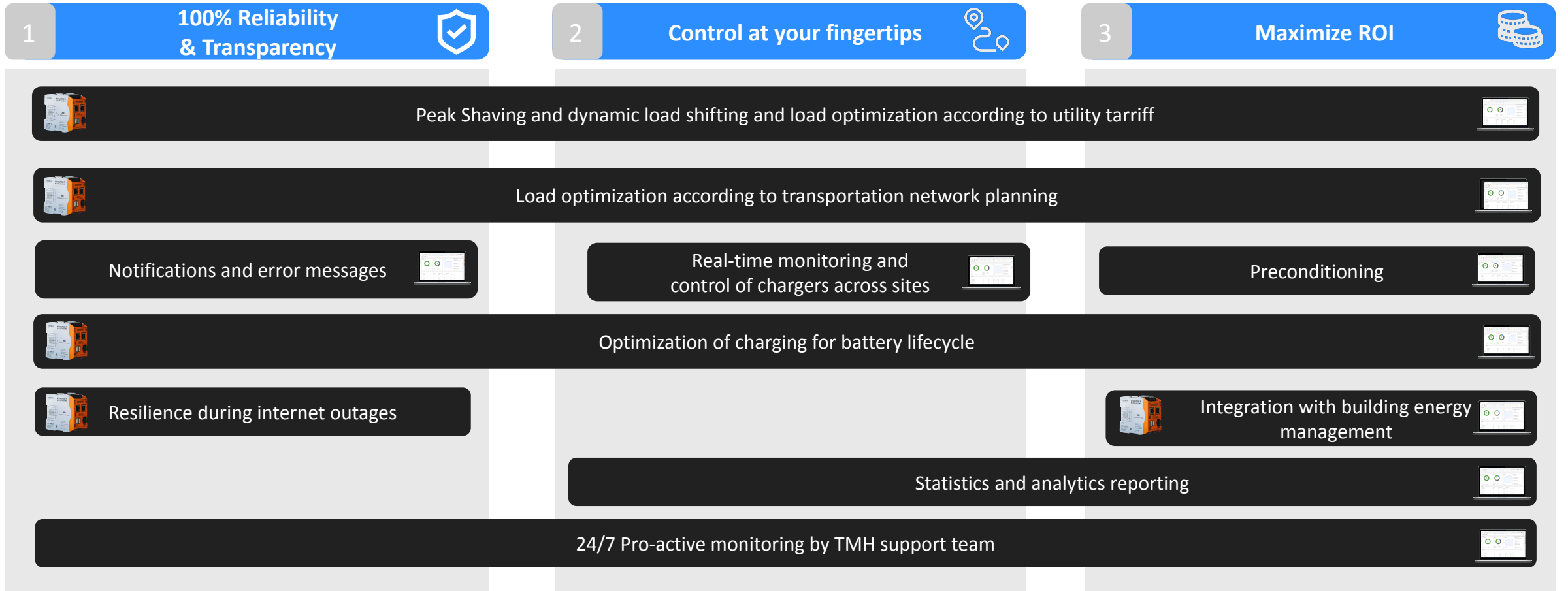


Resilient & Future-proof

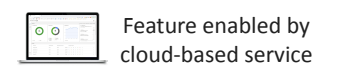
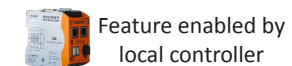


*One controller per site.

ChargePilot's hybrid cloud-hardware approach solves the key challenges of transit electrification



This is a small feature selection, full list available upon request.



ChargePilot manages charging and shifts loads to off-peak hours, saving 65%+ in operational cost and \$1M+ in capital cost



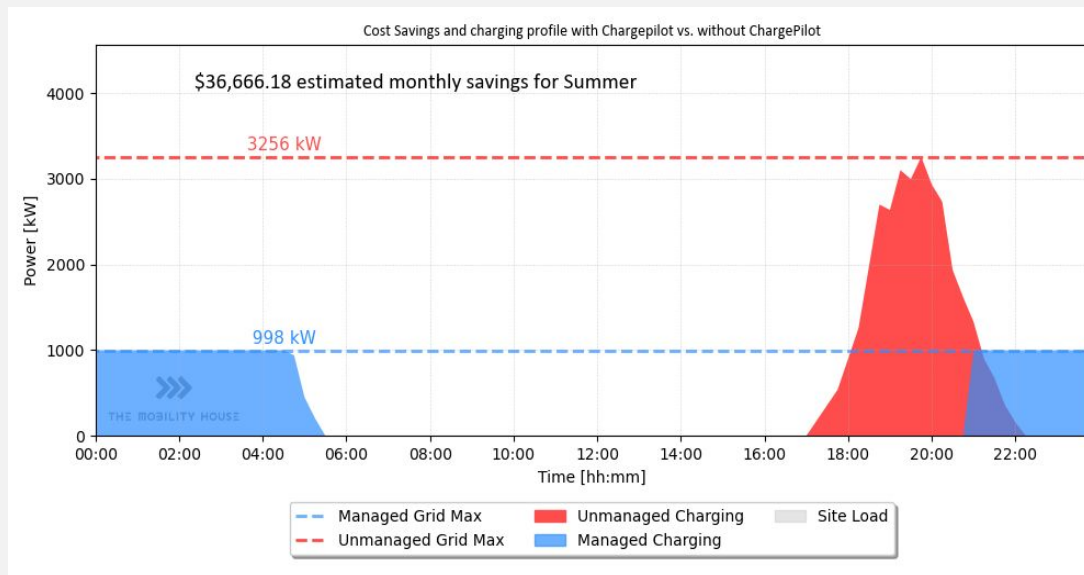
Simulation

3,256 kW

Load peak without load management

998 kW

Load peak with load management



Parameters

- **Vehicles:** 24 MCI D45 CRT LE bus
- **Chargers:** 12x 180 kW (DC) dual ports, 24 ports
- **Utility Rate Plan:** SCE + Lancaster Choice Energy TOU-EV-9 + TOU-EV-PRI-9
- **TOU Peak hours:** 4 am - 9 pm

Results

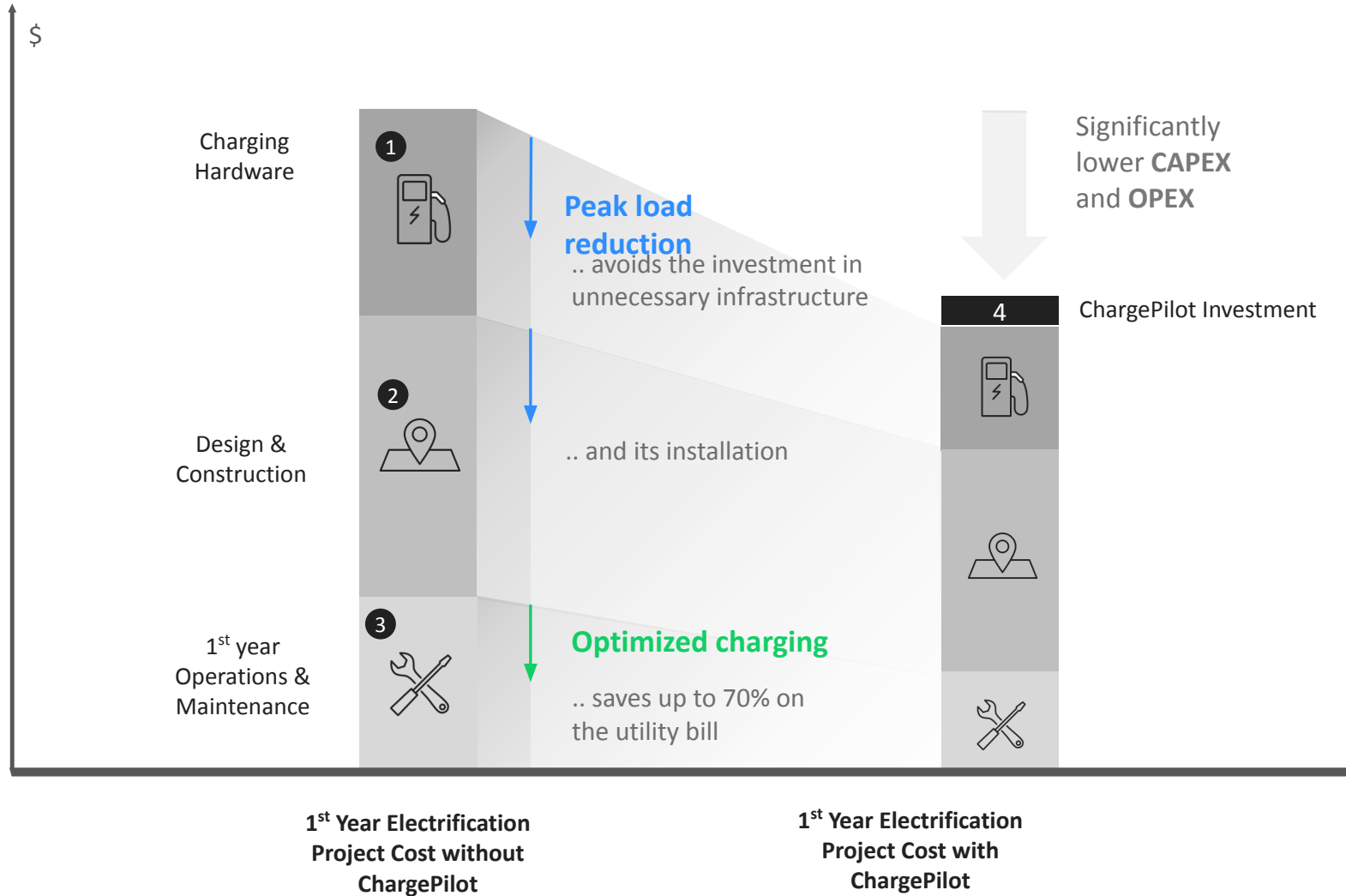
Annual Cost savings

\$532,203

Annual cost reduction

67.4%

Charging and Energy Management will save both capital and operational expenses



Key Takeaways

Charging and Energy Management can significantly lower operational and capital costs of an electric transit fleet:

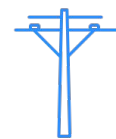
- Peak load reduction for CAPEX savings
- Optimizing charging around ToU tariff for OPEX savings)



Example: KING COUNTY METRO

Project Statistics:

- > **LOCATION:** South Base Test Facility, Tukwila, WA
- > **TOTAL CONTROLLED POWER:** 4.63 MW
- > **CHARGING STATIONS:** 12 chargers, ranging from 150 kW to 600 kW, from three different manufacturers: ABB, Heliox and Siemens
- > **CHALLENGE:** Largest transit bus charging site in US using a 2.5 MW existing grid connection. Serves a 40-bus fleet, with a planned regional expansion to 1,400 buses by 2040.



~\$1M

Savings from using existing grid connection



More than \$100,000 / year

Savings in operating expenses

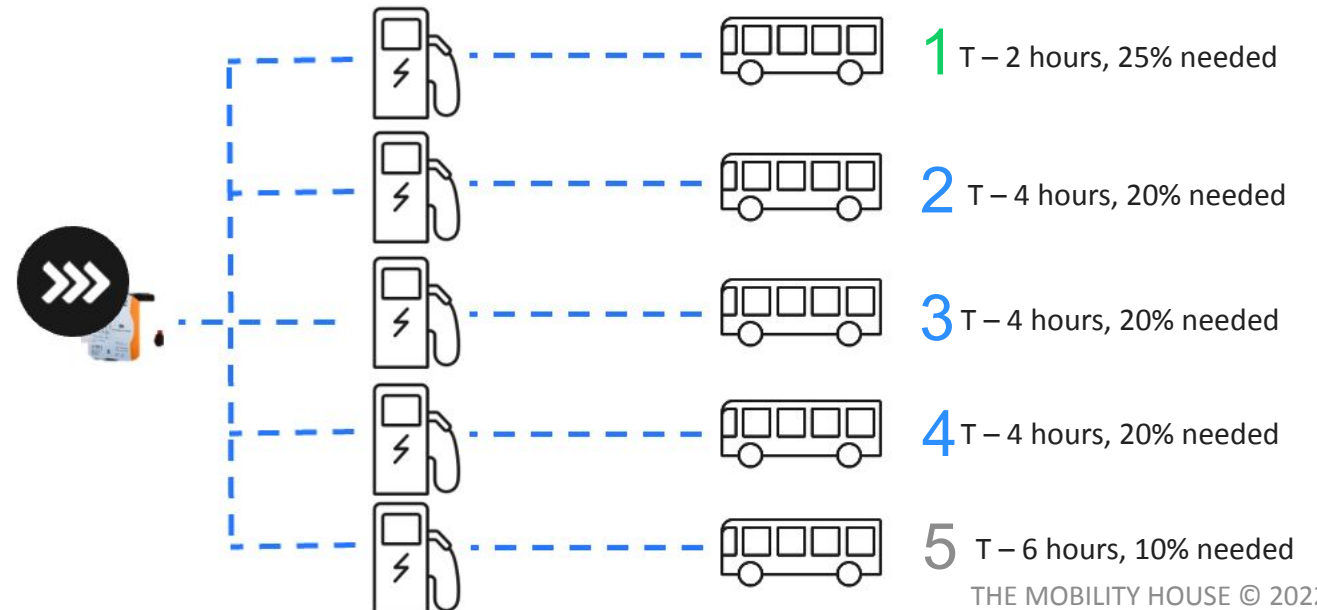
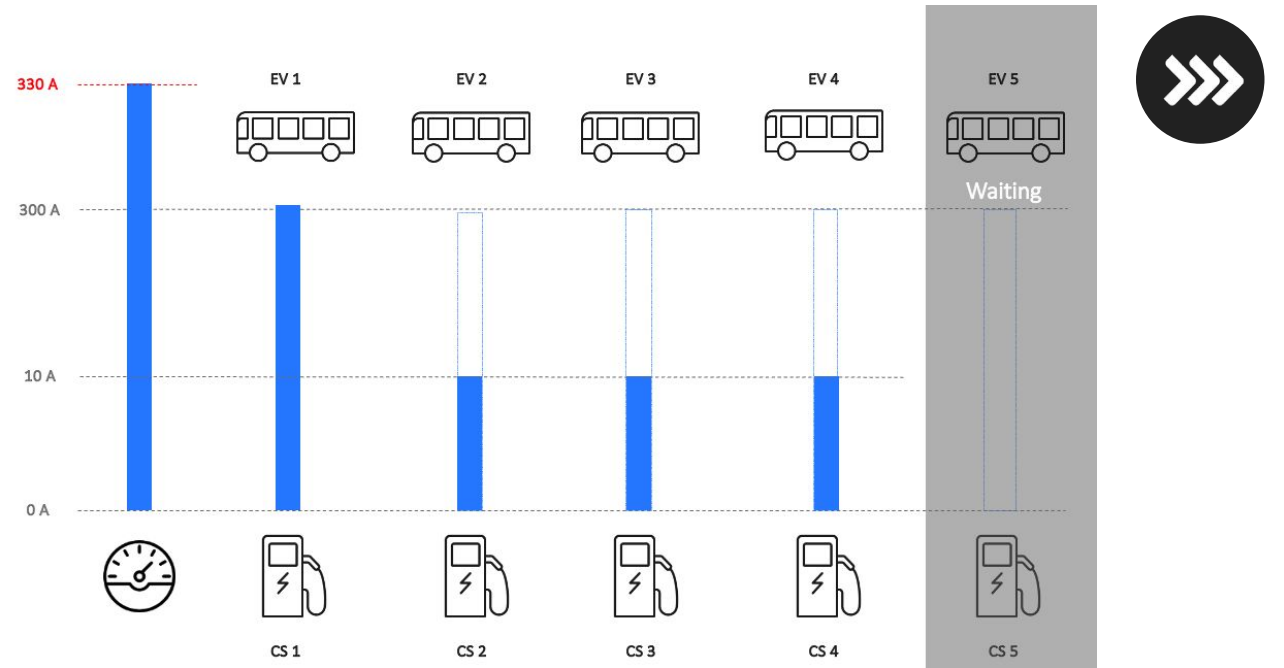
Optimizing charging around your transportation planning

ChargePilot can take into consideration each buses needs **depending on route critical information** such as time of departure and length of route.

From these data points, which can either **entered manually**, entered via TMH provided REST API, or through connection to your company's **fleet management software** (custom integration), Charge pilot will **assign priority** to certain buses over others.

This priority is determined via two "urgency coefficients" **SoC needed** and **Time of Departure**

Priority can also be set to a given bus or charger manually through the dashboard



Pre-conditioning



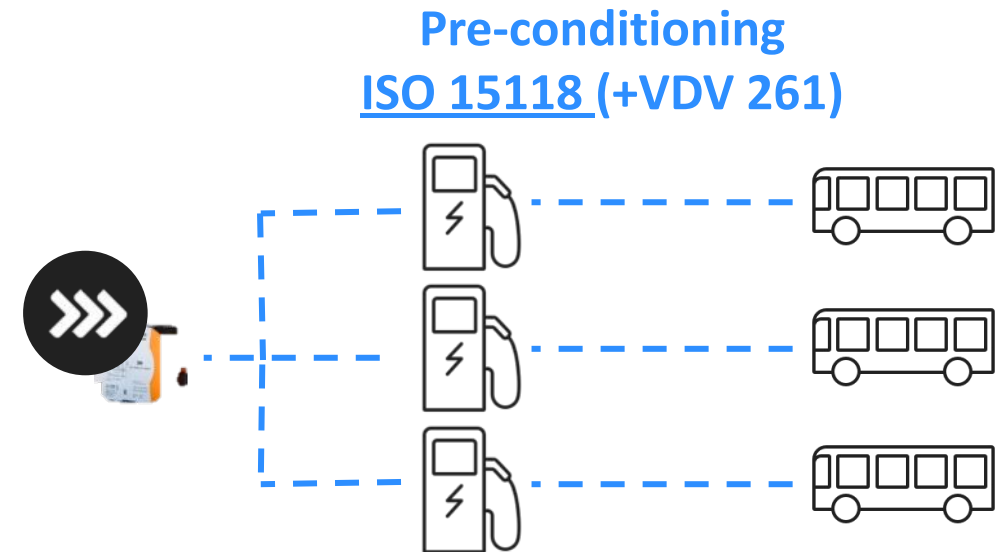
Why is pre-conditioning important?

A BEB's HVAC is powered by the same battery source as the drivetrain. Therefore, HVAC demand accounts for the single largest impact on usable range.

The Center for Transportation and Environment showed a bus with an average number of passengers used 2% more energy in summer and 28% more in winter.

Batteries energy performance are lower in cold temperatures, which can reduce acceleration and range as well as limit the benefits of regenerative braking

- ChargePilot can enable trickle charging which allows buses that are already fully charged to pre-condition while still at the charger. This **saves energy on route** and heats up the battery thereby **improving the batteries electrical performance** prior to leaving the terminal.



- Preconditioning must also be allowed by the charger and bus

Not all chargers and Buses are capable of this feature

Fleet Schedule API



What is an API?

An API or Application Programming Interface is a piece of software and protocols that allows for information exchange between two applications. It can be thought of as a defined call and response system.

We use a Rest API which is an architectural style of API which requires that the client server architecture is managed through HTTPS (Encryption), Stateless client-server information, there is a uniform interface so that the information is transferred in standard form and there is a layered system that organizes each type of server.

Rest APIs are faster more light weight, with increased scalability that is perfect for Internet of Things.

Example code

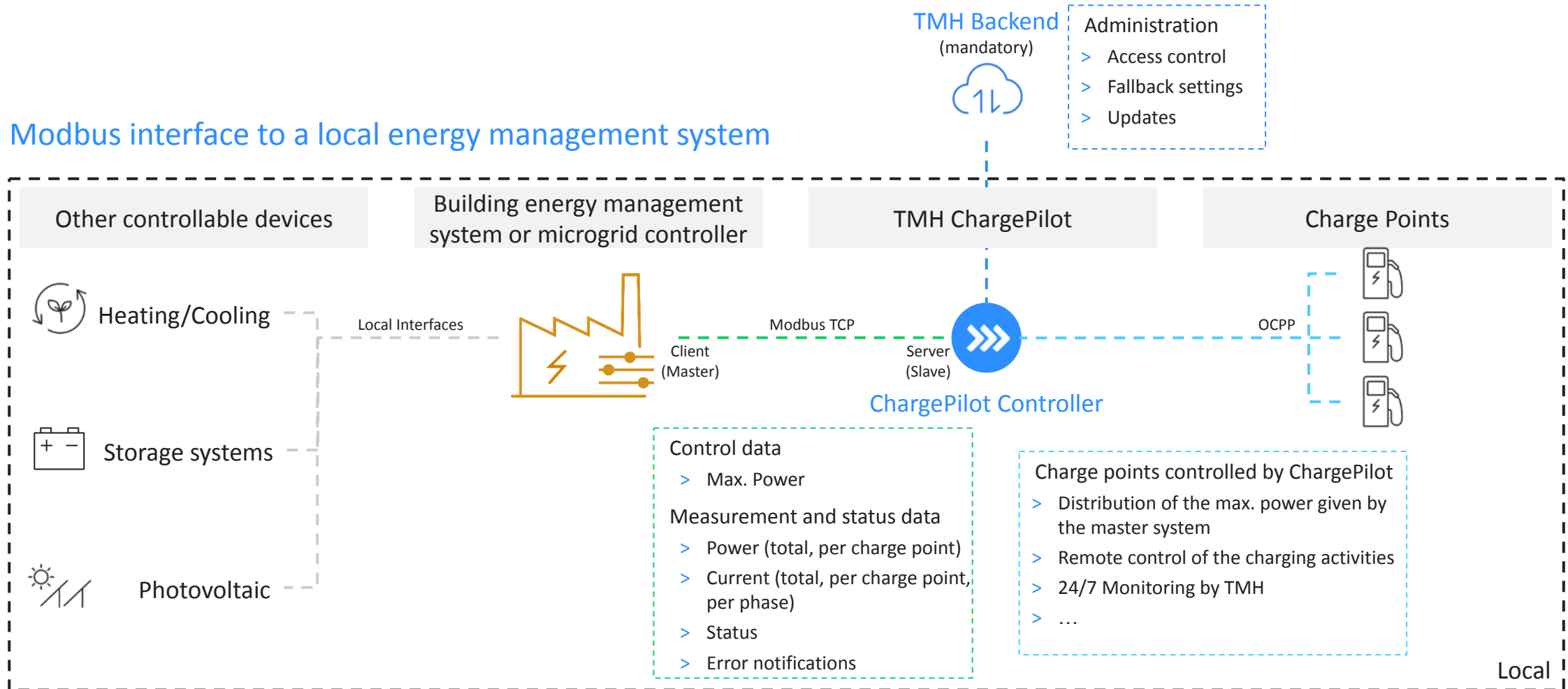
Example Response

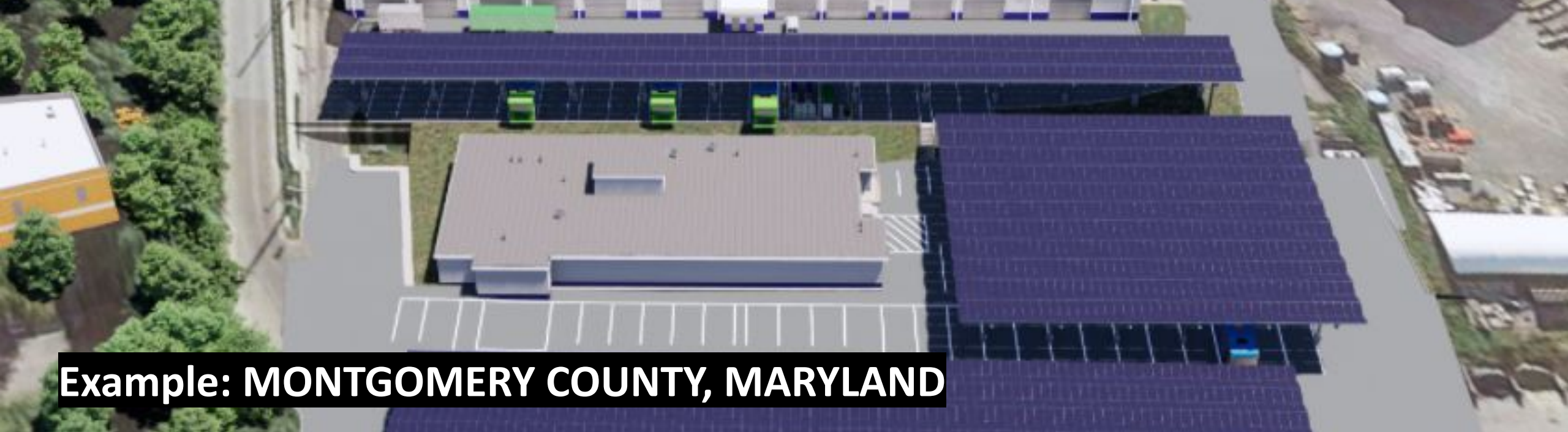
```
{
  "schedules": [
    {
      "departure_time": "17:00:00",
      "energy_demand_next_route_wh": 20000,
      "weekdays": [1],
      "preconditioning": {
        "active": "true",
        "time_seconds": 4500,
        "energy_demand_wh": 70000
      }
    },
    {
      "departure_time": "06:11:00",
      "target_soc_percentage": 10,
      "weekdays": [3,4],
      "preconditioning": {
        "active": "false"
      }
    },
    {
      "departure_time": "08:00:00",
      "target_soc_percentage": 10,
      "weekdays": [3,4],
    }
  ]
}
```


Our Modbus interface enables interaction with existing energy management systems



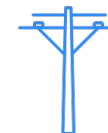
Modbus interface to a local energy management system



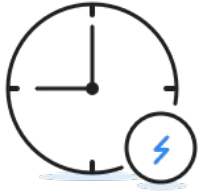


Example: MONTGOMERY COUNTY, MARYLAND

- > **LOCATION:** Brookville Smart Energy Bus Depot
- > **CHARGING STATIONS:** 5 x 180kW DC chargers (triple port), 4 x 60kW DC chargers & 1 x 450kW overhead charger
- > **CHALLENGE:** Integration with local microgrid, mix of single and multiple plug chargers from different manufacturers as well as overhead chargers

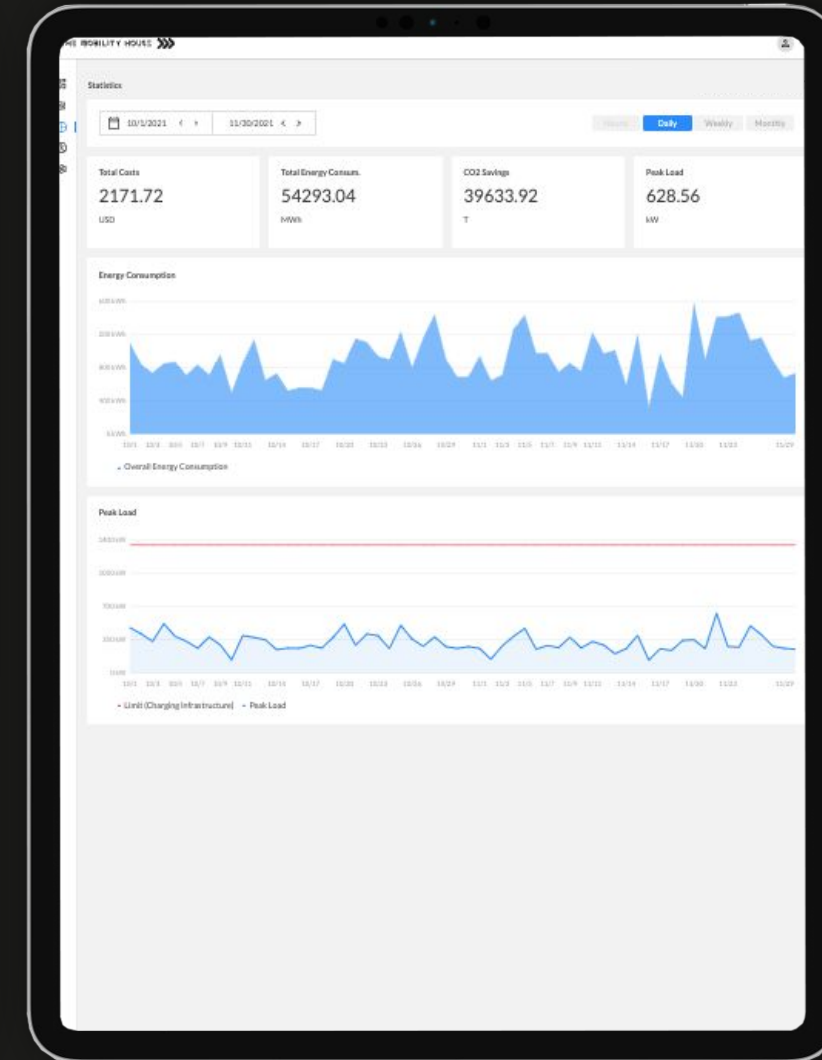
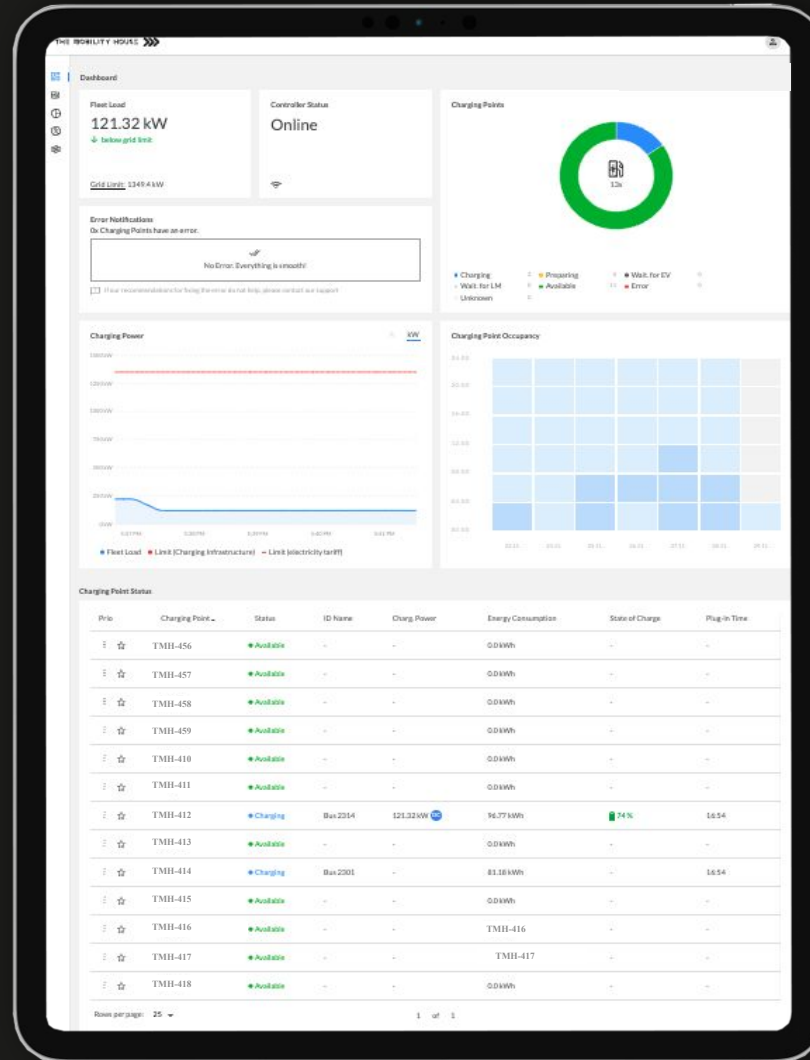


Integration with local
microgrid

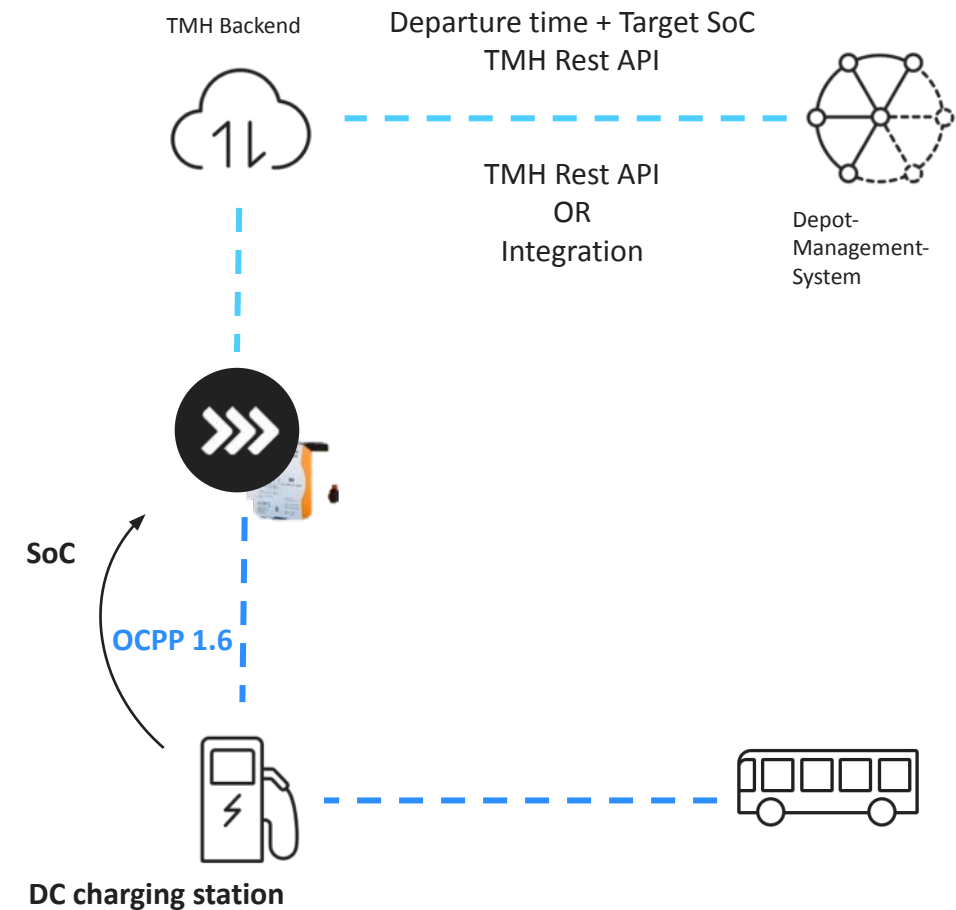
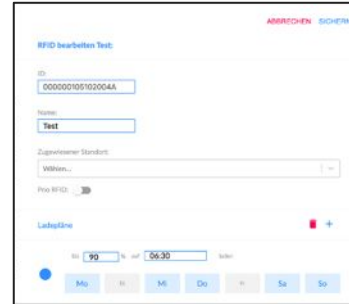
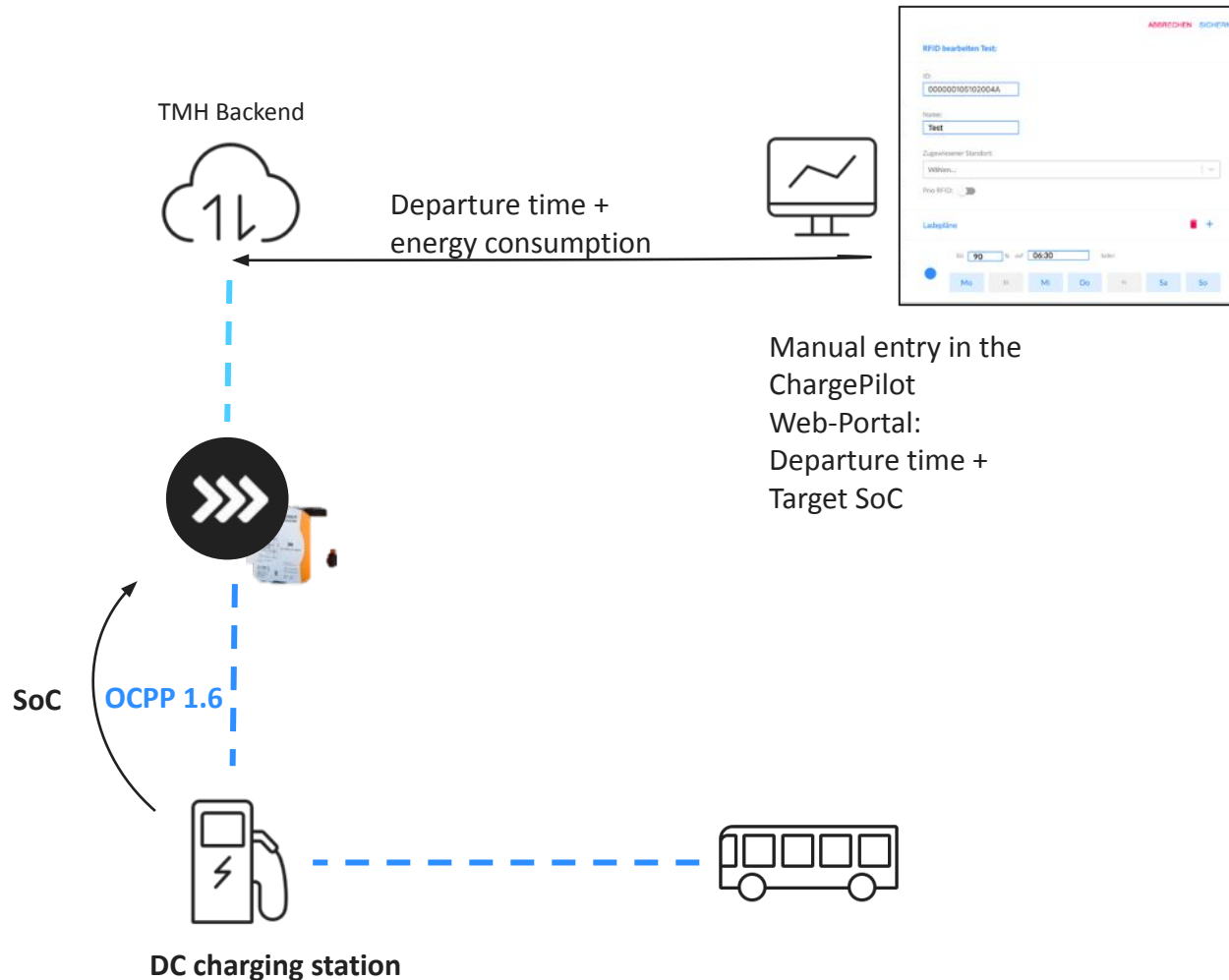


Monitoring & Control

Real-time visibility of all chargers and connected vehicles, from anywhere



Optimizes charging performance according to driving profiles and fleet schedules: Input options



Parallel & Sequential Charging

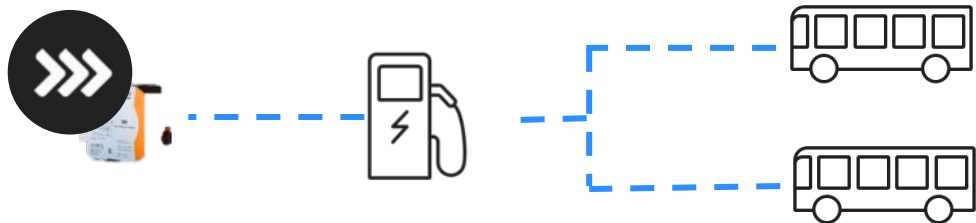


Many Charger OEMs are starting to release Chargers with multiple charging ports attached

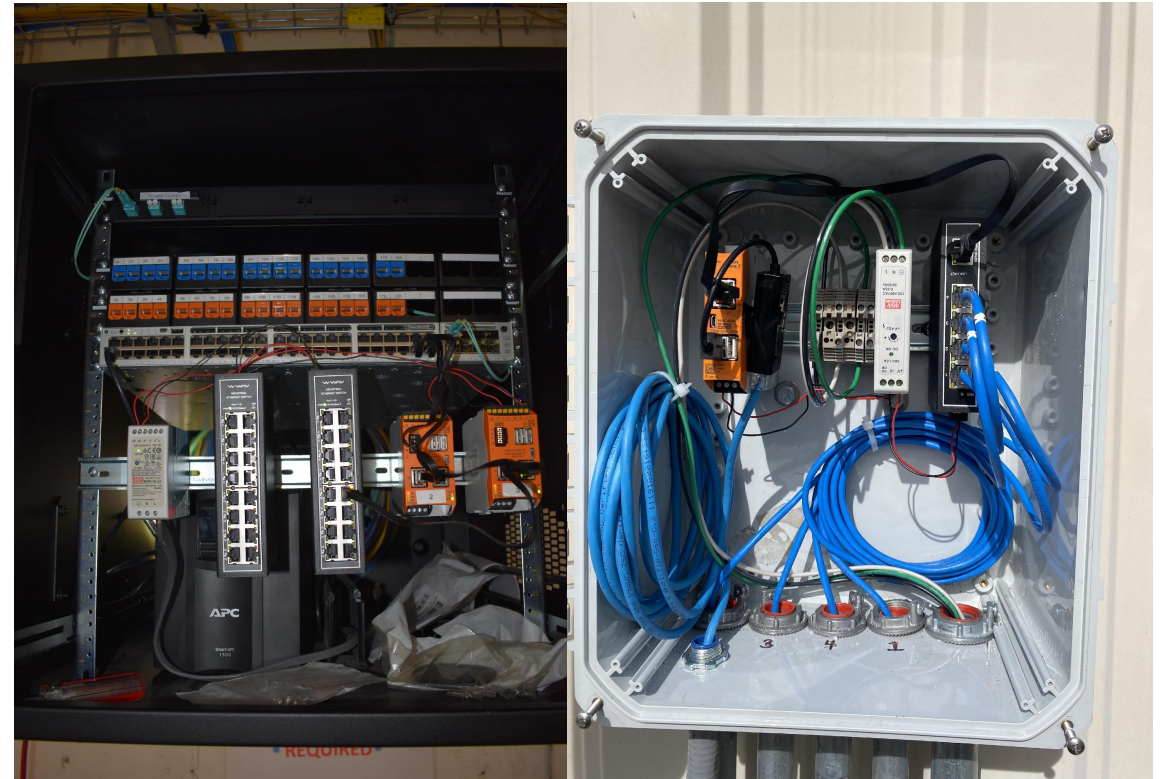
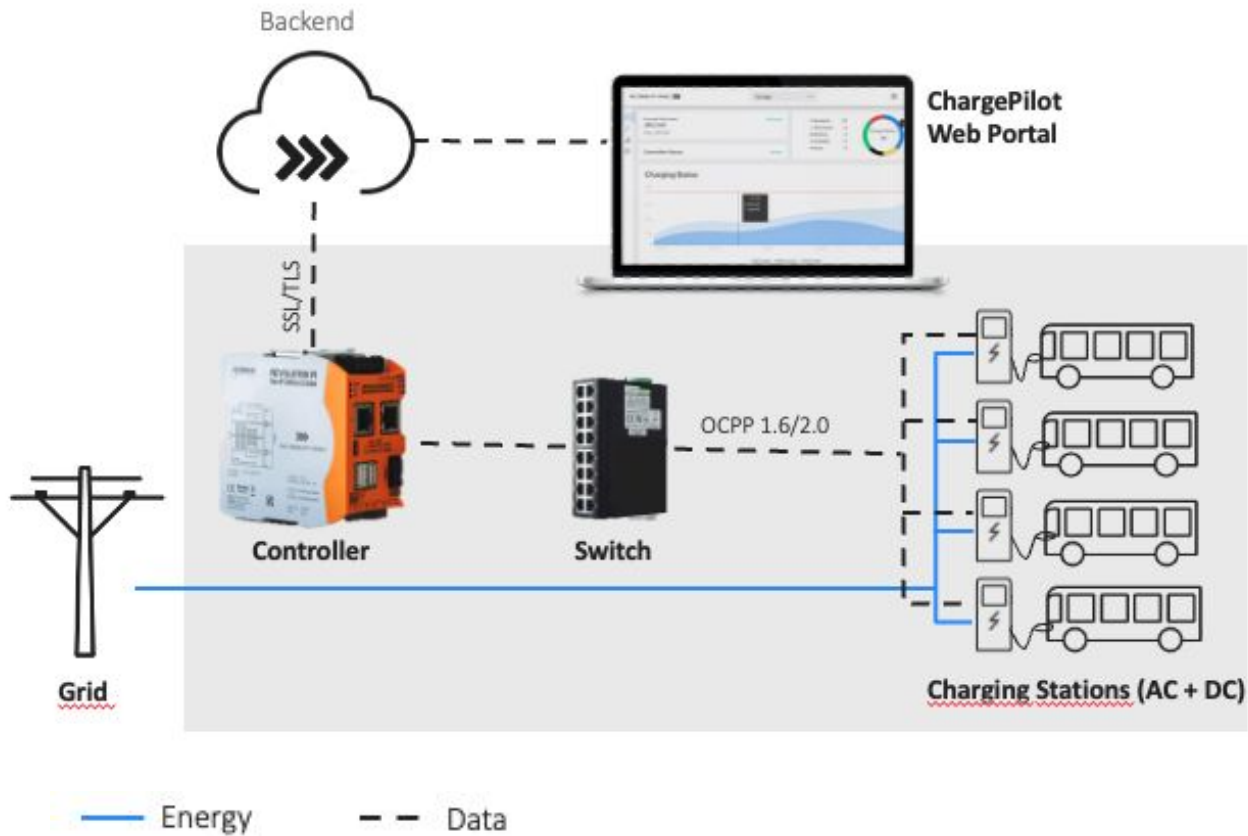
This allows customers to save on installation costs as well as saves space at crowded depots

However, this can cause issues with many of the existing charge management software that are currently on the market

- ChargePilot can handle chargers with multiple charging ports because **ChargePilot sees each individual charging port as its own charger**. Thereby allowing for all the benefits of the charge pilot system to carry over to the newer multiple port Chargers.
- When ChargePilot logic sees that there is power onsite which can be distributed to a port requesting power, ChargePilot logic will distribute that power the charger and allow the chargers Sequential or Simultaneous logic to determine how that is split amongst the multiple ports.
- Dependent on available functionality from the charger manufacturer, ChargePilot's prioritization, remote start, and remote stop can further provide the customer the ability to define which port receives power.
- This allows ChargePilot to be a **future proof and charger OEM agnostic solution**, as no matter what type of chargers you have currently or install in the future, you will still be able to access all the unique benefits of our charge management software.



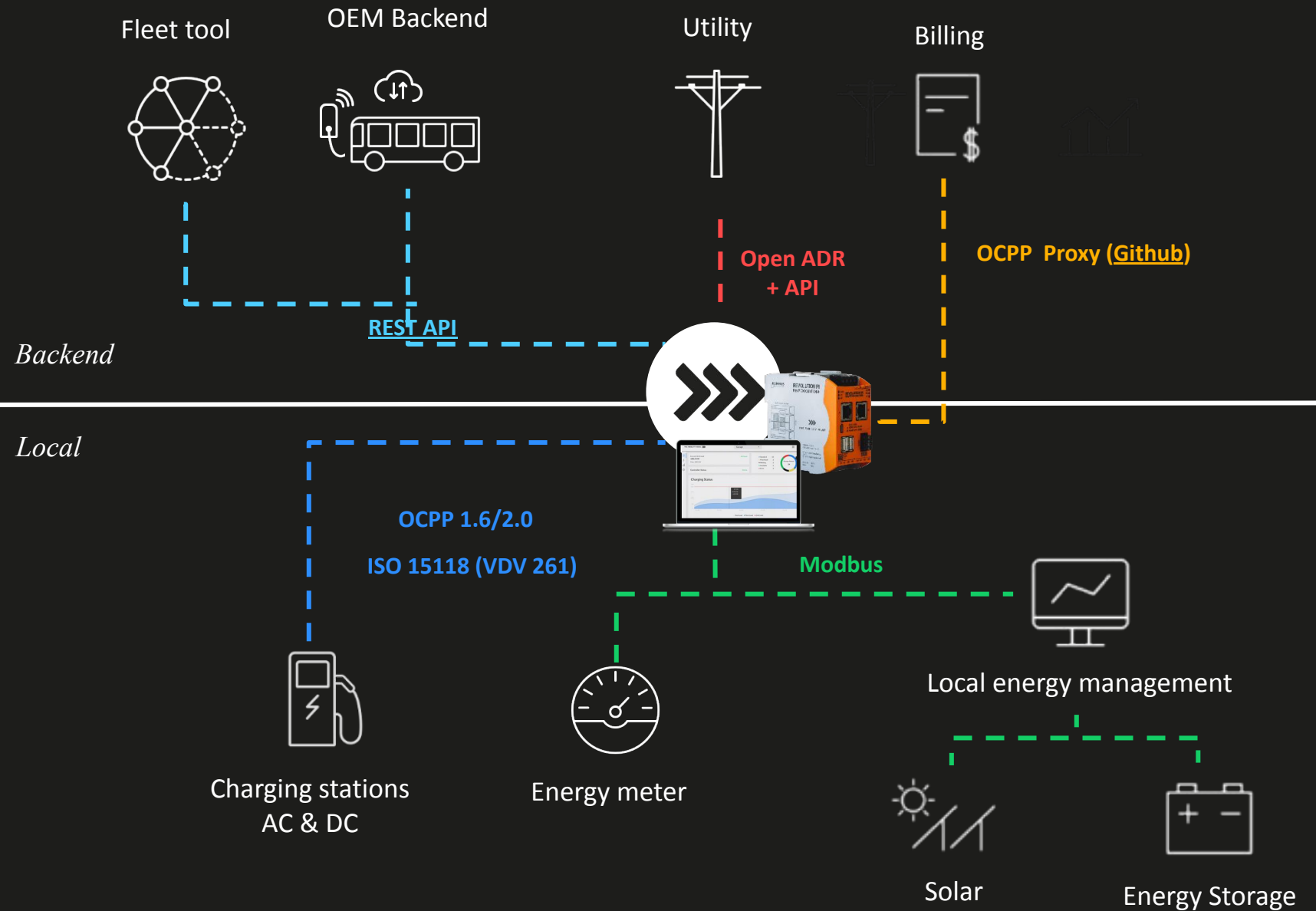
Local components ensure the system continues to function during network outages

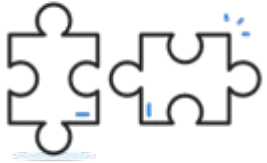




Independent & compatible

ChargePilot can be combined with other systems from different manufacturers via standardized interfaces.



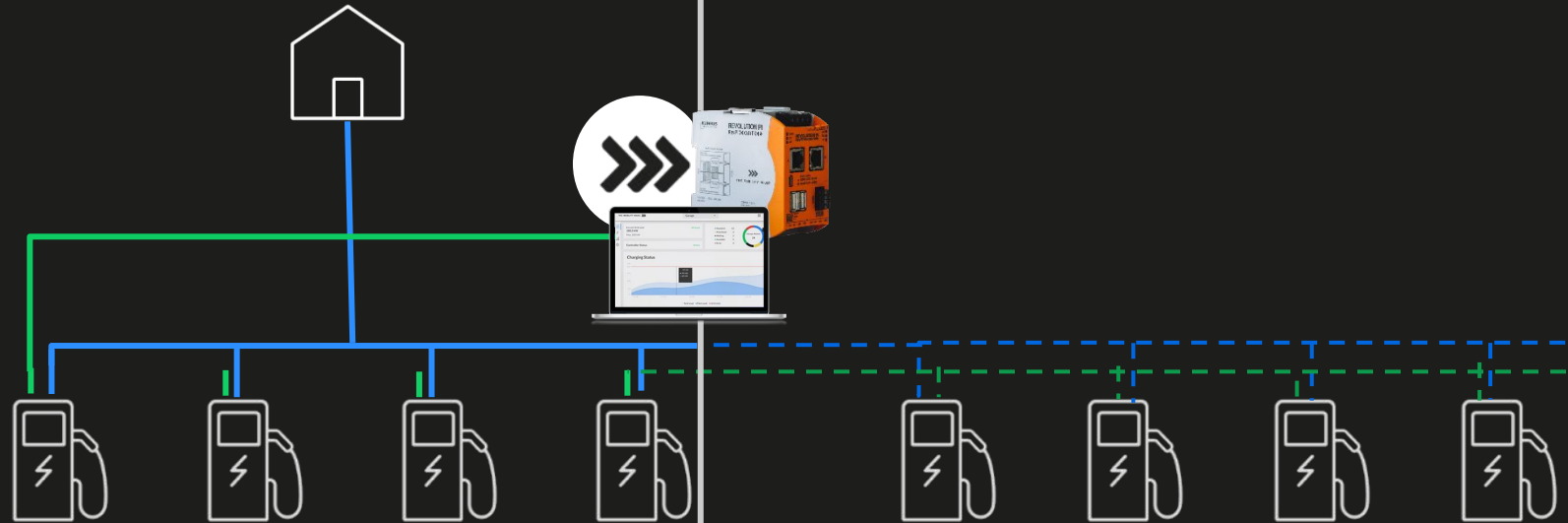


Modular & scalable

Integrate new charging stations from different manufacturers when they are needed.

TODAY

TOMORROW



The Proven Process To Fleet Electrification



We work together with New Flyer, the EVSE and the contractor to implement ChargePilot

